1. **Right to Health:** Three decades after the Supreme Court recognised right to health and medical care as a fundamental right under Article 21.
   - **About:** India still faces challenges in ensuring this right, particularly for rare disease patients.
     - Though Article 41 of the DPSPs mandates public assistance in cases of sickness, the Union Ministry of Health and Family Welfare's (MoHFW) implementation of the National Policy for Rare Diseases (NPRD) 2021 and its funding constraints have come under judicial and public scrutiny.
   - **About National Policy for Rare Diseases (NPRD):** Currently, 63 rare diseases are included under NPRD on the recommendation of the Central Technical Committee for Rare Diseases (CTCRD).
   - **Features of NPRD:** Rare diseases under NPRD are categorized into three groups: **Group 1** - Disorders amenable to one-time curative treatment → **Group 2** - Diseases requiring long-term/lifelong treatment with relatively lower cost of treatment → **Group 3** - Diseases for which definitive treatment is available, but challenges exist in optimal patient selection, very high cost, and lifelong therapy.
   - **About Right to Health:** Article 21 of the Constitution guarantees the right to health and medical care as a fundamental right.
     - Article 41 of the Directive Principles of State Policy (DPSP) mandates public assistance in cases of sickness and disablement.
   - **About Rajasthan Right to Health (RTH) Act, 2022:** It gives every resident of Rajasthan the right to free OPD and IPD services at all public health facilities and select private ones.
     - All residents are entitled to emergency treatment and care without prepayment of any fee.
     - Hospitals cannot delay treatment for medico-legal cases due to pending police clearance.
     - After emergency care and stabilisation, if the patient does not pay charges, the provider will get reimbursement from the state government.
2. **RAPID-CRISPR /Acute Promyelocytic Leukemia (APL):** A new test called RAPID-CRISPR, developed by ACTREC, Tata Memorial Hospital, Mumbai, using CRISPR technology, can quickly and accurately diagnose acute promyelocytic leukemia (APL) in under three hours and at lower cost than existing tests.

- **About Acute Promyelocytic Leukemia (APL):** It is a rare and aggressive form of leukemia, a cancer that affects blood cells.
  - It is caused by a genetic mutation where two genes, PML and RARA, mistakenly fuse together.
  - This leads to the production of fewer white blood cells and platelets, reducing the body's ability to fight infections and control bleeding.



  - APL can cause severe internal bleeding in organs like the lungs and brain, potentially resulting in death within days if untreated.
- **About**: RAPID-CRISPR (Redefined Apl IDentification) test uses CRISPR technology to detect the PML-RARA gene mutation in patient's peripheral blood sample.
  - The test delivers results in under three hours, costs less than existing tests, and does not require complex lab equipment.
  - It works by cutting the PML-RARA gene and triggering a signal detected by a strip similar to a home pregnancy test.
- **About CRISPR Technology:** CRISPR has two applications: Gene editing & Molecular diagnosis.
  - In RAPID-CRISPR, CRISPR is used for molecular diagnosis by detecting and cutting specific gene mutations and triggering detectable signals.

3. CAPTCHA: The CAPTCHA (Completely Automated Public Turing test to tell Computers and Humans Apart) has evolved from simple text-based puzzles to advanced reCAPTCHA systems, significantly enhancing **online security** by verifying user identity and blocking automated bots.

- **About CAPTCHA:** It helps keep websites safe from automated attacks and ensures that online services remain user-friendly by distinguishing humