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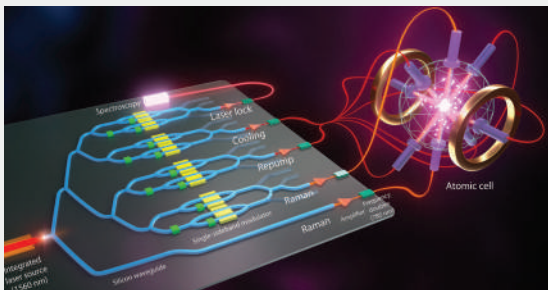
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Prelims UPSC CSE 2025

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PREFACE

Current Affairs UPSC CSE Prelims 2025

This high-quality monthly compilation of Current Affairs for Civil Services Exam Prelims 2025 is designed to help Civil Services Exam aspirants by:

1. **Saving preparation time:** Consolidates key current affairs from multiple sources for CSE Prelims.
2. **Reinforcing static concepts:** Links static concepts with current affairs
3. **Enhancing revision:** Combines important current affairs and static concepts for effective revision.

After reading this Current affairs magazine, you can test your concepts by taking our Current Affairs Test Series in Multiple Choice Question format which helps in the following ways:

- Aligns with the CSE prelims exam pattern.
- Aids understanding and recall by offering multiple perspectives on current affairs.
- Saves time, consolidates and aids quick revision

Details of our Current Affairs Test Series are on the back cover and inside this magazine.

Our team of content developers have worked rigorously to create this high-quality compilation, and we hope that all Civil Services and other competitive exam aspirants will make the best use of it. All the Best!

R. C. Reddy IAS Study Circle
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POLITY

1. Form 17C data

Context: Days after the announcement of Maharashtra Assembly election results, doubts are being raised about electronic voting machines (EVMs), the voting numbers, the disparity between postal ballots and votes. Allegations have been made about mass additions and deletions in the voter list.

About Form 17C data:

- **As per the Conduct of Election Rules, 1961 (1961 Rules)**, the ECI has to maintain two forms namely Forms 17A and 17C, that have data on the number of electors and the votes polled.
- **17A** is used to record the details of every voter who comes into a polling booth and casts his or her vote, and **17C** is an account of all the votes recorded.
- Under Rule 49S (2), a presiding officer is mandated to furnish a copy of the entries made in Form 17C to the polling agents of the candidates at the close of polling.
- **Form 17C has two parts:**
 - **Part I of Form 17C contains crucial information** such as the identification numbers of the EVMs used in the polling station, the total number of electors assigned to the polling station, the total number of voters as entered in the register for voters (Form 17A), the number of voters who decided not to record their votes after signing the register, the number of voters who were not allowed to vote, the total number of test votes and votes recorded per EVM.
 - Part II of the same form contains the results of the counting carried out on the stipulated day.
- The data in Form 17C is used by candidates to verify the results on counting day by matching it with the EVM count. Subsequently, an election petition can also be moved in the concerned High Court in case of any discrepancies to ensure transparency and accountability in the electoral process.

2. Creation of a new district in India

Context: In a landmark decision, the Uttar Pradesh government, led by Chief Minister Yogi Adityanath, has declared the Maha Kumbh area in Prayagraj as a new district.

What is the process to create a new district in India?

- The power to create new districts or alter or abolish existing districts rests with the **State governments**.
- This can either be done through an executive order or by passing a law in the State Assembly.
- Many States prefer the executive route by simply issuing a notification in the official gazette.

What is the role of Central government to play here?

- Firstly, the **Centre has no role to play** in the alteration of districts or creation of new ones. States are free to decide.
- Secondly, the Home Ministry comes into the picture when a State wants to change the name of a district or a railway station.
- Thirdly, the departments such as the Ministry of Earth Sciences, Intelligence Bureau, Department of Posts, Geographical Survey of India Sciences, and the Railway Ministry, provides their clearance to the proposal of state government.
- Fourthly, after examination of their replies, state government receives a no-objection certificate.



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3. Indian President vs US President

Context: *U.S. President Joe Biden pardoned his son, Hunter, sparing the younger Mr. Biden a possible prison sentence for federal felony gun and tax convictions and reversing his past promises not to use the extraordinary powers of the presidency for the benefit of his family.*

Aspects	Indian President	American President
Scope of Pardoning Power	Covers both central and state offenses.	Limited to federal offenses only. ()
Constitutional Basis	Article 72 of the Indian Constitution.	Article II, Section 2 of the U.S. Constitution.
Types of Pardoning Powers	Includes Pardon, Reprieve, Respite, Remission, Commutation.	Includes Pardon, Reprieve, Commutation, Amnesty.
Pardon in Impeachment Cases	Cannot pardon cases of impeachment.	Cannot pardon cases of impeachment. ()
Process and Independence	Acts on the advice of the Council of Ministers; not independent.	Exercises the power independently without advice. ()
Judicial Review	Subject to judicial review if mala fide or unconstitutional.	Generally, not subject to judicial review, except under extraordinary circumstances.
Purpose and Nature	Meant to correct judicial errors, grant clemency in special cases, or address public welfare concerns.	Often used as a discretionary power, sometimes to advance political motives or grant clemency.

4. Impeachment procedure for judges of Supreme court and High courts

Context: *The Opposition parties in the Rajya Sabha are gearing up to submit a motion for the impeachment of Allahabad High Court judge Justice Shekhar Kumar Yadav, following his controversial remarks made at a Vishwa Hindu Parishad (VHP) event.*

Impeachment procedure for judges of Supreme court and High courts:

Impeachment is a process of removing a judge of the Supreme Court or the High Court from his or her office on the grounds of **proved misbehaviour or incapacity** as mentioned in **Article 124(4)** and **Article 218** of the Constitution. The concept and procedure of impeachment of judges are laid down in the **Constitution of India** and the **Judges (Inquiry) Act, 1968**.

Procedure of impeachment of judges of the Supreme Court and High Courts in India:

- **Grounds for removal:** Alongside the constitutional provisions, the *Judges (Inquiry) Act, 1968 defines the grounds on which a judge can face impeachment, such as misuse of office, grave offences undermining a judge's integrity, or any contravention of the Constitution's provisions.* (hence the contravention of the constitution's provision as a criterion is mentioned in Judges (inquiry) act, and not in Article 124 (4) or Article 218).
- **Initiation:** The process begins with a **signed motion by 100 members of the Lok Sabha or 50 members of the Rajya Sabha**, which is submitted to the Speaker or Chairman respectively, as provided under the **Judges (Inquiry) Act of 1968**.
- **Constitution of Inquiry Committee:** *Upon admittance of the motion, an inquiry committee is formed consisting of a Supreme Court judge, a High Court Chief Justice, and an eminent jurist.* The committee will frame charges based on which the investigation will be conducted. A copy of the charges will be forwarded to the judge who can present a written defence.
- **Inquiry and Report:** This committee carries out an in-depth inquiry into the allegations. Post-investigation, **a report is presented to the Speaker or Chairman**, outlining their findings.

- **Parliamentary Process:** If the committee deems the judge guilty, both Houses of Parliament can then discuss the motion. For the motion to pass, it **needs special majority-** (i) a majority of the total membership of that House; and (ii) a majority of at least two-thirds of the members of that House present and voting.
- **Presidential Order:** On successful passage in both Houses, the motion is presented to the President as per Article 124(4), leading to the removal of the judge.

Notable instances where such proceedings were initiated:

- **Justice V. Ramaswami (1991):** The first judge against whom an impeachment motion was initiated due to allegations of misappropriating his official position and funds. The motion, however, couldn't secure a majority in the Lok Sabha and thus failed.
- **Justice Soumitra Sen (2009):** Accused of misappropriation of funds while serving at the Calcutta High Court. Though the Rajya Sabha passed the motion in 2011, Justice Sen's resignation pre-empted Lok Sabha's decision.
- **Chief Justice Dipak Misra (2018):** He faced allegations of judicial misconduct and was accused of compromising the judiciary's independence. However, the **motion was rejected by the Rajya Sabha Chairman on grounds of insufficient merit.**



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ECONOMY

1. Bond Yields

Context: The post-pandemic monetary tightening across the globe has resulted in a lower rise in interest rates in India compared with the United States, resulting in a sharp decline in the spread between the Indian and the US 10-year treasury bond yields in the last four years.

1. What are Bond Yields?

- A bond yield represents the return an investor receives from a bond.
- It is typically expressed as a percentage and is influenced by the bond's price, interest rate, and maturity.
- **Key formula:**

$$\text{Yield} = \frac{\text{Coupon Payment}}{\text{Current Bond Price}}$$

2. When Bond Yields Increase

- **Causes:**
 - **Falling bond prices:** Yields and bond prices move inversely. If demand for bonds falls, their prices drop, and yields rise.
 - **Rising interest rates:** Central banks raising policy rates cause bond yields to increase.
 - **Inflation expectations:** Higher inflation erodes the purchasing power of bond returns, leading investors to demand higher yields.
 - **Economic optimism:** Investors shift from bonds to riskier assets like equities, lowering bond demand.
- **Implications:**
 - **Higher borrowing costs:** Governments and corporations face higher interest rates on new debt issuance.
 - **Impact on equities:** Rising yields can make bonds more attractive relative to stocks, often pressuring equity markets.
 - **Currency impact:** Higher yields can attract foreign capital, strengthening the local currency.

3. When Bond Yields Drop

- **Causes:**
 - **Rising bond prices:** Increased demand for bonds pushes their prices higher, reducing yields.
 - **Lower interest rates:** Central banks cutting rates or signaling dovish monetary policies.
 - **Flight to safety:** In times of economic uncertainty, investors prefer the safety of bonds, increasing demand and lowering yields.
 - **Economic pessimism:** Expectations of slower growth or recession can drive bond yields down.
- **Implications:**
 - **Lower borrowing costs:** Cheaper debt for governments, businesses, and consumers, encouraging spending and investment.
 - **Impact on equities:** Lower yields can increase the attractiveness of stocks, especially growth stocks, due to lower discount rates.
 - **Currency impact:** Reduced yields may lead to capital outflows, weakening the local currency.

Key Inverse Relationship Between Price and Yield

- **Why do bond yields and prices move inversely?**
 - When demand for bonds increases, their prices rise. The fixed coupon payments now represent a smaller percentage of the higher price, reducing the yield.
 - Conversely, when demand falls, prices drop, and yields increase because the same coupon payments are now a larger percentage of the lower price.

In the above question option c is correct, because- Lower yields reduce the discount rate used in financial models, increasing the present value of expected future cash flows. This is particularly beneficial for growth-oriented assets, like tech stocks, whose valuations depend heavily on long-term earnings potential.

2. Mule bank account

Context: The Reserve Bank of India (RBI) said on Friday (December 6) that it has created an artificial intelligence (AI) powered model that could reduce digital fraud by helping banks deal with the increasing problem of “mule” bank accounts. The model, called MuleHunter.AI, has been developed by the Reserve Bank Innovation Hub (RBIH), Bengaluru, a subsidiary of the central bank.

What is a mule bank account?

- A mule account is a bank account that is used by criminals for illegal activities, including the laundering of illicit funds.
- A mule account is typically bought over by the criminals from their original users, individuals who are often from lower income groups, or have low levels of technical literacy.
- The related term “money mule” is used to describe the innocent victims who are used by the criminals to launder stolen or illegal money via their bank accounts.
- When such incidents are reported, the money mule becomes the target of police investigations, because it is their accounts that are involved, while the actual criminals remain undetectable.

How MuleHunter.AI Works

- RBI launches MuleHunter.AI to address the challenges of high false positives and inefficiencies in traditional fraud detection systems.
- MuleHunter.AI uses machine learning algorithms to analyse vast amounts of transaction data.
- It identifies irregularities linked to illicit fund transfers, helping banks pinpoint mule accounts more effectively.
- By focusing on the flow of illegal funds, the tool enhances fraud detection within banking networks.
- The system also integrates data from multiple banks and payment operators, enabling cross-institutional analysis. This unified approach improves detection precision and reduces false positives.
- Initial pilots in two public sector banks have demonstrated the effectiveness of MuleHunter.AI.

- The tool has significantly improved detection accuracy and reduced response times. Banks can now act faster to block suspicious accounts and transactions, minimizing fraud-related losses.

3. Low Productivity Trap

Context: In an interview with The Indian Express, Piketty, who teaches at the Paris School of Economics, says not taxing top 500 or 1,000 billionaires may leave a country in a low productivity trap, and not manoeuvre space to expand the tax base.

Low Productivity Trap:

- A “low productivity trap” is a situation where a firm or economy becomes stuck in a cycle of low productivity, making it difficult to break out and achieve higher levels of growth and prosperity.

Factors contributing to a Low Productivity Trap:

1. **Stagnant innovation and technological advancement** – Directly contribute to low productivity.
2. **Low skilled human resources** – Reduces the efficiency and output of the labour force, leading to low productivity.
3. **Global economic downturns** – May exacerbate productivity issues but is an external factor, not a core cause of a productivity trap within an economy.
4. **Corruption and red tapism** – Hampers business efficiency and innovation, leading to reduced productivity.
5. **Rapid population aging or declining birth rates** – Lowers the working-age population, impacting productivity.



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6. **High inflation** – Indirectly affects productivity by reducing purchasing power but is not a **direct cause of a productivity trap.**
7. **Natural disasters** – **Temporary disruption but not a systemic cause** of a productivity trap unless frequent and persistent.

4. Opinion trading

Context: **Welcome to the world of opinion trading: platforms which allow users to wager on the outcome of future events. The sector is growing exponentially, raking in funding and an estimated 5 crore users, but it seems to have largely gone under the radar in India, unscrutinised.**

Opinion trading:

- **Opinion trading is a form of prediction market where participants buy and sell shares representing their beliefs about the outcome of future events.**
- The sector in India has companies like **Gurugram-based Probo and MPL Opinio.** While the former offers questions on a varied set of sectors like sports, elections and cryptocurrency, the latter only deals with questions related to cricket matches.
- These platforms have received more than Rs 4,200 crore in funding so far from over 35 investors which include Sequoia Capital (PeakXV), Elevation Capital, Accel Partners, Soma Capital and Y Combinator.
- India currently does not have a law which can directly deal with opinion trading platforms like Probo and MPL Opinio – though in foreign markets like United States and Australia, where this industry is more mature, governments have decided to treat the wagers as securities, thereby putting the responsibility of regulation on the stock market regulator.

5. Real effective exchange rate (REER) index

Context: **The rupee is hitting fresh lows against the US dollar each day, yet its exchange rate has scaled an all-time-high in “real effective” terms.** The real effective exchange rate (REER) index of the rupee touched a record 108.14 in November, strengthening by 4.5 per cent during this calendar year, according to the latest Reserve Bank of India (RBI) data.

What is real effective exchange rate (REER) index?

- **The REER measures the rupee’s value vis-à-vis not only the dollar, but other global currencies as well.**
- In this case, it is a weighted average of the rupee’s exchange rate against a basket of 40 currencies of countries that account for about 88 per cent of India’s annual exports and imports.
- The REER also adjusts for inflation differentials between India and each of these trading partners.

Factor responsible for rise of NEER relative to REER:

- NEER measures currency value in nominal terms, unaffected by price level changes.
- REER adjusts NEER for inflation differentials between the domestic country and its trading partners.
- **When domestic inflation rises faster than trading partners, REER will not rise as much as NEER or may even fall, creating a divergence.**

Main reason for recent divergence:

- The main reason for the divergence — the rupee’s simultaneous **weakening and strengthening — has to do with the dollar’s behaviour over the past three months,** especially post Donald Trump’s victory in the US presidential elections on November 5.

7. DARK PATTERN

Context: On dark patterns or design interfaces and tactics used to trick users into desired behaviour, the RBI said, "**The Central Consumer Protection Authority (CCPA) notified guidelines on prevention and regulation of dark patterns on November 30, 2023, with the objective of identifying and regulating such practices.** The RBI is looking into the prevalence of such practices among REs (regulated entities) and considering appropriate policy actions."

DARK PATTERN:

- *The term "dark pattern" in behavioural economics refers to manipulative design practices that deliberately deceive or coerce users into making decisions that may not align with their true preferences or best interests.*
- These patterns are implemented in the design of user interfaces, websites, or apps and exploit cognitive biases, lack of user awareness, or limited decision-making capacity.

Key Features of Dark Patterns:

1. **Manipulative Intent:** Dark patterns are intentionally designed to benefit the organization (e.g., increasing sales, collecting personal data) at the expense of the user.
2. **Exploitation of Cognitive Biases:** They take advantage of psychological tendencies such as loss aversion, inertia, or limited attention span to nudge users into specific behaviors.

3. **Hidden Costs or Actions:** Users may unknowingly agree to terms, purchase products, or share personal information due to unclear or misleading design choices.

Common Types of Dark Patterns:

1. **Roach Motel:** Users can easily get into a situation (e.g., subscribing to a service) but find it difficult to exit (e.g., canceling the subscription).
2. **Sneak into Basket:** Additional items are automatically added to a shopping cart without the user's explicit consent.
3. **Confirmshaming:** Users are guilted into agreeing to something, often through phrasing like "No, I hate saving money" to decline an offer.
4. **Forced Continuity:** After a free trial, users are charged without explicit reminders or consent.
5. **Trick Questions:** Forms or surveys are designed in a way to confuse users, leading them to select options they didn't intend.
6. **Privacy Zuckering:** Users are tricked into sharing more personal information than they intended.



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GEOGRAPHY

1. Places in news

Context: In Baka Khel area of the Bannu district of Khyber Pakhtunkhwa province of Pakistan, 12 terrorists affiliated with the Hafiz Gulbahadur group were eliminated as choppers struck their compound.

	Places in the news	Countries	Reasons
1	Baka Khel	Pakistan	Fight between terrorists and security forces
2	Busan	South Korea	Talks on the world's first plastic pollution agreement
3	Aleppo	Syria	Militants taking over the city
4	Tbilisi	Georgia	Riots over Government's policies

2. Phlegraean Fields

Context: The Phlegraean Fields, now considered one massive supervolcano, are beginning to stir, making the scientific community uneasy. These volcanic fields, nestled just west of Naples, Italy, are among the top eight emitters of volcanic carbon dioxide worldwide.

More on news:

- Since 2005, one spot in particular — the Solfatara crater — has been releasing increased volumes of gas, catching the attention of researchers and locals alike.

What exactly is a super volcano?

- In the simplest of terms, a super volcano is essentially a volcano on steroids. It's a massive volcanic system capable of producing eruptions thousands of times more powerful than a regular volcano.
- These eruptions can eject more than 1,000 cubic kilometers of material into the atmosphere, which can have catastrophic effects on the global climate and environment.

	Super Volcanoes	Locations
1	Campi Flegrei	Italy
2	Taupo Volcano	New Zealand
3	Toba Volcano	Indonesia
4	Yellowstone Volcano	USA

2.

Context: A stampede at a football match dedicated to Guinea's junta chief killed at least 56 people, the government said on December 2, as the opposition accused the military-led authorities of being "directly responsible" for the tragedy.

Guinea is the source of three major West African rivers:

- Niger River:** One of Africa's longest rivers, it flows northeast and then turns southwest towards the Atlantic Ocean.
- Senegal River:** This river flows northwest, eventually emptying into the Atlantic Ocean.
- Gambia River:** Also flowing northwest, this river empties into the Atlantic Ocean.



3. Location of Ghana

Context: Management of the economy will be a defining issue when Ghanaians vote on December 7 to replace President Akufo-Addo who steps down after two terms in office; analysts tip Opposition NDC candidate to emerge victorious, citing voter dissatisfaction over ruling NPP's handling of economy.

Ghana shares borders with three countries:

1. Côte d'Ivoire (to the west)
2. Burkina Faso (to the north)
3. Togo (to the east)



4. International Boundary Lines

Context: South Korea's President Yoon Suk Yeol on Tuesday declared martial law, accusing the Opposition of being "anti-state forces" and saying he was acting to protect the country from "threats" posed by the North.

	Boundary lines	Concerned nations
1	38 th parallel Line	North Korea and South Korea
2	49 th Parallel Line	Canada and USA
3	Oder-Neisse Line	Germany and Poland
4	Blue Line	Israel and Lebanon

5. Water Bodies near Turkey

Context: The Prime Ministers of Britain and Greece were to meet in London on December 3 in the shadow of the long-running row over the Parthenon Marbles, which reports say could be moving towards resolution.

The water bodies that would fall within the sea journey from Patra (Greece) to Istanbul (Turkey) are:

- Ionian Sea
- Aegean Sea
- Dardanelles Strait
- Sea of Marmara
- Bosphorus Strait

Thus, 5 of the listed water bodies would be part of the journey.



6. Lapland region

Context: The Norwegian Parliament voted to extend abortion access to 18 weeks into a pregnancy, adding six weeks to a limit set in 1978 when the procedure was first legalized.

What is Lapland region?

- Lapland is a vast region in Northern Europe that spans across four countries: Norway, Sweden, Finland, and Russia. It's renowned for its stunning natural beauty, including breathtaking landscapes of mountains, forests, and fjords.
- Lapland is particularly famous for its association with the Sámi people, an indigenous group who have inhabited the region for thousands of years. Their culture, traditions, and reindeer herding are integral to the identity of Lapland.

Key features of Lapland include:

- **Northern Lights:** The region is one of the best places in the world to witness the mesmerizing Aurora Borealis.
- **Midnight Sun:** During the summer months, the sun doesn't set for extended periods, creating a unique and magical atmosphere.
- **Winter Wonderland:** Lapland transforms into a winter wonderland, perfect for winter sports like skiing and snowboarding.
- **Reindeer Herding:** The Sámi people have traditionally relied on reindeer herding as a primary livelihood.
- **Arctic Wildlife:** The region is home to a variety of Arctic wildlife, including reindeer, moose, and various bird species.



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7. 'Lake-effect snow' phenomena

Context: Parts of upstate New York, Pennsylvania, Ohio, and Michigan, situated along the Great Lakes, have seen nearly 1.2 metres of "lake-effect" snow since last November 29.

What is 'Lake-effect snow' phenomena?

- The movement of a cold air mass across stretches of warm lake water triggers the lake effect, a phenomenon that has captivated weather experts.
- Lake-effect snow often occurs in relatively narrow bands that dump copious amounts of snow. The phenomenon can drastically increase snowfall totals, and it may slam one area and leave another just miles away untouched.
- Residents along the Great Lakes, the world's largest group of freshwater lakes along the US-canada border, are bracing themselves for even more snowfall in the coming days.

How is the lake effect triggered?

- In the US, the lake effect typically begins when cold air — often from Canada — blows in over the Great Lakes' warmer waters.
- Warming air from the lakes then pushes the moisture in the sky higher into a zone most conducive to snowfall because of its temperature. That creates clouds capable of dumping lots of precipitation downwind, said Phillip Pandolfo, a meteorologist in the National Weather Service's office in Buffalo, New York.
- Most of the moisture needed for lake-effect snow does not actually come from the lakes, but rather from cold air that blows over them. "it's a common misconception that the lakes are a tremendous source of moisture," Pandolfo said. "In practice, we actually need the air to actually have enough moisture in it before it really starts going over the lakes."

How does the moisture-laden air lead to snowfall?

- With the right conditions, the rising, moisture-laden air causes clouds to form that could bring "some really intense snowfall rates,".
- The results typically are thin bands of clouds that can produce heavy snowfall — 5-8 centimetres per hour and sometimes more. And because the bands are narrow, towns near each other could see significant differences in snowfall totals.

- Forecasting lake-effect snow can be difficult; slight changes in wind direction can have a major impact on where the heaviest snow falls, according to the weather service.

Is the lake effect common to the Great Lakes?

- Lake-effect snow goes hand-in-hand with living near a Great Lake. In many cases, about 30-61 cm of snow will fall, but occasionally it can get out of hand.
- In November 2022, lake-effect storms dumped more than 1.8 metres of snow in western New York. Those wintry storms were the worst in New York since at least November 2014, when some communities south of Buffalo were hit with 2.1 metres of snow over three days, collapsing roofs and trapping drivers on a stretch of the New York State Thruway.

8. Location of Malaysia

Context: Health volunteers in Malaysia have been preparing for any surge in waterborne diseases following devastating floods that saw tens of thousands of people evacuated, with concerns in the country that days of constant rain could be on the way.

Malaysia shares land boundaries with:

- Thailand
- Indonesia
- Brunei



9. Geography of Sudan

Context: Experts warn that some 25 million people in Sudan are expected to face acute hunger this year.

Geographical Entities

- **Nubian Desert:** Located in northeastern Sudan.
- **Libyan Desert:** Spans across parts of Libya, Egypt, and Sudan (northern Sudan).
- **Darfur Region:** A region in western Sudan.
- **Lake Turkana:** Located primarily in Kenya, with a small part extending into Ethiopia. Not found in Sudan.
- **Nuba Mountains:** Located in south-central Sudan.
- **Nile River:** Flows through Sudan as it travels from the equatorial regions to Egypt.
- **Lake Rukwa:** Located in southwestern Tanzania. Not found in Sudan.



10. Rivers and associated countries

Context: Congo's Health Minister said Thursday the government is on alert over a mystery flu-like disease that in recent weeks killed dozens of people, nearly half of which were children.

	Rivers	Bordering countries
1	Congo River	Democratic Republic of the Congo (DRC) and Republic of the Congo (ROC)
2	Ubangi River	Central African Republic (CAR) and the Democratic Republic of the Congo (DRC)
3	Kasai River	Democratic Republic of the Congo (DRC) and Angola
4	Sangha River	Cameroon and the Central African Republic (CAR)

11. Carpathians Mountain range

Context: A top Romanian court on Friday annulled the first round of the country's presidential election, days after allegations emerged that Russia ran a coordinated online campaign to promote the far-right outsider who won the first round.

The Carpathians Mountain range:

- The Carpathians form an arc that spans Central and Eastern Europe, making them one of the most extensive mountain ranges in the region.
- They are often divided into three main segments: Western Carpathians (Czech Republic, Slovakia, Poland), Eastern Carpathians (Poland, Ukraine, Romania), and Southern Carpathians (Romania and Serbia). Hungary is included as some foothills extend into its territory.



12. Location of Kenya

Context: An armored vehicle carrying Kenyan police rumbles through Haiti's capital with a shattered window that a high-caliber bullet failed to penetrate, a permanent sign of violence the officers face almost daily in Port-au-Prince. The Kenyans, who were deployed to Haiti earlier this year to help quell gang violence, have faced relentless attacks.

Kenya shares its borders with the following countries:

- South Sudan
- Ethiopia
- Somalia
- Tanzania
- Uganda



13. Tribes and associated countries

Context: The Nicobarese tribe inhabiting the Nicobar group of islands in the eastern Indian Ocean are genetically close to the South and Southeast Asians, a new study finds.

More on news:

The genomic analysis of 1,559 people from this tribe linked the Nicobarese people's genetic proximity with the Austroasiatic language-speaking Htin Mal communities living along Thailand-Laos's Nan province.

	Tribes	From Countries
1	The Karen People	Thailand, Myanmar
2	Jola People	Gambia, Guinea-Bissau, Senegal
3	Chewa people	Malawi, Botswana, Namibia, Mozambique, Tanzania, Zambia, Zimbabwe
4	Afar people	Djibouti, Eritrea, Ethiopia

14. Petroleum Reserves & Countries

Context: The top United Nations human rights watchdog on December 3 ordered Venezuela to avoid destroying tally sheets and other electoral material as it investigates allegations that President Nicolás Maduro stole this summer's election.

	Petroleum Reserves	Countries
1	Sirte Basin	Libya
2	Permian Basin	USA
3	Maracaibo Basin	Venezuela
4	Santos Basin	Brazil

15. Prime Meridian

Context: Ghana's Vice President Mahamudu Bawumia has conceded defeat a day after a tense presidential election, marking a historic political comeback for the opposition candidate, former leader John Mahama.

The Prime Meridian passes through the following countries:

- United Kingdom (England)
- France
- Spain
- Algeria
- Mali
- Burkina Faso
- Togo
- Ghana



16. Landlocked countries of Africa

Context: Burkina Faso's ruling military leader Captain Ibrahim Traore on Friday dismissed the country's Prime Minister, Apollinaire Joachim Kyelem de Tambela, and dissolved the government. The sacked premier had served at the head of three successive governments, surviving each reshuffle. No reason was given for the dismissal.

Landlocked countries of Africa:

Botswana, Burkina Faso, Burundi, Central African Republic, Chad, Ethiopia, Eswatini (formerly Swaziland), Lesotho, Malawi, Mali, Niger, Rwanda, South Sudan, Uganda, Zambia, Zimbabwe



17. Capital cities & geographical latitudes

Context: Departing from convention, the Austrian President Alexander Van der Bellen opted not to invite the FPÖ to form a government, even though it had emerged the largest party in the parliament's lower house.

The capital cities from North to South based on their geographical latitudes:

- Riga, Latvia (56.9496° N)
- Warsaw, Poland (52.2297° N)
- Amsterdam, Netherlands (52.3676° N)
- Vienna, Austria (48.2082° N)
- Skopje, North Macedonia (41.9973° N)

EUROPE



18. Conflicted Regions

Context: Guyana is revisiting a dark history nearly half a century after the U.S. Rev. Jim Jones and more than 900 of his followers died in the rural interior of the South American country.

	Contested Regions	Conflicting Countries
1	Essequibo region	Guyana and Venezuela
2	Bakassi Peninsula	Nigeria and Cameroon
3	Abyei Region	Sudan and South Sudan
4	Ilemi Triangle	South Sudan and Kenya



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19. Rivers & towns

Context: Once a lifeline for communities settled along its banks, the Hindon River in Western Uttar Pradesh, often called India's Sugar Bowl, has been reduced to a drain carrying domestic and industrial waste. This transformation has been linked to severe health issues, including cancer, skin infections, and hepatitis.

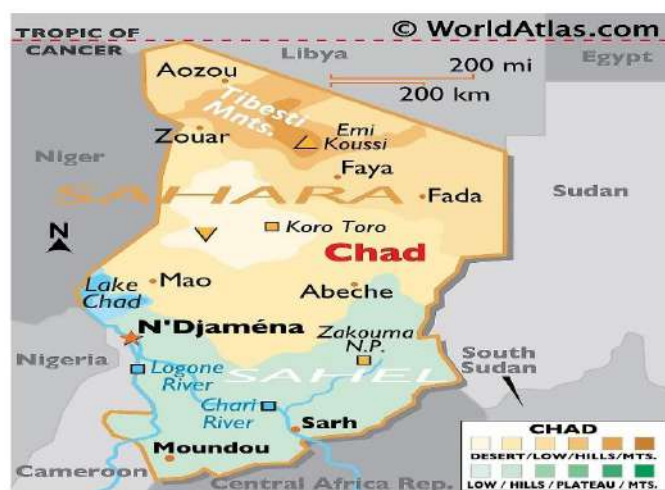
	Cities/Towns	Rivers
1	Ghaziabad	Hindon
2	Bareilly	Ramganga
3	Sambalpur	Mahanadi
4	Kurnool	Tungabhadra

20. Location of CHAD

Context: France has started the withdrawal of its military from Chad with the departure of two warplanes that were based in the capital N'Djamena, the French army said, two weeks after Chad said it was ending its defence cooperation pact with Paris.

Chad shares borders with six countries:

1. **Libya** to the north
2. **Sudan** to the east
3. **Central African Republic** to the south
4. **Cameroon** to the southwest
5. **Nigeria** to the southwest
6. **Niger** to the west



21. Caspian Sea

Context: Kazakhstan's state-owned energy company said Wednesday that it had decontaminated Soviet-era oil waste on the shores of the Caspian Sea, which has been hit by pollution and the effects of global warming.

The rivers that empty into the **Caspian Sea** from the list are:

1. **Volga River** – The longest river in Europe, flowing into the northern Caspian Sea.
2. **Ural River** – Flows into the northern part of the Caspian Sea.
3. **Kura River (Azerbaijan/Georgia)** - Originates in Turkey and Passes through Georgia and Azerbaijan
4. **Atrek River** - Forms part of the border between Iran and Turkmenistan

Other rivers,

1. **Amu Darya** – Historically flowed into the Aral Sea, not the Caspian Sea.
2. **Tarim River** – Endorheic River, does not reach any sea, as its waters are lost in the Tarim Basin.
3. **Ob River** – Flows into the Arctic Ocean, not the Caspian Sea.

22. Location of Switzerland

Context: Switzerland has withdrawn the MFN status granted to India following an adverse court ruling against Nestle, a move that will result in adverse tax implications for Indian entities operating in the European nation.

Switzerland shares borders with five countries:

- **France** to the west
- **Germany** to the north
- **Austria** and **Liechtenstein** to the east
- **Italy** to the south



23. Trenches & Oceans

Context: Researchers have discovered a new predatory crustacean species, *Dulcibella camanchaca*, in the hadal zone of the Atacama Trench.

	Trenches	Associated Oceans
1	Aleutian Trench	Pacific Ocean
2	South Sandwich Trench	Atlantic Ocean
3	Diamantina Trench	Indian Ocean
4	Romanche Trench	Atlantic Ocean

24. Location of Moldova

Context: Moldova's parliament on December 13 voted in favour of imposing a state of emergency in the energy sector over fears that Russia could leave the European Union candidate country without sufficient natural gas supplies this winter.

The Danube River flows through or borders ten European countries:

- **Germany**
- **Austria**
- **Slovakia**
- **Hungary**
- **Croatia**
- **Serbia**
- **Bulgaria**
- **Romania**
- **Ukraine**



25. European Countries location

Context: Five migrants died early December 14 when a migrant boat sank off Crete, Greece's coastguard said, leaving 40 people reportedly missing while 39 survivors were rescued.

The straight line between Athens (located in Greece) and Budapest (located in Hungary) would cross through several countries:

1. Greece (starting point)
2. North Macedonia
3. Serbia
4. Romania
5. Hungary (ending point)



26. Local Winds

Context: Santa Ana-driven wildfires are a natural part of California's landscape. However, experts say the wildfire season in California has lengthened in recent years.

	Local winds	Characteristics	Locations
1	Leveche	Hot and dry	Spain
2	Foehn	Hot and dry	Canada
3	Norte	Strong and cold	Mexico
4	Gregale	Strong and cold	Malta

27. Location of Morocco

Context: Morocco is emerging as a springboard for India's ambitions to expand its footprint in Africa for defence exports. Pitching Morocco as a gateway to Africa and Europe for Indian companies, Abdeltif Loudyi, Morocco's Minister Delegate to the Head of the Government, and In-Charge of Administration of National Defence, said they would like "to offer state-of-the-art environment, zero bureaucracy, and profitability for Indian defence companies".

Morocco shares land border with:

Morocco shares continuous land boundary with Algeria, Western Sahara, and three non-contiguous lines around the Spanish territories of Ceuta, Melilla, and Peñón de Vélez de la Gomera.



28. Straits & Oceans/Seas

Context: A Russian oil tanker carrying thousands of tonnes of oil products split apart during a heavy storm on December 15, spilling oil into the Kerch Strait, while another tanker was also in distress after sustaining damage, Russian officials said.

	Straits	Connecting oceans/seas
1	Strait of Tartary	Sea of Okhotsk with Sea of Japan
2	Yucatan Channel	Caribbean Sea with Gulf of Mexico
3	Kerch Strait	Black Sea with the Sea of Azov
4	Tsugaru Strait	Sea of Japan with the Pacific Ocean

29. Iron Gate Region

Context: Serbia's secret service and police have been spying on journalists and opposition activists by installing spyware on their mobile phones, Amnesty International said December 16.

The Iron Gate Region:

- The Iron Gate region is a stunning gorge on the Danube River, forming a natural border between Serbia and Romania. It's renowned for its dramatic landscapes, historical significance, and unique biodiversity.

Key features and attractions:

- **Đerdap Gorge:** The Iron Gate is part of the larger Đerdap Gorge, one of Europe's longest and deepest gorges.
- **Iron Gate I and II Hydroelectric Power Stations:** These massive dams and power plants have significantly altered the landscape and the flow of the Danube.
- **Trajan's Table:** A Roman tablet commemorating the Roman conquest of the region.
- **Dacian Fortress:** Ruins of a Dacian fortress, offering insights into the history of the region.

- **Stunning scenery:** The towering cliffs, winding river, and lush forests create breathtaking views.

The Iron Gate region offers a unique blend of natural beauty, historical significance, and cultural experiences.

**30. Important Lakes**

Context: In a significant step to combat the dwindling population of short neck clams, the ICAR-Central Marine Fisheries Research Institute has initiated a stock enhancement programme. On December 17, three million seeds of short neck clam (*Paphia malabarica*), produced at the Vizhinjam Regional Centre of the CMFRI, were released into Ashtamudi Lake here.

	Lakes	Endemic species
1	Loktak Lake	Sangai deer
2	Chilika Lake	Irrawaddy dolphin
3	Vembanad Lake	Karimeen
4	Ashtamudi Lake	Short-neck clam

31. Subregions of Pacific Islands

Context: A powerful 7.3 magnitude earthquake struck just off the coast of Vanuatu on Tuesday, causing widespread destruction in the South Pacific Island nation as the injured began arriving at a hospital and unconfirmed reports of casualties emerged.

	Subregions	Countries
1	Melanesia	Papua New Guinea, Fiji, Vanuatu, Solomon Islands, and New Caledonia
2	Micronesia	Palau, Marshall Islands, Federated States of Micronesia, Nauru, and Kiribati
3	Polynesia	Samoa, Tonga, Tuvalu, Cook Islands, French Polynesia, Easter Island, Hawaii, and New Zealand

32. Turkana Basin region

Context: Footprints from Kenya's Turkana Basin show that Homo erectus and Paranthropus boisei lived simultaneously 1.5 million years ago, with distinct bipedalism patterns suggesting different evolutionary trajectories.

Turkana Basin region:

- The **Turkana Basin region**, located in East Africa, is globally renowned for its **paleoanthropological significance** and **unique geographical features**. Here's why it is popular:

Key Reasons:

1. Fossil Discoveries:

- The region is a rich repository of ancient human and animal fossils.
- Significant findings include some of the earliest hominid fossils, such as *Australopithecus*, *Homo habilis*, and *Homo erectus*.
- The discovery of the nearly complete skeleton of "Turkana Boy" (*Homo erectus*) is one of the most notable finds.

2. Cradle of Humankind:

- It is considered one of the most important areas for understanding human evolution.
- Research conducted here has provided insights into the origins and development of early humans.

3. Lake Turkana:

- The region is home to **Lake Turkana**, the world's largest permanent desert lake and the largest alkaline lake.
- The lake supports unique biodiversity, including endemic fish species and a significant population of crocodiles.

4. UNESCO World Heritage Site:

- The Lake Turkana National Parks have been designated as a UNESCO World Heritage Site due to their ecological and archaeological importance.

5. Geological Significance:

- The area is characterized by volcanic activity, unique rock formations, and sediment layers that provide insights into ancient climates and ecosystems.

33. Geography of Africa

Context: An overcrowded boat capsized on a river in central Congo on December 17, killing at least 25 people, including children, and leaving dozens missing, officials and local residents said.

The equator passes through six African nations:

- Gabon
- Republic of the Congo
- Democratic Republic of the Congo
- Uganda
- Kenya
- Somalia



34. Countries bordering the Baltic Sea

Context: Poland's government on December 18 adopted a bill that would allow it to temporarily limit asylum rights, as it seeks to halt irregular migrant arrivals from neighbouring Belarus.

The countries bordering the Baltic Sea are:

- Denmark
- Germany
- Poland
- Russia
- Lithuania
- Latvia
- Estonia
- Finland
- Sweden



35. Location of Libya

Context: The Ministry of External Affairs (MEA) on December 20 confirmed that it was actively assisting the group of Indian workers who were trapped in Libya due to a lack of proper documentation four months ago.

More on the news:

- Speaking to reporters earlier in the day, MEA spokesperson Randhir Jaiswal said that the Indian workers had travelled to Libya's Benghazi via Dubai without valid paperwork, leading to complications upon their arrival.
- At least 16 workers are said to be trapped in a cement factory in the African country.

Libya has six land borders:

- **Egypt** to the east
- **Sudan** to the southeast
- **Chad** to the south
- **Niger** to the southwest
- **Algeria** to the west
- **Tunisia** to the northwest



36. Nordic Countries

Context: Unsettled by Russia's expansionism and emboldened by its recent accession to NATO, Finland is rallying to strengthen its national self-defense beyond its traditional military capabilities.

Definitions:

- **Nordic Countries:** Include Denmark, Finland, Iceland, Norway, and Sweden. These countries share historical and cultural ties and are part of the Nordic Council.



37. Location of Mozambique

Context: Mozambique is braced for an escalation in protests after the announcement due by December 23 of final results of a disputed election, a turning point in two months of unrest that has killed 130 people and caused major disruption.

Mozambique borders the following countries:

- Tanzania to the north
- Malawi to the northwest
- Zambia to the northwest
- Zimbabwe to the west
- South Africa to the south and southwest
- Eswatini to the south and southwest



38. Coast names & associated countries

Context: At least 13 people died in two incidents in Nigeria on Saturday as crowds, mostly women and children, scrambled for charity, police authorities said. In the state capital Abuja, at least 10 people died and many more were injured in a scramble to receive gifts of charity being distributed by the Holy Trinity Catholic Church in Maitama district.

	Coast names	Associated countries
1	Slave Coast	Togo, Benin, and Nigeria
2	Gold Coast	Ghana
3	Ivory Coast	Côte d'Ivoire
4	Grain Coast	Liberia

39. Denali Fault

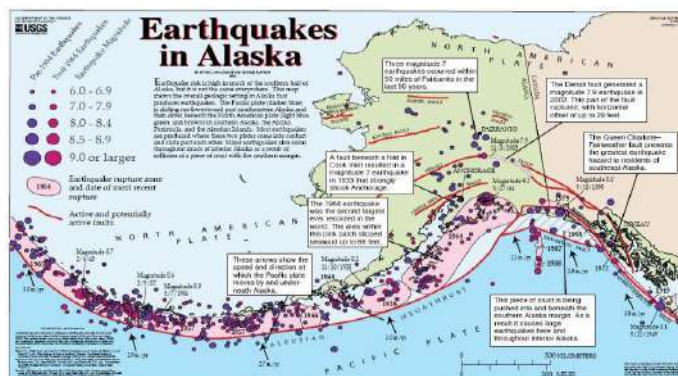
Context: A study shows that three sites spread along the Denali Fault located in the southern half of Alaska were once a smaller united geologic feature indicative of the final joining of two land masses. That feature was then torn apart by millions of years of tectonic activity.

More on the news:

- Historical reconstruction of 483 km of horizontal movement on the Denali Fault found that the three locations at one time formed a terminal suture zone, which represents the final integration of tectonic plates into a larger mass.

About Denali Fault:

- The Denali Fault is a major transform fault located in Alaska, USA. It is characterized by horizontal, strike-slip motion and is one of the most active seismic zones in North America.
- The fault is known for producing large earthquakes, such as the 2002 Denali earthquake.



40. Location of Slovakia

Context: Russian President Vladimir Putin held talks in the Kremlin on Sunday with Slovakia's prime minister, Robert Fico, in a rare visit to Moscow by an EU leader since Russia's all-out invasion of Ukraine in February 2022.

Slovakia has five neighbouring countries:

1. **Poland:** To the north.
2. **Ukraine:** To the east.
3. **Hungary:** To the south.
4. **Austria:** To the southwest.
5. **Czech Republic:** To the northwest.



41. Nomadic Communities

Context: The Moken, a group of indigenous people from Thailand and Myanmar, once sailed freely between the archipelago of 800 islands off the coast of the two countries.

	Nomadic Communities	From Countries
1	Bedouin	Saudi Arabia, Jordan, Egypt
2	Tuareg	Mali, Niger, Algeria, Libya
3	Raika	India
4	Moken	Thailand, Myanmar

42. Location of Panama

Context: President-elect Donald Trump threatened to reassert U.S. control over the Panama Canal, accusing Panama of charging excessive rates to use the Central American passage, which allows ships to cross between the Pacific and Atlantic oceans.

Panama has two land borders:

- **Costa Rica:** to the west
- **Colombia:** to the southeast

It also has coastlines on both the Caribbean Sea to the north and the Pacific Ocean to the south.



43. Horn of Africa

Context: Fierce clashes erupted anew on December 24 along the border between Ethiopia and Somalia's breakaway region of Somaliland, as armed clan militias and Liyuu Police forces engaged in intense combat, merely days after similar hostilities resulted in multiple casualties on both sides.

Somalia shares its longest land boundary with **Ethiopia** and its shortest land boundary with **Djibouti**.



44. Seas of Philippines

Context: The Philippine military on December 23 said it plans to acquire the US Typhon missile system to protect its maritime interests, some of which overlap with regional power China.

Starting from the South China Sea in the west, and moving counter-clockwise:

South China Sea → Sulu Sea → Celebes Sea → Philippine Sea.



45. Location of Switzerland

Context: Switzerland adopted the latest EU sanctions package on Russia and Belarus, the government said on Monday. The move came one week after the European Union targeted Moscow's vessels and Chinese entities found to have traded with the Russian military.

The Rhine River forms a natural border between three pairs of nations:

1. Germany and France
2. Germany and Switzerland
3. Switzerland and Liechtenstein



46. Major Geographical entities found in Turkey

Context: An explosion at an ammunition factory in northwest Turkey left 11 dead and five injured Tuesday morning. The blast occurred in Balıkesir province, according to the state-run Anadolu Agency. The factory is in a rural area away from population centers.

Major Geographical entities found in Turkey:

- **Anatolian Plateau:** This plateau forms the central part of Turkey and is a significant geographic feature.
- **Taurus Mountains:** These mountains run across southern Turkey and are a prominent feature of its geography.
- **Mount Ararat:** This volcanic mountain is situated in eastern Turkey near the borders with Armenia and Iran.
- **Cappadocia Region:** Cappadocia is a historical and tourist region in central Turkey, known for its unique rock formations and underground cities.

While,

Sea of Crete: The Sea of Crete is part of the Aegean Sea and is located closer to Greece, not within Turkish boundaries.

47. Location of Kazakhstan

Context: Kazakhstan officials said 38 people have died after an Azerbaijani airliner with 67 passengers crashed near the Kazakhstani city of Aktau on December 25. Deputy Prime Minister Kanat Bozumbaev disclosed the death toll while meeting with Azerbaijani officials, the Russian news agency Interfax reported.

The location of Capitals from North to South:

- **Astana (Kazakhstan)** – Located farthest north among these cities.
- **Bishkek (Kyrgyzstan)** – South of Astana.
- **Tashkent (Uzbekistan)** – South of Bishkek.
- **Dushanbe (Tajikistan)** – South of Tashkent.
- **Ashgabat (Turkmenistan)** – Located farthest south among these cities.



1. **Caledon River:** Forms part of the boundary between Lesotho and South Africa.
2. **Orange River:** Also forms part of the boundary between Lesotho and South Africa.
3. **Limpopo River:** Does **not** form any boundary with Lesotho, as it is located far to the north.
4. **Drakensberg Mountain Range:** Forms a significant natural boundary between Lesotho and South Africa.
5. **Kalahari Desert:** Does **not** form a boundary with Lesotho, as it is located to the west and north of South Africa.

48. Location of Suriname

Context: Desi Bouterse, a military strongman who led a 1980 coup in the former Dutch colony of Suriname then returned to power by election three decades later despite charges of drug smuggling and murder, has died. He was 79.

Suriname has three land borders:

- **Guyana** to the west
- **French Guiana** (an overseas department of France) to the east
- **Brazil** to the south



49. Location of Lesotho

Context: India sent humanitarian assistance consignment to Lesotho comprising of 1000 metric tonnes of rice to help in addressing the food security and nutritional requirements of people in Lesotho.

The geographical entity to determine if it forms a natural boundary between **Lesotho** and **South Africa**:



50. Location of Spain

Context: More than 10,000 migrants died while trying to reach Spain by sea this year, a report released by a Spanish migration rights group said on December 26.

Spain shares land boundary with following countries:

- **France** - Yes, shares a border with Spain along the Pyrenees
- **Portugal** - Yes, shares Spain's western border
- **Morocco** - land borders with Morocco through its autonomous cities (enclaves) of Ceuta and Melilla on the northern coast of Africa.
- **Andorra** - Yes, located in the Pyrenees between France and Spain
- **Monaco** - No, located on France's Mediterranean coast



51. Brahmaputra Tributaries

Context: China has approved the construction of the world's largest dam, stated to be the planet's biggest infra project costing \$137 billion, on the Brahmaputra River in Tibet close to the Indian border, raising concerns in riparian states — India and Bangladesh.

Left Bank Tributaries

These tributaries generally originate from the Himalayan ranges or the Tibetan Plateau:

1. Lohit River
2. Dibang River
3. Dihang River (also known as the Siang)
4. Subansiri River
5. Buri Dihing River
6. Dhansiri River
7. Kolong River

Right Bank Tributaries

These tributaries mostly originate from the hills of Arunachal Pradesh and the plateau regions:

1. Manas River
2. Torsa River
3. Jaldhaka River
4. Teesta River
5. Kameng River
6. Pagladiya River
7. Gadadhar River

52. Water bodies in Africa

Context: The Kenya National Commission on Human Rights has raised concerns over the rising number of government critics who were apparently abducted as four people were reported missing over the weekend, bringing the total number of abductions to 82 since the anti-government protests in June.

Analysis of the listed geographical entities lie or cross the equator:

1. **Lake Victoria:** Lies on the equator. The equator passes through the northern part of Lake Victoria.
2. **Lake Turkana:** Located entirely north of the equator in Kenya. It does not cross the equator.
3. **Mount Kilimanjaro:** Situated south of the equator in Tanzania. It does not cross the equator.
4. **Congo River:** The equator crosses the Congo River twice as it flows through Central Africa.
5. **Galápagos Islands:** These islands are located in the Pacific Ocean, straddling the equator. Some of the islands lie north of the equator, while others lie south.

Hence, three entities lie or cross the equator:

- Lake Victoria
- Congo River
- Galápagos Islands

53. Neighbours of Slovakia

Context: Russia's President Vladimir Putin has said that he was open to accepting Slovakia's offer as a place for peace negotiations with Ukraine.

Neighbours of Slovakia:

Slovakia shares borders with the following countries:

- Poland to the north
- Ukraine to the east
- Hungary to the south
- Austria to the southwest
- Czech Republic to the northwest



54. Journey from Strait of Dardanelles to Mariupol port in Ukraine

Context: Russia warned on December 28 of severe environmental damage from a huge oil spill in the Black Sea caused when two tankers collided in a storm near Crimea, which declared a state of emergency. One tanker sank and another ran aground on December 15 in the Kerch Strait between Russia and the annexed Crimean Peninsula.

Journey from Strait of Dardanelles to Mariupol port in Ukraine:

To arrange the water bodies in order from the Strait of Dardanelles to Mariupol port in Ukraine, let us trace the route step by step:

1. **Strait of Dardanelles:** This is the starting point of the journey. It connects the Aegean Sea to the Sea of Marmara.
2. **Sea of Marmara:** After passing through the Strait of Dardanelles, the journey enters the Sea of Marmara.
3. **Bosphorus Strait:** The Sea of Marmara connects to the Black Sea via the Bosphorus Strait.
4. **Black Sea:** After crossing the Bosphorus Strait, the journey continues into the Black Sea.
5. **Kerch Strait:** To enter the Sea of Azov from the Black Sea, the ship passes through the Kerch Strait.
6. **Sea of Azov:** Finally, Mariupol port is located in the Sea of Azov.

Correct Sequence: 3 → 2 → 5 → 4 → 1

55. Ethnicities & associated countries

Context: The jailed leader of Turkey's outlawed Kurdistan Workers' Party (PKK), Abdullah Ocalan, has been quoted as indicating he may be prepared to call for militants to lay down arms, after a key ally of President Tayyip Erdogan urged him to end the group's decades-old insurgency.

	Ethnicities	From Countries
1	Tigray	Ethiopia
2	Tutsis	Rwanda
3	Chechens	Russia
4	Yazidis	Iraq

56. Rivers & Dams

Context: Arunachal Pradesh Chief Minister Pema Khandu said the Siang Upper Multipurpose Project (SUMP), estimated to cost ₹1.13 lakh crore, was being planned by the Centre not just for generating electricity but to maintain the natural flow of the river all year round and mitigate risks of flooding if China released excess water.

	Name of the dams	Rivers	Countries
1	Three Gorges Dam	Yangtze River	China
2	Itaipu Dam	Paraná River	Brazil/Paraguay
3	Grand Coulee Dam	Columbia River	United States



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57. Gulf of Guinea

Context: In Cameroon, the NGO Papaye International runs a sanctuary for the endangered animals on three islands in the Douala-Edea national park.

The **Gulf of Guinea** is located on the west coast of Africa, and several countries have coastlines along its waters. These countries are:

The countries that “open up” onto the Gulf of Guinea are:

- Angola
- Benin
- Cameroon
- Côte d'Ivoire
- Democratic Republic of the Congo
- Republic of the Congo
- Equatorial Guinea
- Gabon
- Ghana
- Guinea
- Guinea-Bissau
- Liberia
- Nigeria
- São Tomé and Príncipe
- Sierra Leone
- Togo



58. Location of South Korea

Context: South Korea was reeling Monday from the loss of 179 people after a Jeju Air plane crash-landed and burst into flames, with a team of US investigators joining local authorities to probe possible causes.

From west to east, the water bodies are arranged as follows:

1. Yellow Sea
2. Cheju Strait
3. Korean Strait
4. Sea of Japan



59. Location of Thailand

Context: Three foreigners have died in a hotel fire in a popular tourist area of Thailand's capital Bangkok, according to local authorities. The fire broke out on the fifth floor of the Ember Hotel on Sunday night, Bangkok's Fire and Rescue Department said on December 30.

Thailand shares land borders with four countries:

- Myanmar to the west
- Laos to the northeast and east
- Cambodia to the southeast
- Malaysia to the south



The region attracts scientists, geologists, and adventurers due to its **otherworldly landscape** and extreme environmental conditions.



60. Danakil Depression

Context: At least 66 people have died after a truck plunged into a river in southern Ethiopia, a hospital director said December 30. The accident took place Sunday when an old, overcrowded truck that was contracted by wedding guests fell off the Gelan Bridge, where villagers said traffic crashes have happened before.

Danakil Depression:

The **Danakil Depression** is located in the **Afar Region** of northeastern Ethiopia. Known as one of the **hottest and most inhospitable places on Earth**, it lies at the junction of three tectonic plates.

Key Features of the Danakil Depression:

- **Temperature:** One of the **hottest places on Earth**, with average annual temperatures often exceeding **35°C (95°F)**.
- **Volcanic Activity:** Home to **active volcanoes** like **Erta Ale**, which contains one of the few permanent **lava lakes** in the world.
- **Geological Significance:** It is a unique geological site featuring **sulfur springs**, **salt flats**, and **colorful hydrothermal fields**.
- **Lowest Point in Africa:** Parts of the Danakil Depression are more than **100 meters below sea level**.
- **Salt Mining:** Traditional **salt mining practices** are still carried out by local Afar people.



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ENVIRONMENT

1. Carbon Offsetting and Reduction Scheme for International Aviation

Context: As the EU enforces sustainable aviation fuel regulations, India is strategizing on CORSIA participation. Starting 2027, Indian airlines must comply with offsetting requirements, prompting discussions among ministries to protect national interests while preparing for the growing SAF market.

What is CORSIA?

The **Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)** is an initiative by the **International Civil Aviation Organization (ICAO)** aimed at mitigating the environmental impact of international aviation. Aviation is a significant contributor to global greenhouse gas (GHG) emissions, and CORSIA focuses on achieving **carbon-neutral growth** in the industry from 2020 onwards.

Key Features of CORSIA

1. Purpose:

- To stabilize CO₂ emissions from international aviation at 2020 levels by requiring airlines to offset any emissions exceeding this baseline.

2. How It Works:

- Airlines calculate their CO₂ emissions annually.
- If emissions exceed 2020 levels, airlines are required to purchase **carbon offset credits** from approved projects like renewable energy, reforestation, or energy efficiency initiatives.

3. Implementation Phases:

- **Pilot Phase (2021–2023):** Voluntary participation by states.
- **First Phase (2024–2026):** Voluntary participation continues.
- **Second Phase (2027–2035):** Participation becomes mandatory for most states, with exceptions for:
 - Least developed countries
 - Small island developing states
 - Landlocked developing countries
 - States with low levels of international aviation.

4. Scope:

- Applies only to international flights (flights between two countries).
- Domestic aviation emissions are handled by national policies, not CORSIA.

5. Exemptions:

- Flights to and from exempted countries.
- Very small operators with minimal emissions.

2. Environmental Accidents

Context: Plan to dispose of 337 tonnes yet to be implemented; no plan for 11 lakh tonnes of contaminated soil plus mercury and waste dumps; Supreme Court and NGT orders ignored for years as groundwater contamination spreads; the Centre has released ₹126 crore to the Madhya Pradesh government.

	Accidents	Causes
1	Vizag gas leaks (2020)	Leakage of styrene gas
2	Chasnala Mining Disaster (1975)	Explosion of methane gas followed by flooding of the mine
3	NTPC Unchahar Plant incidence (2017)	Blast of boiler
4	Korba incidence (2009)	Structural failure during the construction of a chimney



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3. Ratapani Wildlife Sanctuary

Context: The Madhya Pradesh government has notified Ratapani forest in Raisen district as a tiger reserve in the state, officials said on December 3. It is the eighth tiger reserve in the state after Kanha, Satpura, Bandhavgarh, Pench, Sanjay Dubri, Panna and Veerangana Durgavati.

About Ratapani Wildlife Sanctuary:

- **Location:** Situated in Raisen and Sehore districts of Madhya Pradesh, it spreads over 825.90 sq km.
- This rocky forest with aquatic environment is spread on the **Vindhya Hills**.
- It runs parallel on the northern side of the Narmada River. The Kolar River forms the western boundary of the Sanctuary.
- The Sanctuary has Bhimbetka, a group of rock shelters and rock paintings, which is one of the "World Heritage Site" declared by UNESCO.
- It also encompasses many other historical and religious destinations like **Ginnourgarh Fort**, POW camp, **Keri Mahadeo**, **Ratapani dam**, **Jholiyapur dam**, etc.
- **Landscape:** It is rugged with hills, valleys, plateaus, and plains.
- **Flora:**
 - The forest of this Sanctuary is of **dry deciduous and moist deciduous** types.
 - About **55%** of the area is **covered by teak**. The remaining mixed forests consist of various dry deciduous species.
- **Fauna:**
 - The regal striped cat is the apex predator, and estimates suggest that 40 tigers roam these forests.
 - **Chinkara**, an endangered species, is also found in the Sanctuary.
 - It is also home to animals like **the Panther, Hyena, Jackal, Indian Fox, Wild Dog, Jungle Cat, Small Indian Civet, Blue Bull, Chinkara, Black Buck, Chausingha, Spotted Deer, Barking Deer**, etc.

4. Ramsar Sites

Context: The State Level Monitoring Committee (SLMC), Kerala, appointed by the National Green Tribunal, has recommended implementation of projects in a time-bound manner to check the illegal discharge of biowaste, including faecal sludge, into Ashtamudi Lake in Kollam district.

	Ramsar Sites	Locations
1	Tawa Reservoir	Madhya Pradesh
2	Kazhuveli Bird Sanctuary	Tamil Nadu
3	Ashtamudi Lake	Kerala
4	Nagi Bird Sanctuary	Bihar

5. GRIHA norms

Context: The 16th GRIHA Summit, the annual flagship event organized by GRIHA Council, commenced today in New Delhi, with a focus on the theme "Accelerating Climate Action in the Built Environment".

About GRIHA norms:

- GRIHA is an acronym for **Green Rating for Integrated Habitat Assessment**. GRIHA is a Sanskrit word meaning – 'Abode'.
- It is a **rating tool** that helps people assesses the performance of their building against certain nationally acceptable benchmarks.
- It evaluates the environmental performance of a building holistically over its entire life cycle, thereby providing a definitive standard for what constitutes a 'green building'.
- The rating system, based on accepted energy and environmental principles, will seek to strike a balance between the established practices and emerging concepts, both national and international.
- It is developed by TERI (The Energy and Resources Institute).
- This tool has been adopted by the **Ministry of New and Renewable Energy**.

- **Criteria:**
 - It assesses a building out of 34 criteria and awards points on a scale of 100.
 - In order to qualify for GRIHA certification, a project must achieve at least 50 points.
 - Certain criteria / sub-criteria are mandatory and have to be complied for the project to be at all eligible for rating.
- **Project scoring**
 - 50-60 points is certified as a 1-star GRIHA rated building,
 - 61-70 is a 2-star GRIHA rated building,
 - 71-80 is a 3-star GRIHA rating building,
 - 81-90 is a 4-star GRIHA rated building
 - 91-100 is a 5-star GRIHA rated building

6. Sonai-Rupai Wildlife Sanctuary

Context: The Assam Forest department confirmed the Royal Bengal Tigers' presence in the Sonai-Rupai Wildlife Sanctuary, with the first photographic evidence captured in the Sonitpur district.

About Sonai-Rupai Wildlife Sanctuary:

- It is a protected area located in the state of Assam in India.
- It covers an area of 175 sq.km. The area was declared as a sanctuary in 1998.
- It is located along the foothills of the Great Himalayan Range.
- The eastern boundary of Sonai Rupai Wildlife Sanctuary is marked by the Gabhoru River. The western boundary is marked by the Panchnoi River and further west, area is surrounded by the Rowta reserve forest.
- The northern area of the sanctuary shares an interstate boundary with the Kameng reserve forest of the West Kameng district of Arunachal Pradesh. In the southern area there is the Charduar reserve forest and villages.

- There are four perennial rivers that flow through the sanctuary: Dalsiri, Gabharu, Gelgeli, and Belsiri. During the rainy season, also find several wetlands known as "bheels."
- It experiences a sub-tropical type of climate with hot and humid summers, with heavy summer rains often causing floods and river overflows.
- **Vegetation:** The forest types in the sanctuary comprise **tropical evergreen, semi-evergreen and moist deciduous forests.**
- **Flora:** Some common trees found in the sanctuary include **Hollock, Koro, Nahar, Titasapa, Simul, Sal, Ajar, Hatipeta, and more.**
- **Fauna:**
 - It is famous for **Indian bison, elephants, and one-horned rhinoceros**, which are the main attractions of the region.
 - Other wildlife species found here include sambar deer, barking deer, hog deer, Himalayan Crestless porcupines, Large Indian Civets, Small Indian Civets, Black bears, and Sloth bears.

7. Tortoise/Turtle species

Context: Researchers have identified two genetically distinct groups of the species. The genetic divergences showed up as differences in physical features that could inform strategies on where and how to release and conserve rescued tortoises, Subhasree Sahoo, a Ph.D. student and first author of the study, says.

	Tortoise/Turtle species	IUCN status
1	Northern river terrapin	Critically Endangered
2	Indian softshell turtle	Vulnerable
3	Red Crowned Roofed Turtle	Critically Endangered
4	Indian Star Tortoise	Vulnerable

8. Similipal Tiger Reserve

Context: Odisha has initiated interState coordination with Jharkhand to bring back a female tiger which was released into the Similipal Tiger Reserve to boost the genetic diversity of the reserve's big cat population.

About Similipal Tiger Reserve (STR):

- STR is located within the Mayurbhanj District, in the Northern-most part of Odisha. It is spread over 2750 sq km.
- It is surrounded by high plateaus and hills, the highest peak being the twin peaks of Khairiburu and Meghashini (1515m above mean sea level).
- The terrain is mostly undulating and hilly, interspersed with open grasslands and wooded areas.
- It was declared a 'Tiger Reserve' in the year 1956 and included under the national conservation programme 'Project Tiger' in 1973.
- The STR along with a 'transitional area' of 2250 sq. km has been included as a part of the World Network of Biosphere Reserves by UNESCO in the year 2009.
- It is the only landscape in the world that is home to melanistic tigers.
- The region around STR is home to a variety of tribes including Kolha, Santhala, Bhumija, Bhatudi, Gondas, Khadia, Mankadia and Sahara.
- **Flora:**
 - An astounding **1078 species of plants including 94 species of orchids** are found here.
 - **Eucalyptus**, are also the major floral attraction in the area.
- **Fauna:** Leopard, Gaur, Elephant, Langur, Barking and Spotted Deer, Sloth Bear, Mongoose, Flying Squirrel, Porcupine, Turtle, Monitor Lizard, Python, Sambar, Pangolin etc

9. Environment related Terms

Context: The 'mission 100% electrification' project is about chasing a mirage of turning into a green railway; a large number of serviceable diesel locomotives will also become redundant.

	Terms	definitions	Examples
1	Greenlighting	Spotlighting a single green initiative to distract from less sustainable practices	A company heavily promotes its recycling program while hiding high carbon emissions in manufacturing
2	Greenhushing	Keeping quiet about green initiatives to avoid scrutiny	A company has a successful recycling program but doesn't promote it for fear of scrutiny
3	Greencrowding	Slow to adopt green initiatives due to industry norms	A company adhering to the minimal environmental standards set by competitors
4	Greenrinsing	Changing ESG targets without genuine progress	A company frequently updates its carbon neutral target date without making significant steps towards achieving it



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10. Sacred grooves

Context: The Supreme Court on December 18 directed the Centre to create a comprehensive policy for the management of sacred groves across the country.

What are sacred grooves?

- Sacred groves are patches of trees traditionally protected by local communities for their religious and cultural significance. They also contribute to the conservation of the local biodiversity. These small forests are commonly found in Tamil Nadu, Kerala, Karnataka and Maharashtra.

	Name of the sacred grooves	States/UTs
1	Sarna	Bihar, Jharkhand, Chattisgarh
2	Oran	Rajasthan
3	Lai Umang	Manipur
4	Kavu	Kerala

11. The Pantanal

Context: Brazil's real on December 18 fell to its weakest level against the dollar since the currency was introduced in 1994, undercut by investors' frustration with President Luiz Inácio Lula da Silva's efforts to rein in government spending.

The Pantanal

The Pantanal is the largest tropical wetland in the world, covering an area of approximately 150,000–195,000 square kilometers. It is located primarily in Brazil, with smaller portions extending into Bolivia and Paraguay.

Recognized for its incredible biodiversity, the Pantanal is considered one of the most pristine and biologically diverse ecosystems on Earth.

Geography and Hydrology**1. Location:**

- Found in the **Upper Paraguay River Basin**, the Pantanal lies mostly within the Brazilian states of **Mato Grosso** and **Mato Grosso do Sul**. Smaller portions extend into eastern Bolivia and northern Paraguay.

2. Hydrological System:

- The Pantanal is a giant seasonal floodplain. During the rainy season (November to March), **80% of its area** becomes submerged as rivers overflow, creating a vast network of interconnected lakes and wetlands.
- In the dry season, the water recedes, leaving behind fertile soils and isolated water bodies that support rich wildlife.

3. Climate:

- The region has a **tropical savanna climate**, with distinct wet and dry seasons.
- Annual rainfall ranges from **1,000 to 1,500 millimeters**, supporting the seasonal flooding cycle.

Biodiversity**1. Fauna:**

- The Pantanal is a sanctuary for wildlife, hosting more than:
 - **470 species of birds** (e.g., hyacinth macaws, jabiru storks).
 - **300 species of fish** (e.g., piranhas, dorados).
 - **120 species of mammals** (e.g., jaguars, capybaras, giant anteaters).
 - **80 species of reptiles** (e.g., caimans, anacondas).

2. Flora:

- The vegetation is a mix of **savanna, grasslands, and gallery forests**.
- It acts as a natural filter, purifying water as it flows through the wetlands.

12. India State of Forest Report (ISFR) 2023

Context: India's forest and tree cover has reached a quarter of the country's total geographical area, according to the India State of Forest Report (ISFR) 2023, released by the Government of India on December 21.

More on the news:

- The increase of 25.17% breaks down to 21.76% of forest cover (7.15 lakh sq. km) and 3.41% of tree cover (1,289 sq. km).

The forest cover under India State of Forest Report (ISFR) 2023:

- The Forest Survey of India (FSI) defines "forest cover" as land with tree canopy density exceeding 10% and covering at least one hectare.
- Thus "forest" in ISFR includes plantations.
- The FSI counts trees outside forests towards the 'tree cover' if they occupy less than one hectare and if they also lie outside reserve forest areas.
- The FSI has been assessing forest cover since 1987 and tree cover since 2001.
- The current report estimated green cover using data from the Resourcesat series of satellites operated by the Indian Space Research Organisation.

Facts under India State of Forest Report (ISFR) 2023:

- Since 2021, Madhya Pradesh has had the largest area under forest and tree cover (85,724 sq. km).
- The largest increase in forest and tree cover in this period was recorded in Chhattisgarh (684 sq. km).
- The overall increase in tree and forest cover means a net gain after accounting for losses. Among other places, losses have been recorded in the Western Ghats and Eastern States Area (58.22 sq. km less forest cover) and the Northeast (327.30 sq. km less forest cover) — both highly biodiverse regions.
- Likewise, while "very dense" forests expanded by 3,465.12 sq. km, 'moderately dense' and 'open' forests have shrunk by 1,043.23 sq. km and 2,480.11 sq. km, respectively.

13. Lion-tailed macaque

Context: Human-wildlife interaction is a growing concern in areas where roads and plantations continue to encroach on natural habitats. A recent study warns of a growing threat to the critically endangered lion-tailed macaque, endemic to the Western Ghats due to increasing human interaction.

More about the news:

- Nearly 25% of the macaque population in eight key locations along the Western Ghats (the Anamalai Hills, Nelliampathy, Nilambur Ghats, Sholayar, Gavi, Sabarimala, Vallimalai Hills and Agumbe) areas engage in interactions with humans.
- This includes accepting food from tourists, raiding waste, and entering human settlements.
- The lion-tailed macaque, with only about 4,200 individuals remaining, faces severe risks due to food provisioning, which leads to malnutrition, disease, and dependence on unnatural food sources and increased vulnerability to road accidents and aggression from humans.

About lion-tailed macaque

- The lion-tailed macaque is classified as endangered on the IUCN Red List and protected under Appendix I of CITES.
- Its population faces threats from habitat loss, fragmentation, and human encroachment.
- The long-term consequences of increased human interaction include increased exposure to zoonotic diseases and diet-related illnesses; behavioural changes such as reduced foraging in natural habitats; increased reliance on human-provided food and population decline through rise in injuries, road accidents, and stress-induced mortality, according to the study.

Other Macaque species in India:

- **Bonnet Macaque (*Macaca radiata*):** This is one of the most familiar macaques in India, known for the distinctive “bonnet” of dark hair on its head. **They are highly adaptable and can be found in a variety of habitats, from forests to urban areas. The IUCN (International Union for Conservation of Nature) has classified the Bonnet Macaque as Vulnerable.**
- **Assam Macaque (*Macaca assamensis*):** **Found in northeastern India, Assam macaques are characterized by their long, thick fur and a dark face. They are primarily arboreal and live in tropical and subtropical forests.** The IUCN (International Union for Conservation of Nature) has classified the Assam Macaque as **Near Threatened**.

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SCIENCE & TECHNOLOGY

1. Bromalites

Context: An international collaboration has been able to identify undigested food remains, plants and prey in the fossilised faeces of dinosaurs, which helped reconstruct the rise of the dinosaurs to become the dominant players in Earth's ancient ecosystems. The study has been published in the journal Nature.

More about news:

- The analyses of hundreds of samples provide clues about the role dinosaurs played in the ecosystem around 200 million years ago.
- Fossil records show that dinosaurs evolved during the middle part of the Triassic period (247 to 237 million years ago).
- However, the domination of dinosaurs in terrestrial ecosystems was not seen until approximately 30 million years later, early in the Jurassic period.
- Many non-dinosaur tetrapods (four-limbed vertebrates) were displaced during this time, but what caused dinosaurs to dominate the ecosystem has remained in question.

What are Bromalites?

- The researchers have investigated this transition by reconstructing food webs using over 500 fossilised remains of digestive material (such as faeces or vomit), known as bromalites, from the Polish Basin, which span the Late Triassic to earliest Jurassic.
- Analyses of these remains (including 3D imaging of their internal structures to reveal undigested food contents) were compared to the existing fossil record, along with climate and plant data, to estimate the changes in size and abundance of vertebrates during this period.

2. Bacteriophages

Context: Engineers and biochemists at McMaster university have brought their skills together to make it possible for untrained users to confirm contamination in fluids using a biogel test that changes color in the presence of such bacteria as E. coli, listeria and other frequent testing targets.

More on news:

- The test uses harmless bacteriophages embedded in the gel to locate target bacteria in a sample of fluid such as lake water, urine or a container of milk, even in low concentrations.

Master of Microbes: How Bacteriophages Destroy Specific Bacteria

- Bacteriophages are the most common form of life on Earth. Each form of bacteriophage is specialized to destroy one form of bacteria.
- In the test, phages – as they are called informally – find and attack the target bacteria in a sample, causing the bacteria to release microscopic amounts of intracellular material which the test can read, triggering a color change that is readily visible to the eye. If the sample is clean, the color stays the same.
- The new process takes just hours, producing results much more quickly than lab cultures, which can take two days to generate results.



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3. Digital Arrest: A Cybercrime Scam

Context: In yet another incident, a Mumbai woman was made to strip and duped of ₹1.8 lakh by scammers after they convinced the 26-year-old that she was under 'digital arrest.'

Digital Arrest: A Cybercrime Scam

- A "digital arrest" is a type of cybercrime scam where fraudsters impersonate law enforcement officials, such as the CBI or customs officers, and threaten victims with arrest via video calls or phone calls.

How it works:

1. **Impersonation:** Scammers pose as legitimate authorities, often using deepfakes or other techniques to make their impersonation more convincing.
2. **False Accusations:** Victims are falsely accused of serious crimes, such as money laundering, tax evasion, or drug trafficking.
3. **Intimidation and Threats:** Scammers use threats of arrest, legal action, or imprisonment to instill fear in their victims.
4. **Financial Demands:** Victims are pressured to pay a "fine" or "bail" to avoid arrest or other legal consequences.

How to Protect Yourself:

- **Be Skeptical:** Never share personal or financial information with unsolicited callers or messages.
- **Verify Information:** If you receive a suspicious call or message, independently verify the information with the relevant authorities.
- **Avoid Panic:** Stay calm and don't rush into making decisions under pressure.
- **Report the Scam:** Contact local law enforcement and report the incident to relevant cybercrime authorities.
- **Educate Yourself:** Stay informed about the latest cybercrime trends and techniques.

Remember, legitimate law enforcement agencies will never ask for sensitive information or payments over the phone or through digital platforms. If you encounter such a situation, it's likely a scam.

4. Shock diamonds

Context: Sometimes when a rocket or a jet takes off, its exhaust has an alternating pattern of light and dark patches (see image). The bright patches in this formation are called shock diamonds, a.k.a. Mach diamonds. Shock diamonds are formed when an engine releases its exhaust into the atmosphere at a supersonic speed.

What are shock diamonds?

- Just as exhaust leaves the engine, the exhaust can be at a lower pressure than atmospheric pressure at the same altitude.
- As the exhaust flows out, the atmosphere compresses it until the two pressures are equal. It's also possible that the exhaust becomes over-compressed, at which point it will expand outward again to drop its pressure.
- This seesawing process may repeat itself multiple times until the exhaust pressure is close to the atmospheric pressure.
- This entire process generates waves in the exhaust plume, leading to the formation of shock diamonds.
- When the atmospheric pressure bears down on the plume, it causes exhaust that's diverging outward to bend inward instead, before its pressure causes the exhaust to bend outward again and so on.
- When it flows inward, the pressure in that portion increases, hiking the temperature there and causing any fuel passing through that area to burn.
- The combustion creates a bright spot at that location, i.e., a shock diamond.
- The bending of the exhaust outward and inward produces shock waves that flow through the plume, creating the shock diamond pattern throughout.

5. AI-powered Linen Inspection and Sorting Assistant

Context: The Indian Railways has implemented an Artificial Intelligence-based system to inspect and sort linens such as bed sheets and towels provided to passengers in the air-conditioned coaches.

More on news:

- The AI-powered Linen Inspection and Sorting Assistant (LISA) was developed by the Pune division of Indian Railways and was recently inaugurated by Union Railway Minister Ashwini Vaishnav at the laundry facilities of the Ghorpadi Integrated Coaching Complex (GICC).
- The LISA system is an advanced AI-based automation machine designed to ensure 100% quality inspection of bed sheets used in trains.
- Utilising state-of-the-art artificial intelligence, LISA meticulously inspects each bed sheet for any defects, stains or damage, ensuring that passengers receive only the highest quality linens during their travel.
- It ensures 100% quality inspection and performs thorough checks to detect and segregate substandard linens.

6. Nano Bubble Technology

Context: Union Minister of State for Forest, Environment and Climate Change Sh. Kirti Vardhan Singh on Tuesday launched 'Nano Bubble Technology' for cleaning and purifying water of National Zoological Park, Delhi to promote the health of aquatic animals.

What is Nano Bubble Technology?

- Nano bubble technology involves the use of extremely small gas bubbles (usually smaller than 200 nanometers in diameter) suspended in a liquid. These nano-sized bubbles possess unique properties, such as high surface area, stability, and the ability to penetrate small spaces, which make them suitable for various applications across industries.

Applications of Nano Bubble Technology

1. Environmental Remediation

- Water treatment
- Wastewater management
- Oil spill cleanup

2. Agriculture

- Irrigation enhancement
- Disease prevention

3. Aquaculture

- Enhanced oxygenation
- Disease control

4. Medical and Healthcare

- Drug delivery
- Ultrasound contrast agents
- Wound healing

5. Food and Beverage Industry

- Food preservation
- Cleaning and sterilization

6. Industrial Applications

- Mining (froth flotation)
- Textile processing
- Cooling systems

7. Energy Sector

- Hydrogen production
- Enhanced oil recovery (EOR)

8. Cosmetics and Personal Care

- Skin care products
- Hair care treatments

9. Sports and Wellness

- Hydrotherapy
- Surface cleaning in swimming pools

10. Future Potential

- Carbon capture
- Nanomedicine
- Microelectronics cleaning systems

While, this technology cannot work in high temperature state and in solid state, hence they cannot be used for metallurgical applications and manufacturing electronics.

7. ecDNA

Context: On November 6, three papers were published in the journal Nature by a team called eDyNAmiC — an international collaboration led by Stanford University professor Paul Mischel. The studies explore how ecDNA is formed and contributes to the progression of cancer and drug resistance.

What is ecDNA?

- **Definition:** Extrachromosomal DNA (ecDNA) is a circular DNA structure that breaks away from the main chromosome and floats freely inside the nucleus.
- **Formation:**
 - Can result from DNA damage caused by natural processes such as chromothripsis (chromosome breakage and rearrangement) or replication errors.
 - Triggered by environmental factors like smoking, exposure to harmful substances, and genetic mutations.

Key Findings on ecDNA

- **Prevalence:**
 - Present in about 17% of tumour samples.
 - Common in liposarcomas, brain tumours, and breast cancers.
 - Increases after treatments like chemotherapy.
- **Impact on Outcomes:**
 - Correlates with metastasis and worse patient outcomes.

ecDNA and Cancer Growth

- **Oncogene Multiplication:**
 - ecDNA often contains multiple copies of oncogenes, which promote tumour growth.
 - Oncogenes on ecDNA are more active compared to those on chromosomes.

• Mobility and Interaction:

- Unlike chromosomal DNA, ecDNA moves freely within the nucleus and interacts with other ecDNA to form hubs.
- These hubs increase oncogene expression.

• Effect on Protein Production:

- Transcription of ecDNA to mRNA results in oncogene expression being up to four times higher than chromosomal DNA.
- Accelerates tumour evolution and drug resistance.

An Inheritance of Loss: ecDNA and Genetic Principles

• Violation of Mendel's Third Law:

- Mendel's third law of independent assortment states that genes on different chromosomes are inherited randomly.
- ecDNA is inherited in clusters during cell division, violating this principle.

• "Jackpot Effect":

- The clustering of ecDNA enhances gene interactions, supports cancer growth, and preserves favourable genetic combinations across generations.
- Facilitates cancer's ability to adapt and thrive.

• Coordinated Segregation:

- The transcription process from DNA to RNA helps coordinate ecDNA inheritance during cell division.

Implications

- Overturns traditional understanding of genetic inheritance.
- Highlights the role of ecDNA in cancer progression and treatment resistance.
- Suggests new avenues for cancer research and potential therapeutic strategies.

8. GAIT analysis

Context: Technology that helps decipher grainy CCTV footage better, coupled with limping gait of a suspect, helped police arrest a man who raped a seven-month-old infant in north Kolkata last December 6.

Application of GAIT analysis:

1. Healthcare and Rehabilitation

- **Diagnosis and Treatment of Disorders:** Identifies abnormalities in walking patterns caused by conditions such as Parkinson's disease, cerebral palsy, multiple sclerosis, and stroke.
- **Orthopedic Assessment:** Evaluates the effects of injuries, such as fractures or ligament tears, and aids in post-surgical rehabilitation (e.g., joint replacements).
- **Prosthetics and Orthotics:** Optimizes the design and fit of prosthetic limbs and orthotic devices to ensure natural movement.
- **Fall Risk Assessment:** Analyzes gait in elderly individuals to predict and prevent falls.
- **Neurological Therapy:** Monitors progress in therapy for patients with motor control disorders.

2. Sports and Performance Enhancement

- **Athlete Training:** Improves performance by analyzing movement efficiency and correcting biomechanical inefficiencies.
- **Injury Prevention:** Identifies factors contributing to sports-related injuries, such as overuse or improper technique.
- **Rehabilitation Post-Injury:** Tracks recovery progress in athletes and ensures a safe return to sports activities.

3. Biomechanics and Research

- **Movement Studies:** Helps researchers understand the biomechanics of walking and running.
- **Human Kinetics:** Explores the interplay between muscles, bones, and joints during movement.

- **Development of Assistive Devices:** Aids in designing robotic exoskeletons, powered wheelchairs, and other mobility aids.

4. Robotics and AI

- **Humanoid Robotics:** Guides the design of robots with human-like walking capabilities.
- **Gait Recognition Systems:** Used in artificial intelligence for identity verification and surveillance applications.
- **Bipedal Locomotion:** Develops algorithms for balancing and movement in robots.

5. Forensics and Security

- **Criminal Identification:** Analyzes gait patterns from surveillance footage to identify suspects.
- **Behavior Analysis:** Assists in profiling and understanding movement patterns in specific environments.

6. Veterinary Medicine

- **Animal Rehabilitation:** Assesses gait abnormalities in animals and aids in treatment planning.
- **Performance Evaluation:** Used in racehorses, dogs, and other animals to evaluate and enhance performance.
- **Prosthetic Design:** Optimizes prosthetics and orthotics for injured animals.

7. Ergonomics and Workplace Safety

- **Workplace Design:** Improves the ergonomics of workspaces by analyzing worker movement and reducing strain-related injuries.
- **Monitoring Fatigue:** Identifies signs of fatigue in workers to prevent accidents, especially in physically demanding jobs.

8. Military and Defense

- **Soldier Training:** Enhances the physical efficiency of soldiers by improving walking and running mechanics.
- **Combat Gear Testing:** Ensures that military gear does not impede mobility or increase the risk of injury.

9. Wearable Technology

- **Fitness Trackers:** Incorporates gait analysis to provide insights into walking and running efficiency.
- **Smart Insoles and Shoes:** Monitors pressure distribution and stride to improve posture and reduce fatigue.

While, non-locomotory applications like Curing of depression or anxiety, analysis of pressure point of lower back while in sitting posture do not involve GAIT analysis.

9. Occupational Diseases

Context: Mine workers need early diagnosis and treatment of silicosis. On November 29, the National Green Tribunal (NGT) directed the Central Pollution Control Board to draft new guidelines vis-à-vis "granting permission for [silica] mining and washing plants", and the Uttar Pradesh government and Pollution Control Board to set up health-care facilities in areas with silica mines.

	Occupational Diseases	Industries
1	Musculoskeletal Disorders (MSDs)	Construction
2	Hypersensitivity Pneumonitis	Agriculture
3	Byssinosis	Textile
4	Pneumoconiosis	Mining

10. Parkinson's Disease

Context: A study from the University of Arizona shows that the protein PNA5 helps protect brain cells, offering a promising avenue for treating cognitive symptoms in Parkinson's disease, a condition currently lacking effective cognitive therapies.

Parkinson's Disease and Cognitive Research on PNA5

• Parkinson's Disease Overview:

- Neurological disorder primarily causing tremors, stiffness, slow movement, and poor balance.
- Cognitive symptoms can progress to Parkinson's dementia.
- No effective treatments currently exist for cognitive decline in Parkinson's disease.

• Cognitive Symptoms and Prevalence:

- 25%-30% of newly diagnosed patients show mild cognitive impairment.
- As the disease progresses, 50%-70% of patients experience significant cognitive problems.

• PNA5 Research Highlights:

- Developed by Meredith Hay, PhD, PNA5 shows potential to prevent cognitive decline in Parkinson's disease.
- PNA5 works by targeting neuroinflammation and protecting brain cells from further degeneration.

• Role of Inflammation in Parkinson's:

- Chronic activation of microglia (brain immune cells) leads to inflammation and tissue damage.
- Supercharged microglia secrete harmful chemicals linked to cognitive decline.
- PNA5 reduces the inflammatory chemical levels and mitigates brain cell damage.

• Mechanism of Action:

- PNA5 modulates the immune response, returning microglia to a normal state.
- Prevents neuron degeneration in brain regions critical for learning and memory.

- **Future Implications:**
 - Researchers aim to refine dosages, identify biomarkers, and study sex-specific effects of PNA5.
 - The drug could complement existing treatments for motor symptoms.
- **Potential Broader Applications:**
 - PNA5 shows promise for treating other dementias, including vascular dementia and Alzheimer's disease.

11. Nafithromycin

Context: India has achieved a groundbreaking milestone in the fight against antimicrobial resistance (AMR) with the development of Nafithromycin, the country's first indigenous macrolide antibiotic.

Nafithromycin: Milestone for Public Health

- Nafithromycin, was officially launched on November 20, 2024, by Union Minister Dr. Jitendra Singh.
- Developed by Wockhardt with support from the Biotechnology Industry Research Assistance Council (BIRAC), Nafithromycin, marketed as "Miqnaf," targets Community-Acquired Bacterial Pneumonia (CABP) caused by drug-resistant bacteria, which disproportionately affects vulnerable populations such as children, the elderly, and those with compromised immune systems.
- This groundbreaking antibiotic is ten times more effective than current treatments like azithromycin and offers a three-day treatment regimen, significantly shortening the recovery time while improving patient outcomes.
- Nafithromycin is designed to treat both typical and atypical drug-resistant bacteria, making it a crucial tool in addressing the global health crisis of AMR (Anti-microbial Resistance).
- It boasts superior safety, minimal side effects, and no significant drug interactions.
- Nafithromycin's development marks a historic milestone as the first new antibiotic in its class to be introduced globally in over 30 years.

- The drug, which has undergone extensive clinical trials across the U.S., Europe, and India, has been developed with an investment of ₹500 crores and is now awaiting final approval from the Central Drugs Standard Control Organization (CDSCO).
- This innovation exemplifies the power of public-private collaboration and underscores India's growing capabilities in biotechnology.
- Nafithromycin's successful introduction represents a major leap in the fight against AMR, offering hope for treating multi-drug-resistant infections and saving lives worldwide.



12. Melye-amiley

Context: Extract from a traditional fermented bamboo shoot variety of Tripura, popularly called 'Melye-amiley' has anti-obesity effects and offers a solution to weight management and metabolic health, according to a new study. It reduces lipid accumulation and increases fatty acid β -oxidation.

More on news:

- The techniques of fermentation have been as old as human civilization that have passed through generations, mainly used to preserve food, enhance nutritional quality and also to enhance taste and flavour.

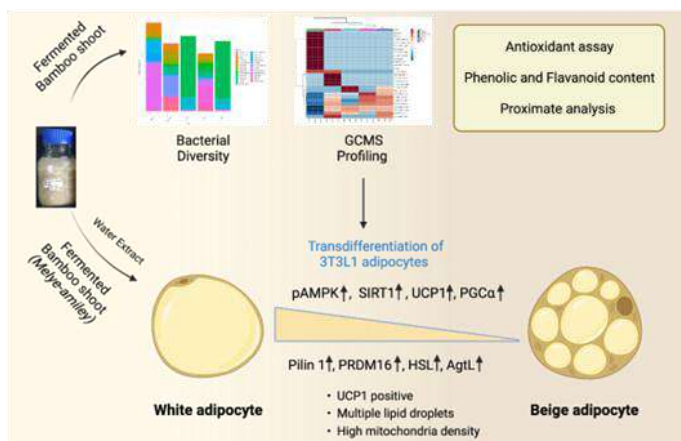
- Based on the environment, availability of food materials and traditional knowledge of the community, the techniques and the products vary.

The study on 'Melye-amiley':

- A study led by Prof. Mojibur R. Khan from the Institute of Advanced Study in Science and Technology (IASST), an autonomous institute of the Department of Science and Technology (DST) looked into anti-obesity effects of different varieties of traditional fermented bamboo shoots of the north eastern region.

The results of study:

- Based on in vitro cell culture studies the team has observed that a traditional fermented bamboo shoot variety of Tripura, called 'Melye-amiley' can reduce intracellular lipid accumulation.
- The process involved increase in the expression of lipolytic (HSL, LPL, and AgtI) and fat browning regulator genes (UCP1, PRDM16, and PGC1-alpha).
- Furthermore, the study demonstrates that treatment with Melye-amiley leads to the upregulation of thermogenic protein expression via the AMPK signaling pathway.
- This process stimulates mitochondrial biogenesis and enhances fatty acid β -oxidation, offering a multifaceted approach to weight management and metabolic health.
- These findings suggest that fermented bamboo shoot extract has promising anti-obesity effects by boosting energy expenditure in white adipocytes. This study was recently published in the prestigious journal 'Food Frontiers.'



13. Ceres' Exploration and Discovery

Context: Researchers used data from NASA's Dawn mission to uncover new evidence of internal organic material reservoirs on Ceres, the dwarf planet.

Ceres' Exploration and Discovery

- Six years ago, NASA's Dawn mission sent its final signal to Earth, concluding its exploration of Ceres and Vesta, the two largest objects in the asteroid belt.
- Since then, Ceres — a water-rich dwarf planet with signs of geological activity—has remained a subject of scientific debate about its origin and evolution.
- Now, a study led by researchers at the Instituto de Astrofísica de Andalucía (IAA-CSIC), using Dawn mission data and advanced analysis techniques, has uncovered eleven new regions suggesting the presence of an internal reservoir of organic materials.
- The findings, published in *The Planetary Science Journal*, offer valuable insights into the planet's hidden chemistry.

New Insights into Organic Compounds on Ceres

- In 2017, the Dawn spacecraft detected organic compounds near Ceres' Ernutet crater in its northern hemisphere, prompting questions about their source.
- One theory suggested the compounds were delivered by recent impacts from organic-rich comets or asteroids.
- The new study, however, explores a different possibility: that the organic material formed within Ceres itself and has been preserved in a reservoir protected from solar radiation.

A Potential Witness to the Dawn of the Solar System

- With a diameter exceeding 930 kilometers, Ceres is the largest object in the main asteroid belt.
- This dwarf planet — which shares some characteristics with planets but doesn't meet all the criteria for planetary classification — is recognized as the most water-rich body in the inner Solar System after Earth, placing it among the ocean worlds with potential Astro biological significance.

14. AgeXtend

Context: Researchers at IIT-Delhi have developed AgeXtend as a tool to efficiently cut down the time taken to identify viable molecules with geroprotectors, or age defying properties, through conventional research. The authors who have published the experiment in a recent issue of *Nature Aging*, have said that they screened over 1.1 billion compounds, over a period of two years, and the platform had uncovered several promising candidates validated through experiments on yeast, worms (*C. elegans*), and human cell models. A fraction of them, less than 1%, have been identified with anti-ageing properties.

How it works?

- AgeXtend uses AI to predict and identify compounds with anti-ageing properties, assess their safety, and understand their biological effects.
- It looks at the structure of new molecules and can predict accurately if they have gero-protective characteristics.
- But where this product diverges from others that might already have been employed by researchers is that it can explain why it considers certain compounds as anti-ageing, it reveals why it chose these components — the mechanisms.
- This will help to guide further research and indicate the particular direction in which validation needs to proceed.
- The research team has made available its code and data on open source on the website, free for researchers and students, and at a charge for companies.

15. DHARINI dataset

Context: The Indian Institute of Technology-Madras has achieved a rare feat in the field of brain mapping technology by releasing 3D high resolution images of human foetal brain on December 10.

More on the news:

- IIT-M director V Kamakoti claimed that such images are being released for the first in the world and the achievement is also special as such advanced human neuroscience data has been produced for the first time in India.

The DHARINI dataset:

- As many as 5,132 brain sections were digitally imaged at cell resolution level using cutting-edge brain mapping technology developed by the team at Sudha Gopalakrishnan Brain Centre at IIT.
- The high-resolution foetal brain images will have significant applications in enhancing current foetal imaging techniques and have the potential to enable early diagnosis and treatment of health conditions affecting the brain, Kamakoti said.
- The image dataset, named 'DHARANI,' is now the largest publicly accessible digital dataset of the human foetal brain and is freely available to researchers worldwide.
- The dataset provides detailed insights into brain development from the second trimester of a foetus and researchers have identified over 500 brain regions, making it a complete atlas of the human brain.
- The findings of this research have been accepted for publication as a special issue in the *Journal of Comparative Neurology*, a century-old peer-reviewed systems neuroscience journal.

16. Super Puff Planets

Context: A team of researchers from Penn State and Osaka University has discovered that an unusual planetary system, known for its three ultra-low density "super-puff" planets, includes at least one more planet. While observing Kepler-51d, the third planet in the system, with NASA's James Webb Space Telescope (JWST), the team encountered a surprise: the planet transited its star two hours earlier than predicted by existing models.

Characteristics of Super Puff Planets

- Super puff planets are very unusual in that they have very low mass and low density.
- The three previously known planets that orbit the star, Kepler-51, are about the size of Saturn but only a few times the mass of Earth, resulting in a density like cotton candy.

- They have tiny cores and huge atmospheres of hydrogen or helium, but how these strange planets formed and how their atmospheres haven't been blown away by the intense radiation of their young star has remained a mystery.

How these planets are detected?

- When a planet passes in front of — or transits — its star when viewed from Earth, it blocks some of the star's light, causing a slight decrease in the star's brightness.
- The duration and amount of that decrease gives clues to the planet's size and other characteristics.
- Planets transit when they complete an orbit around their star, but sometimes they transit a few minutes early or late because the gravity from other planets in the system tug on them.
- These minor differences are known as transit timing variations and are built into astronomers' models to allow them to accurately predict when planets will transit.

17. Metals & Diseases

Context: Manganese (Mn) contamination of water is causing cancer in the Gangetic plains of Bihar, a study by a team of scientists from Patna-based Mahavir Cancer Sansthan has claimed.

	Diseases	Elements/metals
1	Plumbism	Lead
2	Wilson's Disease	Copper
3	Itai-itai disease	Cadmium
4	Methemoglobinemia	Nitrogen



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18. XLumina

Context: XLumina, an AI framework, enhances super-resolution microscopy by exploring vast optical configurations, rediscovering established techniques, and creating superior experimental designs.

About XLumina:

- Discovering new super-resolution microscopy techniques often requires years of painstaking work by human researchers.
- The challenge lies in the vast number of possible optical configurations in a microscope, such as determining the optimal placement of mirrors, lenses, and other components.
- To address this, scientists at the Max Planck Institute for the Science of Light (MPL) have developed an artificial intelligence (AI) framework called XLumina.
- This system autonomously explores and optimizes experimental designs in microscopy, performing calculations 10,000 times faster than traditional methods.
- The team's groundbreaking work was recently published in Nature Communications.

18. Io's volcanoes

Context: Nasa has revealed new details about Io, Jupiter's third-largest moon and the most volcanic world in our solar system. Io has over 400 active volcanoes on its surface, creating stunning lava flows and eruptions that send plumes into space.

What powers Io's volcanoes?

- Io's volcanoes are likely powered by separate magma chambers instead of one large magma ocean. According to the paper titled "Io's tidal response precludes a shallow magma ocean", published in Nature, this phenomenon explains the moon's intense volcanic activity.
- Io's volcanoes constantly erupt, spewing lava and plumes that shape its unique surface.
- Although Io was discovered in 1610, its volcanic activity was only confirmed in 1979 by Nasa scientist Linda Morabito.

How did Nasa observe Io?

- Nasa's Voyager 1 spacecraft captured the first images of Io's volcanic plumes in 1979.
- About the same size as Earth's Moon, Io is constantly squeezed by its elliptical orbit around Jupiter.
- This squeezing, called tidal flexing, creates intense heat inside the moon, melting its interior and causing eruptions.
- During close flybys in late 2023 and early 2024, Nasa's Juno spacecraft used Doppler measurements to collect precise gravity data.
- This showed that Io doesn't have a global magma ocean as previously thought, but instead has separate magma chambers powering its volcanoes.

	Planets	Moons
1	Mars	Phobos, Deimos
2	Jupiter	Io, Europa, Ganymede, Callisto
3	Saturn	Titan, Rhea, Iapetus, Dione
4	Uranus	Miranda

19. Cyber slavery

Context: An attempt by an agent to send three Tamil Nadu youth to Cambodia for employment in "fraudulent, scam-based companies for cyber slavery" was foiled by the Protector of Emigrants (POE), Chennai, and the Tamil Nadu Crime Branch CID, police said on December 13.

Cyber slavery:

Cyber slavery is an emerging and alarming form of modern-day slavery and human trafficking where individuals are coerced, exploited, or trafficked into performing illegal online activities under duress. It is a manifestation of digital exploitation in the age of advanced technology and organized cybercrime.

Key Features of Cyber Slavery

1. **Exploitation in Cybercrime Activities**
Victims are forced to engage in illegal activities, such as:
 - Running phishing scams.
 - Conducting financial frauds like money laundering.
 - Carrying out fake online sales or investments.
 - Hacking or data theft for criminal organizations.
2. **Trafficking and Recruitment**
 - Criminal syndicates target vulnerable individuals, often through false job advertisements or promises of legitimate work, particularly in the tech industry.
 - Victims are lured into foreign countries or remote locations, where they are held captive, monitored, and forced to work.
3. **Control and Coercion**
 - Victims may face threats, physical abuse, or restrictions on their freedom to ensure compliance.
 - Their passports or documents are often confiscated to prevent escape.
4. **Global Reach**
 - Cyber slavery is not limited to one region; victims are trafficked across borders, often to Southeast Asian nations like Cambodia or Myanmar, where such crimes are on the rise.
 - The cyber activities perpetrated by victims often have a global impact, targeting individuals or institutions worldwide.
5. **Challenges for Law Enforcement**
 - The anonymity of cyberspace makes it harder to trace perpetrators.
 - Victims, often trapped in foreign jurisdictions, struggle to access legal aid or assistance.

20. Solid-phase alloying

Context: Metal scrap can be directly transformed and upgraded into high-performance, high-value alloys without the need for conventional melting processes, according to a new study published this week in the journal Nature Communications. The study demonstrates that scrap aluminium from industrial waste streams can produce high-performance metal alloys.

Solid-phase alloying:

- Solid-phase alloying is a revolutionary metalworking technique that transforms metal scrap into high-quality alloys without the traditional melting process.
- Instead, it relies on mechanical forces to blend and homogenize the metals, resulting in a more sustainable and efficient manufacturing process.

The Shape method:

- The innovative solid-phase alloying process converts aluminium scrap blended with copper, zinc, and magnesium into a precisely designed high-strength aluminium alloy product in a matter of minutes, compared to the days required to produce the same product utilizing conventional melting, casting, and extrusion.
- The research team used a PNNL-patented technique called Shear Assisted Processing and Extrusion, or SHAPE, to achieve their results. However, the researchers noted that the findings should be reproducible with other solid-phase manufacturing processes.

Longer lifespan

- Within the SHAPE process, a high-speed rotating die creates friction and heat that disperses the chunky starting ingredients into a uniform alloy with the same characteristics as a newly manufactured aluminum wrought product.
- The solid phase approach eliminates the need for energy-intensive bulk melting, which combined with the low-cost feedstocks originating from scrap, has the potential to sharply reduce the cost of manufacturing these materials.
- For consumers, this means recycled aluminium products will have a longer lifespan and better performance at a lower cost, whether they are part of a vehicle, a construction material, or a household appliance.

21. Cold moon

Context: The Full Moon on December 15, also called the "Cold Moon," marks an important celestial event towards the end of this year.

What is cold moon?

- The Cold Moon is the name given to the full moon that occurs in December.
- It's called the Cold Moon because it appears during the coldest months of the year in the Northern Hemisphere.
- The Full Moon in December is called by different names in various parts of the world.
- Some among them are Yule or the Oak Moon, Datta or Dattatreya Jayanti Festival Moon, Karthikai Deepam Festival Moon, etc.
- The Maine Farmers' Almanac called it the Cold Moon because it occurs closer to the winter solstice, giving long and cold winter nights.

Religious significance of Cold Moon

- This full moon corresponds with Datta Jayanti or Dattatreya Jayanti for Hindus, who commemorate the birth of the Hindu God Dattatreya (Datta).
- This falls on the month of Margashira or Margazhi in the Hindu calendar.
- The full moon also falls when Hindus in Tamil Nadu, Kerala and neighbouring Sri Lanka observe the day as Karthikai Deepam.
- According to NASA, the moon lines up with the Pleiades constellation (Krittikai or Karttikai). People in these regions light up diyas to celebrate the festival over a few days.

22. Dark comet

Context: Researchers have doubled the number of known dark comets, identifying two distinct types: larger ones in the outer solar system and smaller ones in the inner solar system. This discovery raises new questions about their origins and their role in delivering life-sustaining materials to Earth.

What is dark comet?

- **In the context of space, a “dark comet” is a celestial object that resembles an asteroid but exhibits comet-like behaviour.**

Key characteristics:

- **Appearance:** **They often appear as asteroids, lacking the bright tails and comas (the fuzzy cloud around a comet's nucleus) typically associated with comets.**
- **Orbit:** Like comets, they follow elongated, elliptical orbits around the Sun, bringing them closer to the Sun and then farther out.
- **Outgassing:** **The defining characteristic is their subtle outgassing activity. They release small amounts of gas, causing slight deviations from their expected orbits due to the momentum imparted by the escaping gas.** This outgassing is often too faint to be directly observed.

Origin and significance:

- **Potential source of Earth's water:** Some scientists believe that dark comets may have played a significant role in delivering water to Earth in the early stages of its formation.
- **Understanding the evolution of the solar system:** Studying dark comets can provide valuable insights into the formation and evolution of the solar system, as they represent a transitional phase between asteroids and comets.

23. Different types of black holes

Context: A study published in the *Astrophysical Journal Letters* on November 7. It was carried out by astrophysicists from the Institute for Advanced Study in Princeton, New Jersey, and led by George Wong of the School of Natural Sciences at Princeton University. **In their study, the researchers presented a new method to measure the properties of black holes by using the effects they have on light flowing around them.**

More about the news:

- When it comes to making sense of our universe, the importance of black holes is hard to understate.
- **Scientists know that a black hole exerts a strong gravitational pull, so much so that any object that gets closer to its centre beyond a point can never get back out.**
- The effects of black holes on their surroundings include the release of a tremendous amount of energy.
- These effects are crucial to **determining the structures of the galaxies they occupy and how the stars around them evolved over time.**

Different types of black holes:

- **A Kerr Black Hole is a solution to Einstein's field equations that describes a black hole with mass and angular momentum (rotation), but no electric charge.**
- This distinguishes it from the **Schwarzschild Black Hole (non-rotating, static) and the Kerr-Newman Black Hole (rotating with electric charge).**

24. PlantRNA-FM

Context: **PlantRNA-FM, an AI model created by researchers at the John Innes Centre and the University of Exeter, deciphers the genetic “language” of plant RNA by analyzing patterns in RNA sequences and structures across species. This breakthrough technology offers new insights into RNA functions and holds potential for innovation in plant science, crop improvement, and gene design.**

More on news:

- **A groundbreaking Artificial Intelligence (AI) model designed to decode the sequences and structural patterns that form the genetic “language” of plants has been launched by a research collaboration.**

- **Named Plant RNA-FM**, this innovative model is the first of its kind and was developed by a partnership between **plant researchers at the John Innes Centre and computer scientists at the University of Exeter**.
- The model, say its creators, is a **smart technological breakthrough that can drive discovery and innovation in plant science and potentially across the study of invertebrates and bacteria**.
- RNA, like its better-known chemical relative DNA, is an important molecule throughout all organisms, responsible for carrying genetic information in its sequences and structures.
- In the genome, RNA architecture is made up of combinations of building blocks called nucleotides, which are arranged in patterns in the same way that the alphabet combines to make words and phrases in language.

25.. Aerosol chemistry

Context: **Shahzad Gani, of the Centre for Atmospheric Sciences in IIT Delhi, said the new study indexes a 'major shift' in our understanding of how the formation of secondary aerosols like hydroxymethanesulphonate 'can happen in fine particles even in extremely cold, dark conditions'.**

Aerosol chemistry

- **Hydroxymethanesulphonate formation has been traditionally thought to occur in clouds and fog, not in aerosols, because the former have more liquid water.**
- Hydroxymethanesulphonate formation also requires more acidic conditions, whereas the sulphite ions (SO_3^{2-}) required for its formation are present in adequate amounts only when the air is less acidic.
- The higher density of water droplets in clouds and fog absorbs more water-soluble gases, rendering them less acidic than most aerosols.

How Hydroxymethanesulphonate is getting formed in aerosols?

- At very low temperatures, water typically freezes to ice.

- But sometimes, in a process called supercooling, the temperature of a liquid can drop well below its freezing point without it turning solid.
- **As a result, they contain liquid water, which allows hydroxymethanesulphonate to form within these particles.**
- The rapid shift in the acidity of $\text{PM}_{2.5}$ in many places is largely the handiwork of the relative concentration of two ions: sulphate (SO_4^{4-}) and ammonium (NH_4^+).
- Sulphate ions increase the acidity of aerosol particles while the latter, a base, neutralise the acidity.
- Two ammonium ions are required to neutralise the acidity contributed by each sulphate ion.
- If there were to be an equal number of sulphate and ammonium ions in an aerosol particle, it would be more acidic.
- Further, ammonium in aerosols can exist in its gaseous form, ammonia, and in its ionic form dissolved in the liquid water in the aerosol.
- In normal conditions, the two forms exist in equilibrium, where the rates of conversion of ammonium to ammonia and ammonia to ammonium are equal.
- At very low temperatures, fewer ammonium ions are able to jump to the gaseous state.
- And as the concentration of ammonium ions within the aerosol particle builds up, its acidity drops further, making it a fertile site for hydroxymethanesulphonate production.

26. Indian Vessels

Context: **INS Nirdeshak, the second ship of Survey Vessel (large) project, was commissioned into the Indian Navy, in a ceremony presided over by Union Minister of State for Defence Sanjay Seth at Visakhapatnam Naval Dockyard, here on December 18.** The ship is designed to conduct hydrographic surveys, aid in navigation, and support maritime operations.

	Name of the vessels	Types of the vessels
1	INS Tushil	Stealth-guided missile frigate
2	INS Nirdeshak	Survey vessel
3	INS Surat	Missile destroyer
4	INS Vagsheer	Diesel attack submarine

27. Altermagnetism

Context: Altermagnetism, a newly imaged class of magnetism, offers potential for the development of faster and more efficient magnetic memory devices, increasing operation speeds by up to a thousand times.

More on the news:

- Researchers from the University of Nottingham have demonstrated that this third class of magnetism, combining properties of ferromagnetism and antiferromagnetism, could revolutionize computer memory and reduce environmental impact by decreasing reliance on rare elements.

Altermagnetism's Unique Properties

- A groundbreaking study has imaged a newly discovered type of magnetism called altermagnetism for the first time.
- This discovery could pave the way for developing advanced magnetic memory devices capable of operating up to a thousand times faster than current technologies.
- Altermagnetism is a unique magnetic order where tiny magnetic building blocks align in opposite (antiparallel) directions, similar to antiferromagnetism.
- However, unlike traditional antiferromagnetic materials, the crystal structures hosting these magnetic moments are rotated relative to one another, creating a distinct magnetic pattern.

Potential Impacts

- Magnetic materials are used in the majority of long-term computer memory and the latest generation of microelectronic devices.

- This is not only a massive and vital industry but also a significant source of global carbon emissions.
- Replacing the key components with altermagnetic materials would lead to huge increases in speed and efficiency while having the potential to massively reduce our dependency on rare and toxic heavy elements needed for conventional ferromagnetic technology.
- Altermagnets combine the favorable properties of ferromagnets and antiferromagnets into a single material.
- They have the potential to lead to a thousand-fold increase in speed of microelectronic components and digital memory while being more robust and energy efficient.

28. Never events (NE)

Context: Medical complications are expected risks inherent to medical procedures. Iatrogenic causes may overlap with complications but are specifically tied to medical interventions, whether acceptable or negligent.

More about:

- The concept of 'never events' (NE) is described broadly as serious and largely preventable incidents that should never occur in healthcare settings if proper safety protocols are followed.
- Never events as a term was introduced in 2002 by the National Quality Forum (NQF) in the United States.
- It has since been adopted in the Western world, particularly in countries like the U.S, U.K., and Canada, and they maintain a list of never events.
- They highlight the importance of preventing harm through systemic checks, improved processes, and strict adherence to safety protocols.
- Never events lack a universal definition and overlaps with terms like 'sentinel events' or 'serious reportable events'.

- These categories generally share the theme of preventable harm resulting in severe patient consequences such as operating on the wrong side of the limb, insulin overdose, or mismatched blood transfusion.
- This could lead to disability, death, or great discomfort for the patient. The broad scope of never events overshadows the systemic complexities behind such incidents.

The Indian context

- Never events as a term has not been explicitly acknowledged or used in the Indian context.
- Instead, medical negligence is applied in medico-legal cases and allegations of professional misconduct in healthcare.
- While never events emphasise preventable harm within healthcare systems, in India, similar incidents are categorised and addressed under the broader legal framework of medical negligence.
- Medical negligence occurs when a healthcare provider fails to meet the expected standard of care, leading to harm, as per the Bolam test.
- This may involve acts of commission, such as administering incorrect medication, or omission, like neglecting to check for retained placenta in the uterus after delivery.
- The evaluation of negligence is based on whether the actions align with what a competent peer would have done under similar circumstances.

Geography and Hydrology

2. Location:

- Found in the **Upper Paraguay River Basin**, the Pantanal lies mostly within the Brazilian states of **Mato Grosso** and **Mato Grosso do Sul**. Smaller portions extend into eastern Bolivia and northern Paraguay.

List of never events as per NHS

Never events are difficult to eradicate, but efforts and a method to prevent them are critical.



CATEGORY	NEVER EVENT
Surgical	Wrong site surgery
Surgical	Wrong implant/prosthesis
Surgical	Retained foreign object post-procedure
Medication	Mis-selection of a strong potassium solution
Medication	Administration of medication by the wrong route
Medication	Overdose of insulin due to abbreviations or incorrect device
Medication	Overdose of methotrexate for non-cancer treatment
Medication	Mis-selection of high-strength midazolam during conscious sedation
Mental health	Failure to install functional collapsible shower or curtain rails
General	Falls from poorly restricted windows
General	Chest or neck entrapment in bed rails
General	Transfusion or transplantation of ABO-incompatible blood components or organs
General	Misplaced naso- or oro-gastric tubes
General	Scalding of patients
General	Unintentional connection of a patient requiring oxygen to an air flowmeter
General	Undetected oesophageal intubation

29. Quantum Spin Liquids

Context: Scientists have found evidence of a strange state of matter called a quantum spin liquid in a material known as pyrochlore cerium stannate.

Quantum Spin Liquids

- Physicists have long speculated about the existence of a rare state of matter called a quantum spin liquid.
- In this state, magnetic particles refuse to settle into an orderly arrangement, even at absolute zero temperature.
- Instead, they stay in a constantly shifting, entangled state driven by the strange rules of quantum mechanics.
- This creates unusual properties that resemble fundamental interactions in the universe, such as the way light and matter behave.
- Despite its potential significance, proving the existence of quantum spin liquids through experiments has been notoriously difficult.

30. Discoveries in Multi-Planet Systems

Context: New observations show that planets forming in protoplanetary disks like that around PDS 70 can trigger the formation of subsequent planets.

Discoveries in Multi-Planet Systems

- New radio astronomy observations of a forming planetary system reveal that once the first planets emerge near a star, they can influence the surrounding material, guiding it to form additional planets farther out.
- In this process, each planet plays a role in creating the next, much like falling dominos triggering one another.
- So far, astronomers have identified over 5,500 planetary systems, with more than 1,000 confirmed to have multiple planets.
- Planets form in protoplanetary disks — massive clouds of gas and dust surrounding young stars. Despite this knowledge, the exact process of how multi-planet systems like our Solar System develop remains unclear.

Planet formation sequence:

1. **Nebula Formation:** A large cloud of gas and dust (nebula) forms in space.
2. **Gravitational Collapse:** The nebula collapses under gravity, leading to the formation of a rotating disk with a central protostar.
3. **Planetesimal Formation:** Dust and gas particles in the disk collide and stick together, forming planetesimals.
4. **Protoplanet Formation:** Planetesimals collide and coalesce, forming larger protoplanets, which eventually evolve into planets.



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31. Mirror Life

Context: Experts warn that mirror bacteria could escape natural biological controls, potentially evolving to exploit resources in ways that disrupt ecosystems and pose unforeseen dangers to the environment and public health.

Mirror Life

- “Mirror life” refers to synthetic organisms with molecular structures reversed from those found in natural life.
- At first glance, creating such life forms seems impossible—and for now, it is.
- Even the simplest mirror bacterium would be far too complex for scientists to build with current technology.
- However, the idea of mirror life may not remain purely theoretical.
- Rapid advancements in biotechnology could make its creation possible within the next few decades.
- If realized, mirror-image bacteria could revolutionize drug development, offering groundbreaking medical treatments.
- But they could also pose serious environmental risks, behaving in unpredictable and potentially harmful ways.

32.

Context: New research challenges the idea that the moon formed roughly 4.35 billion years ago after a Mars-sized object smashed into the early Earth.

More about the study:

- The moon may be more than 100 million years older than some scientists previously thought, according to a new study.
- The research, published December 18 in the journal Nature, challenges the longstanding idea that the moon formed roughly 4.35 billion years ago, after a Mars-sized object smashed into the early Earth and created our natural satellite.

- That timeline is based on analyses of lunar rock samples from NASA's Apollo missions.
- But the new study suggests that the moon formed earlier — around 4.51 billion years ago — and then experienced a dramatic "re-melting" event at the time other scientists had assumed it first formed.
- The melting occurred as the moon was moving away from the Earth, the authors say, when the planet's constant gravitational tugs warped the moon in a way that caused it to super-heat.
- The process altered the lunar surface and thus hid the moon's real age, according to the study.

Big Splash Event:

- The 'Big Splash Event' refers to the giant impact hypothesis, which suggests that Earth's Moon was formed around 4.5 billion years ago when a Mars-sized celestial body, often referred to as Theia, collided with the early Earth.
- The debris from this colossal collision eventually coalesced to form the Moon.

33. Discovery of Magic in Particle Physics

Context: Researchers at the Large Hadron Collider have found that top quarks exhibit a property known as magic, which could advance quantum computing.

More about study:

- The study, conducted by twin professors shows that the level of magic in top quarks can inform the necessity for quantum computers in simulations.

Discovery of Magic in Particle Physics:

- A brotherly research duo has discovered that when the Large Hadron Collider (LHC) produces top quarks – the heaviest known fundamental particles – it regularly creates a property known as magic.
- This finding, published in Physical Review D, has implications for the progression of quantum computing, with magic being a measure that describes how difficult a quantum system is for a non-quantum computer to calculate.

Insights from High-Energy Collisions

- The LHC is the world's largest and most powerful particle accelerator, consisting of a 27-kilometer ring of superconducting magnets with a number of accelerating structures through which two high-energy particle beams travel at close to the speed of light before they are made to collide.
- The amount of magic exhibited by top quarks depends on how fast they are moving and their direction of travel, all of which can be measured by the ATLAS and CMS detectors that observe the results of the LHC proton collisions.

34. Universal Immunization Programme

Context: Tamil Nadu, which records at least 150 cases of mumps in a month now, had earlier this year requested the Union government to consider adding the mumps vaccine to the Universal Immunisation Programme (UIP).

About Universal Immunization Programme (UIP)

- Introduction:
 - The Universal Immunization Programme (UIP) is one of the largest public health initiatives in India aimed at protecting children and pregnant women from preventable diseases.
 - Launched in 1978 as the Expanded Programme on Immunization (EPI), it was renamed Universal Immunization Programme (UIP) in 1985 to extend its coverage beyond urban areas to rural India.
 - UIP became part of the Child Survival and Safe Motherhood Programme in 1992 and the National Reproductive and Child Health Programme in 1997. It has been a key component of the National Rural Health Mission (NRHM) since 2005.

- **Objectives of UIP:**

- To provide **free immunization** to children and pregnant women against **12 vaccine-preventable diseases**.
- To target **2.67 crore newborns** and **2.9 crore pregnant women** annually.
- To achieve **full immunization** of children within their first year of life, reducing **morbidity** and **mortality** from vaccine-preventable diseases.

- **Diseases Covered Under UIP:**

- **National Immunization** (9 diseases):
 - **Diphtheria**
 - **Pertussis** (Whooping Cough)
 - **Tetanus**
 - **Polio**
 - **Measles**
 - **Rubella**
 - **Childhood Tuberculosis**
 - **Hepatitis B**
 - **Meningitis & Pneumonia** caused by *Haemophilus influenzae* type B (Hib)
- **Sub-national Immunization** (3 diseases):
 - **Rotavirus Diarrhea**
 - **Pneumococcal Pneumonia**
 - **Japanese Encephalitis**

35. Kapteyn's Estimate

Context: Scientists thought the minimum mass of dark matter was about 10^{-31} times the mass of a proton. But in May, theoretical physicists revised the limit and pushed it up by an order of magnitude to 2.3×10^{-30} proton masses.

More about the Kapteyn's Estimate:

- In 1922, Dutch astronomer Jacobus Kapteyn studied the motion of stars neighbouring the Sun and concluded the density of "dark matter" (using that term for one of the first times) must be 0.0003 solar masses per cubic light year.
- Since then, through a century of increasingly sophisticated measurements, the accuracy of Kapteyn's conclusion has held up remarkably well.
- This density of dark matter can be re-expressed as the heft of two protons per teaspoon, which means your house could contain dark matter with a mass equivalent of a trillion protons.
- But this would also be naïve: Kapteyn's and subsequent measurements are only valid when regarding the million-cubic-lightyear volume and don't apply when we zoom in for a closer look.
- This is because stars, whose motion is used for the measurement, are themselves separated by a few light years.

36. Tunisian Dorsal

Context: Tunisia is in its sixth year of drought and has seen its water reserves dwindle, as temperatures have soared past 50 degrees Celsius (122 degrees Fahrenheit) in some areas during the summer.

The Tunisian Dorsal:

- This is a mountain range that runs across the country in a northeasterly direction, extending from the Algerian border in the west to the Cape Bon peninsula in the east.
- It forms a significant part of the country's topography and plays a role in its climate and regional divisions.
- Essentially, the Dorsal acts as a natural barrier, influencing rainfall patterns and creating distinct ecological zones.
- The area north of the Dorsal, known as the Tell, is characterized by lush vegetation and milder climate, while the south, known as the Sahel and the Steppes, is drier and more arid.



- **Global Transition:** Underpin the shift to a low-carbon economy, fostering renewable energy adoption.

The 30 critical minerals:

- These minerals are Antimony, Beryllium, Bismuth, Cobalt, Copper, Gallium, Germanium, Graphite, Hafnium, Indium, Lithium, Molybdenum, Niobium, Nickel, PGE, Phosphorous, Potash, REE, Rhenium, Silicon, Strontium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zirconium, Selenium and Cadmium.

Is India dependent on China?

- An in-depth examination of import data of 30 critical minerals spanning 2019 to 2024 reveals India's acute vulnerability to Chinese supplies, particularly for six critical minerals where dependency exceeds 40%: bismuth (85.6%), lithium (82%), silicon (76%), titanium (50.6%), tellurium (48.8%), and graphite (42.4%).

○ Permissible Visits

- Group tourists (minimum of two persons).
- Restricted tourist circuits/routes specified in the permit.

○ Validity and Compliance

- PAP is valid only for the specified area, route, and time.
- Permit holders cannot stay beyond the permit's validity.
- Photocopies of the permit must be deposited at entry and exit points.

○ Restrictions

- Citizens of Afghanistan, China, and Pakistan (and those of Pakistani origin) require prior approval from the Ministry of Home Affairs (MHA).

- Diplomats and officials require special instructions from the Ministry of External Affairs.

○ Registration

- Foreigners must register with the Foreigners Registration Officer (FRO) of the district within 24 hours of arrival.

37. Deletion mutations of mitochondrial genome

Context: In November, researchers from the University of California Los Angeles and the University of Alberta, Canada, reported in the journal *Genome Research* that deletion mutations and aberrant expression of mitochondrial DNA correlated with biological aging in humans and in rodents.

What are deletion mutations of mitochondrial genome?

- As we age, we lose bits of our genome in tissues such as the skeletal muscle and the brain.
- These losses, called deletion mutations, gradually erode the function of a cell component called the mitochondrion.
- Muscle cells lacking a sufficient number of functional mitochondria to support their contractile function die and this causes a loss of muscle mass.
- Gaining a better understanding of the process that causes deletion mutations might help us to prevent or at least delay it.
- The overwhelmingly large fraction of our genome (DNA) resides in the cell's nucleus.
- The rest, a mere five-millionth of the nuclear genome, is located in the mitochondrion.
- The age-related deletion mutations accumulate in the mitochondrial genome (mtDNA).
- So although mtDNA represents only a small fraction of our genome, its deletion mutations appear to be a major trigger of the decrepitude that comes with old age.

38. Quantum Sensing

Context: Researchers achieved a breakthrough in nanodiamond sensors with quantum-grade spin properties, ideal for bioimaging and biosensing. These advanced sensors promise transformative applications in medicine and energy technologies.

What is Quantum Sensing?

- Quantum sensing is an emerging field that harnesses the unique quantum properties of particles — such as superposition, entanglement, and spin states — to detect changes in physical, chemical, or biological environments.
- Quantum sensing refers to the use of quantum phenomena, such as superposition, entanglement, and tunneling, to achieve high precision in measurement.

Applications of Quantum Sensing:

- Inertial Navigation Systems (INS):** Quantum sensors, such as atom interferometers, provide highly accurate measurements of acceleration and rotation, enhancing navigation in the absence of GPS.
- Magnetic Resonance Imaging (MRI):** Quantum sensors, like nitrogen-vacancy (NV) centers in diamonds, can improve sensitivity in detecting magnetic fields, making MRI more precise.
- Seismic Activity Monitoring:** Quantum sensors, particularly those based on atom interferometry, can detect minute vibrations and gravitational waves, aiding in seismic monitoring.
- Dark Matter Detection:** Quantum sensing technologies are used in experiments to detect weak interactions and tiny forces associated with dark matter.

Whereas,

- Home Theatre Systems:** Quantum sensing is not relevant for improving sound or visual performance in home theatre systems.
- Road Traffic Light Management:** Traffic light management relies on conventional sensors and algorithms rather than quantum-based sensing.

39. New Findings on Planet Formation

Context: A new study challenges traditional views of planet formation by showing discrepancies in the composition of gases between a developing exoplanet and its surrounding disk. The research, based on analysis of the PDS 70 system, suggests that planets might not simply accrete gas from their natal disks but may also significantly incorporate solid materials.

New Findings on Planet Formation

- Many scientists have long believed that developing planets closely resemble the swirling disks of gas and dust from which they form, much like children often resemble their parents.
- However, a new study led by astrophysicists from Northwestern University suggests this resemblance may not be as strong as previously thought.
- By examining a still-forming exoplanet and its surrounding natal disk, the researchers discovered a surprising mismatch in the composition of gases between the planet's atmosphere and its birth disk.

Searching for Visible Birth Material

- All planets are born from a natal disk, a rotating disk of gas and dust that surrounds a new star.
- Over millions of years, gravity pulls gas and dust together to form clumps, which eventually grow into planets.
- Until recently, it was impossible to obtain a direct view of a natal disk in order to track a planet's birth.
- Most observable exoplanets are too old, so their natal disks have already disappeared.
- The exception, however, is PDS 70, a natal disk that envelopes two fledgling gas-giant exoplanets — similar to Jupiter — called PDS 70b and PDS 70c.
- Located just 366 million lightyears from Earth within the constellation Centaurus, the planets are, at most, a youthful 5 million years old.

A Simplified Picture of Planet Formation Challenged

- According to the simplified picture, the ratio of carbon and oxygen gases in a planet's atmosphere should match the ratio of carbon and oxygen gases in its natal disk — assuming the planet accretes materials through gases in its disk.
- Instead, it was found that a planet with a carbon and oxygen ratio that is much lower compared to its disk.
- Now, we can confirm suspicions that the picture of planet formation was too simplified.

40. Shock syringe

Context: *In a welcome move for patients who have a fear of needles, a team of researchers at the Indian Institute of Technology, Bombay, has developed a needle-free "shock syringe".*

More about study:

- The study, led by Professor Viren Menezes from the Department of Aerospace Engineering, was published in the *Journal of Biomedical Materials and Devices*.
- The researchers tested the effectiveness of drug delivery by a shock syringe on laboratory rats.
- *Unlike syringes with needles, the shock syringe does not rely on piercing the skin with a sharp tip. Instead, it uses high-energy pressure waves (shock waves) that can travel faster than the speed of sound to pierce the skin.*
- These waves, when generated, compress the surrounding medium, such as air or liquid, through which they travel.

Working mechanism

- The shock syringe, developed in 2021 in Professor Menezes's laboratory, is slightly longer than a regular ballpoint pen.
- *The device has a micro shock tube consisting of three sections: the driver, driven, and drug holder, which work together to create the shockwave-driven microjet for drug delivery.*

- *Pressurised nitrogen gas is applied to the shock syringe that is the driver section of the micro shock tube part; it is filled with liquid drugs to create a microjet of the drug.*
- The microjet travels at a speed nearly twice as fast as a commercial aeroplane at take-off.
- This jet stream of drug passes through the nozzle of the syringe before penetrating the skin.
- The entire process of delivering drugs using a shock syringe is rapid and gentle; most patients wouldn't feel a thing.

41. PELSA

Context: *A research team led by Prof. Mingliang Ye from the Dalian Institute of Chemical Physics, Chinese Academy of Sciences (CAS), in collaboration with Prof. Cheng Luo's group from the Shanghai Institute of Materia Medica, CAS, has developed a highly sensitive proteomics technique known as the peptide-centric local stability assay (PELSA).*

More on news:

- *Published in Nature Methods, this innovative method enables the simultaneous identification of ligand-binding proteins and their binding sites within complex systems.*
- *PELSA is highly versatile, applicable to a wide range of ligands such as metabolites, drugs, and pollutants.*
- Protein interactions with ligands—acting as enzyme substrates, inhibitors, signaling molecules, allosteric modulators, or structural anchors—are fundamental to their biochemical functions.
- *Characterizing protein-ligand interactions is crucial for identifying the functions of uncharacterized proteins, studying regulatory mechanisms in cellular metabolism, and understanding the mechanisms of drug action.*
- Furthermore, pinpointing ligand-binding regions is invaluable for structure-based drug design and formulating biological hypotheses.

Limitations of Traditional Methods

- Traditional methods for determining binding sites and affinities typically require the purification of recombinant proteins, which can be both time-consuming and labour-intensive.
- In addition, purified proteins may not fully replicate their native cellular state, resulting in inaccurate affinity measurements.
- Modification-based proteomics methods offer a powerful solution for identifying ligand-binding proteins and their sites directly in native cellular lysates.
- However, they often require ligand modification, which can affect ligand activity and cannot be applicable to ligands that cannot be modified.
- In the method proposed in this study, the researchers used a large amount of trypsin (E/S ratio of 1:2) to directly generate small peptides from native proteins.
- As these peptides are generated under native conditions, their abundance represented a measurement of proteins' local stability.
- The large amount of trypsin ensured that even protein segments in low energy states could be cleaved, resulting in the generation of a large number of peptides reflecting protein's local stability.
- These peptides were separated from the partially digested proteins, collected, and directly analysed by mass spectrometry.
- By measuring the peptide abundance in ligand-treated and vehicle-treated samples, the ligand-binding regions and the corresponding binding proteins can then be determined.



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42. AMPK

Context: For decades, researchers have been trying to unravel why a severe and prolonged reduction in calorie intake extends life for many animals. Now, a team has found a molecule that could provide caloric restriction in a pill — at least for flies and worms.

More on news:

- A component of bile called lithocholic acid can extend the lifespan of some animals.
- Researchers found, in mice, that levels of the acid rise during calorie restriction and that it activates a protein called AMPK, which scientists have already linked to the health benefits of eating less.
- When nematodes and fruit flies were fed lithocholic acid, the animals lived significantly longer than those that had not been given it.
- There is no evidence yet that lithocholic acid will have the same effect in humans.

43. Perseverance Reaches New Heights

Context: Perseverance, NASA's Mars rover, has completed a daring ascent of Jezero Crater's rim, tackling steep grades and rugged terrain to reach new scientific frontiers.

More on the news:

- The rover's fifth campaign, exploring the Northern Rim, promises groundbreaking insights into Mars' geological past, including rocks potentially dating back to the early solar system.
- This mission is not just about Mars — it's a step toward humanity's exploration of the cosmos.

Perseverance Reaches New Heights

- NASA's Perseverance Mars rover has reached the top of Jezero Crater's rim, at a site the science team calls "Lookout Hill."
- After a challenging months-long climb, the rover is now heading toward its first science destination in this new region, which is unlike any it has explored before.

- Over the course of 3½ months, Perseverance ascended 1,640 vertical feet (500 meters) along steep slopes with grades up to 20%.
- Along the way, it paused to conduct scientific observations.
- On December 12, during the American Geophysical Union's annual meeting in Washington, D.C., the science team shared details about the climb, their recent findings, and the exciting plans for the rover's next phase of exploration.

44. Atmospheric Rivers and Climate Impact

Context: As the planet warms, atmospheric rivers, those mighty storms that sweep across the West Coast, are undergoing transformative changes.

Atmospheric Rivers and Climate Impact

- Communities across the West Coast of the United States are likely to see significant changes in the powerful storms known as atmospheric rivers as the climate continues to warm. However, the effects will vary widely between regions. Southern California will experience one set of changes, while more northerly areas like Seattle will face a very different storm evolution.
- Recent research led by scientists at the U.S. National Science Foundation's National Center for Atmospheric Research (NSF NCAR) reveals that warming conditions will amplify ocean evaporation, leading to substantial changes in atmospheric rivers in Southern California. In contrast, atmospheric rivers farther north will be shaped more by increasing temperatures in both the atmosphere and the ocean.

About Atmospheric Rivers:

- Atmospheric rivers are long, narrow regions in the atmosphere that carry large amounts of water vapor over vast distances.
- When they make landfall, the moisture can be released as heavy rainfall, leading to significant flooding, especially in coastal regions.
- Atmospheric rivers typically form over warm oceanic areas, where evaporation provides the moisture.

- These atmospheric rivers can then transport this moisture over vast distances (sometimes over 1,000 kilometres) before impacting land, often causing heavy rainfall in coastal regions.
- Atmospheric rivers can significantly affect both coastal and inland regions.
- As they approach land, the moisture in the atmosphere is often released as precipitation, which impacts coastal areas first.
- However, the moisture can also affect inland areas, especially in mountainous regions, where the moisture is lifted and condensed, leading to heavy rainfall or snowfall further inland.
- The Pineapple Express is a specific type of atmospheric river that originates in the tropical Pacific Ocean near Hawaii, hence the name "Pineapple." It refers to a narrow band of concentrated moisture that flows from the tropics (particularly around Hawaii) toward the west coast of North America.
- The moisture is carried by strong winds in the atmosphere, leading to significant rainfall and sometimes severe weather conditions when the band of moisture reaches land.

45. SpaDeX Mission

Context: The Indian Space Research Organisation is set to end the year with the launch of the PSLV C60/SpaDeX mission on December 31. The Polar Satellite Launch Vehicle is scheduled to lift off at 9.58 p.m. from the Satish Dhawan Space Centre in Sriharikota.

About SpaDeX Mission

- The Space Docking Experiment (SpaDeX) is a groundbreaking mission by the Indian Space Research Organisation (ISRO) aimed at developing autonomous space docking technology.
- The mission involves PSLV-C60 as the launch vehicle to demonstrate in-space docking technology using two small spacecraft: Chaser (SDX01) and Target (SDX02).

- This technology is a critical milestone for **future lunar missions**, the development of the **Bharatiya Antariksh Station (BAS)**, and other advanced space endeavours.

Mission Overview

- **Launch vehicle:** PSLV-C60.
- **Orbit:** 470 km circular orbit at a 55-degree inclination.
- **Separation dynamics:**
 - Target and Chaser spacecraft will separate with an initial velocity difference to achieve **10-20 km inter-satellite separation**.
 - Propulsion systems will be used to align both spacecraft into the same orbit, achieving **Far Rendezvous**.
- **Docking and demonstration:** After docking, the mission will demonstrate electrical power transfer before undocking for payload operations.

46. AI Language Models

Context: In a relatively short span of time, AI has transformed from a novelty to an everyday tool. What are some of the notable advances in AI in 2024, and how did this tech become a common trope in such a short period?

AI Language Models:

The names **Claude**, **Mistral 7B**, and **Llama** are associated with **advanced AI language models**, not with exoplanets, lunar exploration, or antigen discovery.

1. Claude, Mistral 7B, and Llama: AI Language Models

- These models represent some of the **latest developments in artificial intelligence**, specifically in **natural language processing (NLP)**. These models are based on **transformer architectures** and are trained on massive datasets to perform tasks like **text generation, summarization, translation, question answering**, and more.

- **Claude** is a language model created by **Anthropic**, an AI safety and research company. It is designed to generate human-like text while ensuring safer outputs.
- **Mistral 7B** is developed by **Mistral AI**, and the model is named for its **7 billion parameters**, an indicator of its complexity and capacity for understanding and generating text.
- **Llama** is a family of models developed by **Meta (formerly Facebook)**, and its name stands for "Language Assistant Models for All." The Llama models are known for their balance between efficiency and performance.

These AI language models are notable for their scale, with billions of parameters that enable them to handle a wide range of NLP tasks. They are used in **chatbots, virtual assistants**, and various other applications across multiple industries, including healthcare, finance, and entertainment.

47. Solar probe missions

Context: Operations teams have confirmed NASA's mission to "touch" the Sun survived its record-breaking closest approach to the solar surface on Dec. 24, 2024.

More on the news:

- Breaking its previous record by flying just 3.8 million miles above the surface of the Sun, NASA's Parker Solar Probe hurtled through the solar atmosphere at a blazing 430,000 miles per hour — faster than any human-made object has ever moved. A beacon tone received late on Dec. 26 confirmed the spacecraft had made it through the encounter safely and is operating normally.

This pass, the first of more to come at this distance, allows the spacecraft to conduct unrivalled scientific measurements with the potential to change our understanding of the Sun.

	Solar probe missions	Space agencies
1	Parker Solar Probe mission	NASA
2	Solar Orbiter Mission	European Space Agency (ESA) and NASA
3	Proba-3	European Space Agency (ESA)
4	Aditya-L1	ISRO

48. M87 and Its Pioneering Observations

Context: M87, a prominent galaxy in the Virgo cluster, gained fame after the Event Horizon Telescope (EHT) revealed the first image of a black hole in its centre.

More on the news:

- A subsequent study analysed data from EHT's 2018 campaign, reporting a rare gamma-ray flare — marking the first in over a decade — linked to the galaxy's supermassive black hole.
- The flare provided valuable insights into emission regions, jet dynamics, and the acceleration of high-energy particles, thanks to a collaboration among leading telescopes and researchers.

M87 and Its Pioneering Observations

- M87, also known as Virgo A or NGC 4486, is the brightest galaxy in the Virgo cluster — the largest gravitationally bound structure in the universe.
- It gained global recognition in April 2019 when the Event Horizon Telescope (EHT) released the first-ever image of the black hole at its centre.
- A recent study led by the EHT's multi-wavelength working group, published in the journal Astronomy & Astrophysics, presents findings from the second EHT observation campaign conducted in April 2018.
- This campaign involved over 25 telescopes on Earth and in space, making it one of the most comprehensive observational efforts ever undertaken.
- The researchers reported the first detection of a high-energy gamma-ray flare from M87's supermassive black hole in more than a decade.

- The data captured nearly simultaneous observations across the widest range of wavelengths ever recorded for this galaxy.

49. Asteroids of Asteroid belts

Context: Recent experiments mimicking Vesta's environment suggest salty water, stabilized by sodium chloride, could flow long enough to carve channels before freezing. This discovery builds on findings from NASA's Dawn mission, which explored Vesta and hinted at hidden subsurface ice.

Asteroids of Asteroid belts:

Vesta, Ceres, Psyche, and Pallas are all significant celestial objects located in the asteroid belt, a region of space between the orbits of Mars and Jupiter filled with countless rocky bodies. Let's explore each of them:

1. Vesta:

- **Type:** Asteroid (second-largest object in the asteroid belt)
- **Diameter:** About 525 km
- **Key Feature:** It has a differentiated structure with a metallic core, silicate mantle, and crust, resembling a terrestrial planet in miniature.
- **Mission:** NASA's Dawn spacecraft studied Vesta from 2011 to 2012, providing detailed images and data about its surface and composition.

2. Ceres:

- **Type:** Dwarf Planet (largest object in the asteroid belt)
- **Diameter:** About 940 km
- **Key Feature:** Ceres is unique as it contains water ice beneath its surface and has bright salt deposits, suggesting possible ancient or subsurface ocean activity.
- **Mission:** NASA's Dawn spacecraft studied Ceres after Vesta, arriving in 2015 and uncovering fascinating details about its icy surface and cryovolcanism.

3. Psyche:

- **Type:** Metallic Asteroid
- **Diameter:** About 226 km
- **Key Feature:** Psyche is primarily composed of **nickel and iron**, making it resemble the **core of a protoplanet**. Scientists believe it could offer insights into the building blocks of planetary cores.
- **Mission:** NASA's **Psyche Mission** (launched in **2023**) aims to explore this unique asteroid directly.

4. Pallas:

- **Type:** Asteroid (third-largest object in the asteroid belt)
- **Diameter:** About 512 km
- **Key Feature:** Pallas has an unusual **highly inclined orbit** compared to other asteroids, making it challenging to observe. It's believed to be rich in silicates and carbonaceous material.
- **Observation:** Studied using advanced telescopes, providing insights into its surface and orbital behaviour.



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INTERNATIONAL RELATIONS

1. Organization for Security and Cooperation in Europe

Context: Russia's Foreign Minister Sergei Lavrov arrived in Malta on Thursday to attend an OSCE summit, in his first trip to the European Union since the 2022 invasion of Ukraine.

Organization for Security and Cooperation in Europe (OSCE)

About OSCE:

- It works to build and sustain stability, peace and democracy for more than one billion people, through political dialogue and projects on the ground.
- It works to prevent conflict, manage crises, and promote post-conflict rehabilitation.
- has a comprehensive approach to security encompassing three dimensions: (a) politico-military (b) economic and environmental (c) human dimension.
- Origin– The OSCE's origins date back to the early 1970s, to the Helsinki Final Act (1975) and the creation of the Conference on Security and Co-operation in Europe (CSCE), which during the Cold War served as an important multilateral forum for dialogue and negotiations between East and West.
- In 1994, the CSCE was renamed the Organization for Security and Cooperation in Europe to reflect more accurately changes witnessed.
- With 57 participating States (India is not among the 57 states) in North America, Europe and Asia, the Organization for Security and Co-operation in Europe – is the world's largest regional security organization.
- OSCE participating States enjoy equal status and take decisions by consensus.
- Field operations– Most of the OSCE's staff and resources are deployed in field operations in South-Eastern Europe, Eastern Europe, the South Caucasus and Central Asia.

2. UN Commission on Narcotic Drugs

Context: India has been chosen to Chair the 68th Session of the Commission on Narcotic Drugs (CND). India's Permanent Representative to the UN in Vienna, Shambhu Kumaran officially assumed the Chairmanship of CND November 6. This is the first time that India has been named to Chair this important UN body.

About UN Commission on Narcotic Drugs:

- It was established by the resolution of the United Nations Economic and Social Council (ECOSOC) IN 1946.
- It is one of the functional commissions of the ECOSOC and a Governing Body of the United Nations Office on Drugs and Crime (UNODC).
- The CND has 53 member states that are elected by ECOSOC. It is chaired by a Bureau including one member per Regional Group.
- It has five subsidiary bodies: the Heads of National Drug Law Enforcement Agencies in Europe, Latin America and the Caribbean, Asia and the Pacific and Africa, and the Subcommission in the Near and Middle East.
- It meets annually and adopts a range of decisions and resolutions. Intersessional meetings are convened throughout the year.
- Towards the end of each year, the Commission meets at a reconvened session to consider budgetary and administrative matters as the governing body of the United Nations drug programme.
- It is headquartered in Vienna.



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3. Schengen Zone

Context: Austria is dropping its veto on Romania and Bulgaria becoming full members of Europe's Schengen free-travel area, its interior ministry said, paving the way for EU Interior Ministers to approve the move at a meeting on Thursday. Romania and Bulgaria, both EU and NATO members, partly joined Schengen in March.

What is the Schengen Zone?

- **About:**
 - The **Schengen Agreement is a treaty signed in 1985** by five member states (Belgium, France, Germany, Luxembourg, and the Netherlands) of the European Economic Community.
 - The agreement aims to **create a border-free area in Europe** that allows the free movement of people, goods, services, and capital called the Schengen Area, where internal border checks are largely abolished.
 - All EU member states without opt-outs must join Schengen upon meeting technical requirements.
 - Non-EU countries like Switzerland, Liechtenstein, Norway, and Iceland are part of Schengen through special association agreements.
 - **Over time, the Schengen area has grown to encompass 29 countries.**
- Currently, the Schengen Area consists of 29 member states:
 - Austria, Bulgaria, Belgium, Czech Republic, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland

4. European Free Trade Association

Context: Switzerland suspending the unilateral application of the most favoured nation (MFN) clause with India under the Double Tax Avoidance Agreement (DTAA) should not impact the \$100 billion investment commitment under the recently signed trade deal between India and European Free Trade Association (EFTA) nations.

About European Free Trade Association (EFTA)

- It is an intergovernmental organization established in 1960 by the Stockholm Convention.
- Objective: Promotes free trade and economic integration between its members within Europe and globally.
- Member Countries:
 - EFTA currently has four member countries: Iceland, Liechtenstein, Norway, and Switzerland.
 - The EFTA members are all open, competitive economies committed to the progressive liberalization of trade in the multinational arena as well as in free trade agreements.
- In contrast to the European Union (EU), EFTA is not a customs union. This means that the individual EFTA States are free to set their own customs tariffs and arrange other foreign trade measures vis-à-vis the non-EFTA States.
- The association is responsible for the management of:
 - the free trade between the EFTA countries;
 - EFTA's participation in the European Economic Area (EEA), which includes the European Union and three EFTA countries (Iceland, Liechtenstein, and Norway, but not Switzerland);
 - EFTA's worldwide network of free trade agreements.
- The EFTA countries have developed one of the largest networks of Free Trade Agreements (FTAs). These FTAs span over 60 countries and territories, including the EU.

5. FREE-AI

Context: The Reserve Bank of India (RBI) has constituted an eight-member committee of experts to develop a framework for responsible and ethical enablement of artificial intelligence (FREE-AI) in the financial sector.

More about news:

- The committee, to be headed by Pushpak Bhattacharyya, professor (Department of Computer Science and Engineering), IIT Bombay, will recommend a robust, comprehensive, and adaptable AI framework for the financial sector.
- The committee will assess the current level of adoption of AI in financial services, globally and in India, and review regulatory and supervisory approaches on AI with focus on the financial sector globally.
- As part of the terms of reference, the committee will identify potential risks associated with AI, if any and recommend an evaluation, mitigation and monitoring framework and consequent compliance requirements for financial institutions, including banks, non-bank finance companies (NBFCs), fintech and payment system operators (PSOs).
- It will also recommend a framework including governance aspects for responsible, ethical adoption of AI models / applications in the domestic financial sector, the RBI said.

6. AUSSOM

Context: The UN Security Council voted unanimously on December 27 to create a new African Union-led peacekeeping force in Somalia.

More about the mission:

- The United Nations Security Council authorised an African Union stabilisation and support mission in Somalia – known as AUSSOM – on December 27 that will replace a larger AU anti-terrorism operation from January 1, 2025.

- It aims to stabilize Somalia by supporting its security infrastructure, addressing terrorism threats, and fostering sustainable peace and development.

- Somalia's security has been underwritten by foreign resources since Ethiopia invaded in 2006, toppling an Islamist-led administration but galvanising an insurgency that has since killed tens of thousands of people.

Funding concerns

- The European Union (EU) and United States, the top funders of AU forces in Somalia, wanted to reduce the number of AU peacekeepers due to concerns about long-term financing and sustainability, sources said in June.
- Negotiations about the new force had proven complicated, they said.
- The United States abstained from the UN Security Council vote on Friday over its funding concerns. The remaining 14 council members voted for the resolution.



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ART AND CULTURE

1. Congress Sessions

Context: The Congress Working Committee (CWC) that met in Belagavi, Karnataka on December 26 adopted resolutions committing the party to Mahatma Gandhi's legacy and opposing several policies of the Union government.

	Year of Congress session	President	Milestones/achievements
1	1887	Badruddin Tyabji	1 st Muslim President
2	1908	Rash Behari Ghosh	The Constitution of INC drawn.
3	1924	M.K. Gandhi	Only session where Gandhiji presided
4	1936	Jawaharlal Nehru	1 st session in a village



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MISCELLANEOUS

1. PM e-VIDYA initiative

Context: In a move to foster an inclusive education system, Union Education Minister Dharmendra Pradhan on Friday launched India's first 24X7 television channel on sign language, as part of the PM e-VIDYA initiative.

More about news:

- The channel 31, which will be run **by the National Council of Educational Research and Training (NCERT)**, aims to provide comprehensive educational resources in sign language, benefiting hearing-impaired students, teachers, and educators across India.

PM e-VIDYA: Bridging the Digital Divide

- Launched in 2020 as part of the Atmanirbhar Bharat Abhiyaan, PM e-VIDYA aims to make quality education accessible to all Indian students.** It leverages technology to minimize learning loss and support the National Education Policy (NEP) 2020.

Key Components:

- DIKSHA:** A national digital platform offering high-quality e-content, including QR-coded textbooks for all grades.
- PM e-Vidya DTH TV Channels:** 200+ channels providing supplementary education in multiple languages for classes 1-12.
- SWAYAM:** A national MOOC platform offering higher education and school courses (9th-12th) through NIOS and NCERT. (e-vidya has not replaced SWAYAM platform).
- Radio, Community Radio & CBSE Podcast - Shiksha Vani:** These platforms broadcast educational content to reach students in areas with limited internet access.
- e-Content for Teachers:** Provides various e-courses and digital resources for teacher education and professional development.

By providing multi-mode access to education through digital, online, and on-air platforms, PM e-VIDYA empowers students and educators to adapt to the digital age and ensure inclusive learning for all.

2. GI Tags

Context: Ashtalakshmi 2024 showcased the North East region's rich heritage, highlighting its GI-tagged products, which reflect its unique cultural and agricultural traditions.

	GI Tags	States
1	Wakro Orange	Arunachal Pradesh
2	Dalle Khursani	Sikkim
3	Chak Hao Rice	Nagaland
4	Joha Rice	Assam

3. Disputed regions & concerned states

Ceres' Exploration and Discovery

Context: Shiv Sena (UBT) leader and Rajya Sabha MP Priyanka Chaturvedi has written to Union Home Minister Amit Shah, urging the Centre to grant Union Territory status to Belagavi amid the long-standing border dispute between Maharashtra and Karnataka.

	Disputed regions	Concerned states/UTs
1	Belagavi	Maharashtra and Karnataka
2	Sarchu region	Himachal Pradesh and Ladakh
3	Parwanoo region	Haryana and Himachal Pradesh
4	Naupada district	Odisha and Chhattisgarh



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4. Lipstick effect

Context: At a time when most other consumer segments are grappling with subdued growth, the beauty and cosmetics market remains on an upswing.

The Lipstick effect:

The lipstick effect in economics refers to a phenomenon where consumers tend to buy small, affordable luxury items, such as lipstick, during periods of economic downturn or financial uncertainty. This counterintuitive behaviour stems from the idea that while people may cut back on larger, more expensive purchases, they still seek small indulgences as a way to feel good or maintain a sense of normalcy during tough times.

Key Aspects of the Lipstick Effect:

1. Psychological Comfort:

- Purchasing affordable luxuries provides emotional comfort without causing significant financial strain. It serves as a small morale booster during difficult economic periods.

2. Shifting Priorities:

- Consumers tend to reprioritize their spending, focusing on smaller treats rather than big-ticket items like vacations or cars.

3. Economic Indicators:

- The effect is often seen as an indicator of economic uncertainty. An increase in the sales of items like lipsticks, perfumes, or gourmet coffee can hint at broader financial struggles.

4. Historical Context:

- The term gained prominence during the Great Depression of the 1930s when despite widespread financial hardship, sales of inexpensive beauty products like lipstick remained stable or even grew.
- Leonard Lauder, the chairman of Estée Lauder, highlighted this effect after observing a spike in lipstick sales following the 2001 recession.

5. Modern Examples:

- The 2008 financial crisis saw increased sales of small indulgences like lipsticks, chocolates, and specialty coffees, while spending on luxury cars and high-end electronics declined.

Why Lipstick?

- Lipstick, as a metaphor, represents affordable luxury—an item that allows consumers to feel pampered and maintain a sense of glamour or normalcy without significant expense. While it is called the lipstick effect, the principle applies broadly to various small luxury items.
- This effect underscores the importance of consumer psychology in economics and demonstrates how emotional needs can influence purchasing behaviour, even in challenging financial environments.

5. Peak-Level Social Dialogue

Context: The Social Dialogue Report of the International Labour Organisation (ILO), released in Geneva on December 11, has recommended the governments to uphold fundamental principles and rights at work, especially freedom of association and the effective recognition of the right to collective bargaining.

More on news:

- The report, focusing on 'peak-level social dialogue' (PLSD), also asked the member countries to equip labour administrations and social partners with the necessary resources and technical capacities for effective participation in PLSD.

Peak-Level Social Dialogue (PLSD):

- Peak-Level Social Dialogue (PLSD) refers to discussions conducted at the highest level among stakeholders such as governments, employers, and workers' representatives.
- The aim is to address critical issues related to labour policies, employment rights, wages, and workplace regulations.

- It often plays a significant role in fostering consensus and ensuring equitable labour standards in various economies, particularly during periods of economic or social transitions.

6. Rebellion/insurgent groups

Context: A Myanmar ethnic armed group claimed complete control of a key region along the Bangladesh border, piling further pressure on the junta battling opponents elsewhere across the country. The Arakan Army said late on Tuesday it had complete control over Maungdaw — a district that is home to 1,10,000 people.

	Rebellion/insurgent groups	From Countries
1	Karen National Union	Myanmar
2	M23 Movement	Democratic Republic of Congo
3	Moro Islamic Liberation Front	Philippines
4	Tuareg Rebels	Mali

7. Military Exercises

Context: India, France, and the UAE have initiated the Desert Knight air combat exercise over the Arabian Sea.

	Military Exercises	Indian Armed forces involved	Participating countries
1	Exercise Desert Knight	Indian Air Force	India, UAE, and France
2	Exercise Agni Warrior	Indian Army	India and Singapore
3	Exercise Naseem-al-Bahr	Indian Navy	India and Oman

7. Tidal bores (Pororoca)

Context: Brazilian authorities on Saturday arrested Braga Netto, a former Defence Minister and close ally of ex-President Jair Bolsonaro, as part of an investigation into an alleged coup plot, a police source said. Brazil's Federal Police said it had detained "people who would be obstructing" the investigation.

The tidal bores (Pororoca):

- The Pororoca is a unique and awe-inspiring natural phenomenon that occurs in the Amazon River.
- It's a tidal bore, a powerful wave that surges upstream as the incoming tide from the Atlantic Ocean meets the river's current.

How it forms:

- Tidal Influence:** The primary driver of the Pororoca is the strong tidal forces in the Atlantic Ocean. During spring tides, when the gravitational pull of the sun and moon align, the ocean tides are at their highest.
- River's Shape:** The shape of the Amazon River's estuary, where it meets the ocean, plays a crucial role. The narrowing of the river channel as it approaches the coast amplifies the incoming tide, creating a powerful surge.
- River's Flow:** The Amazon River's strong downstream current further contributes to the formation of the Pororoca. The clash between the incoming tide and the river's flow generates the powerful wave.

Characteristics of the Pororoca:

- Size and Speed:** The Pororoca can reach heights of up to 4 meters (13 feet) and travel upstream at speeds of 10 to 15 miles per hour (16 to 24 kilometers per hour).
- Sound:** The wave is accompanied by a thunderous roar, earning it the name "Pororoca," which translates to "great roar" or "destructive noise" in the indigenous Tupi language.
- Timing:** The Pororoca is most prominent during the equinoxes in March and September, when the spring tides are at their strongest.

8. Northeast States

Context: A Myanmar ethnic rebel group said on Dec 17 it had recaptured its headquarters from the Myanmar military, almost 30 years after it was forced out. Karen National Union (KNU) fighters had seized Manerplaw on the Thai border following days of fighting, KNU leader Saw Thamin Tun told AFP.

The Northeastern states of India that share a border with Myanmar, arranged in order of the length of their shared border (from longest to shortest):

- (a) **Arunachal Pradesh:** 520 km
- (b) **Mizoram:** 510 km
- (c) **Manipur:** 398 km
- (d) **Nagaland:** 215 km



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9. Salt typhoon

Context: The US government has warned senior officials and other "highly targeted individuals" to use encrypted messenger applications instead of ordinary phone calls and texts following a cybersecurity incident in which hackers reportedly exploited systems set up by the US authorities to wiretap Americans.

More on news:

- Last month, Washington accused alleged China-linked hacker group 'Salt Typhoon' of conducting an unprecedented cyber espionage campaign against US telecommunications companies. Beijing has repeatedly denied these allegations as baseless smears.

More about salt typhoon

- "Salt Typhoon" is a name given to a group of Chinese hackers who have been actively targeting telecommunications companies in the United States since at least 2019.

What we know so far:

- **Sophisticated Techniques:** Salt Typhoon employs advanced techniques to infiltrate target networks, often remaining undetected for extended periods.
- **Focus on Telecommunications:** They primarily target telecommunications companies, gaining access to sensitive data and potentially compromising critical infrastructure.
- **Attribution to China:** While not officially confirmed, cybersecurity experts and government officials strongly believe Salt Typhoon is linked to the Chinese government.
- **Potential Impact:** The group's activities pose a significant threat to national security and could potentially disrupt critical communications networks.

The Salt Typhoon attacks highlight the growing threat of cyberespionage and the importance of robust cybersecurity measures to protect critical infrastructure.

10. Importance of Critical Minerals

Context: An in-depth examination of import data of 30 critical minerals spanning 2019 to 2024 reveals India's acute vulnerability to Chinese supplies, particularly for six critical minerals where dependency exceeds 40%.

Definition:

- Critical minerals are those minerals which are essential for economic development and national security, the lack of availability of these minerals or even concentration of existence, extraction or processing of these minerals in few geographical locations may lead to supply chain vulnerability and disruption.

Importance of Critical Minerals:

- **Economic Development:** Support industries like electronics, energy storage, and renewable energy.
- **National Security:** Essential for aerospace, defence, and telecommunication sectors.
- **Sustainability:** Vital for achieving global Net Zero emissions commitments through clean energy technologies.
- **Technological Edge:** Power critical sectors like semiconductors, EVs, and high-tech manufacturing.
- **Global Transition:** Underpin the shift to a low-carbon economy, fostering renewable energy adoption.

The 30 critical minerals:

- These minerals are Antimony, Beryllium, Bismuth, Cobalt, Copper, Gallium, Germanium, Graphite, Hafnium, Indium, Lithium, Molybdenum, Niobium, Nickel, PGE, Phosphorous, Potash, REE, Rhenium, Silicon, Strontium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zirconium, Selenium and Cadmium.

Is India dependent on China?

- An in-depth examination of import data of 30 critical minerals spanning 2019 to 2024 reveals India's acute vulnerability to Chinese supplies, particularly for six critical minerals where dependency exceeds 40%: bismuth (85.6%), lithium (82%), silicon (76%), titanium (50.6%), tellurium (48.8%), and graphite (42.4%).

- Bismuth, primarily used in pharmaceuticals and chemicals, has few alternative sources, with China maintaining an estimated 80% of global refinery production.
- Lithium, crucial for EV batteries and energy storage, faces processing bottlenecks, despite alternative raw material sources, as China controls 58% of global refining.
- Silicon, vital for semiconductors and solar panels, requires sophisticated processing technology that few countries possess.
- Titanium, essential for aerospace and defence applications, has diversified sources but involves high switching costs.
- Tellurium, important for solar power and thermoelectric devices, is dominated by China's 60% global production share and finally graphite, indispensable for EV batteries and steel production, faces supply constraints as China controls 67.2% of global output, including battery-grade material.

11. Protected Area Regime

Context: On December 17, the Union Ministry of Home Affairs (MHA) reimposed the Protected Area Regime (PAR) in the States of Manipur, Nagaland, and Mizoram to restrict and monitor the movement of foreigners.

Why PAP is reimposed in these states?

- After a military coup in Myanmar in February 2021, there was an influx of undocumented migrants — over 40,000 refugees took shelter in Mizoram and around 4,000 refugees are said to have entered Manipur.
- The migrants belonging to the Kuki-Chin-Zo ethnic group share ethnic ties with the communities in Mizoram and Manipur.
- India shares a 1,643 km long border with Myanmar which passes through the States of Arunachal Pradesh, Nagaland, Manipur and Mizoram, The Free Movement Regime (FMR) between the two countries, allowing movement of people living within 16 kms of the international border, was suspended by the MHA in January.

What is Protected Area Permit (PAP)?

- **About**

- PAP is a special permit required by foreign nationals to visit certain areas in India deemed sensitive due to their proximity to international borders.
- These areas fall between the "Inner Line" and the international borders as defined under the **Foreigners (Protected Areas) Order, 1958**.

- **Covered Area**

- The PAP regime covers entire or parts of states such as Arunachal Pradesh, Manipur, Mizoram, Nagaland, Sikkim, Himachal Pradesh, Jammu & Kashmir, Rajasthan, and Uttarakhand.

- **Purpose of the Protected Area Permit**

- The primary objectives of the PAP are:
 - **National Security:** To regulate the entry of foreigners in sensitive areas near international borders.
 - **Preservation of Local Communities:** To protect indigenous populations and their unique cultural heritage.
 - **Environmental Conservation:** To minimize ecological disturbances in fragile regions.

- **Relevant Acts and Regulations**

- **Foreigners (Protected Areas) Order, 1958** – Defines areas as protected and prescribes the requirement for obtaining PAP.
- **Foreigners (Restricted Areas) Order, 1963** – Specifies Restricted Areas (such as Andaman & Nicobar Islands and parts of Sikkim) requiring a Restricted Area Permit (RAP).

- **Key Features of the PAP Regime**

- **Eligibility:** Foreigners, except Bhutanese citizens, need a PAP to enter and stay in these regions.

- **Permissible Visits**

- Group tourists (minimum of two persons).
- Restricted tourist circuits/routes specified in the permit.

- **Validity and Compliance**

- PAP is valid only for the specified area, route, and time.
- Permit holders cannot stay beyond the permit's validity.
- Photocopies of the permit must be deposited at entry and exit points.

- **Restrictions**

- Citizens of Afghanistan, China, and Pakistan (and those of Pakistani origin) require prior approval from the Ministry of Home Affairs (MHA).
- Diplomats and officials require special instructions from the Ministry of External Affairs.

- **Registration**

- Foreigners must register with the Foreigners Registration Officer (FRO) of the district within 24 hours of arrival.

12. Sports Festivals

Context: The Tamil Nadu government has issued an elaborate Standard Operating Procedure to be followed to ensure safe conduct of jallikattu events in 2025.

	Name of sports/festivals	States
1	Jallikattu	Tamil Nadu
2	Dhirio	Goa
3	Kambala	Karnataka
4	Maramadi	Kerala



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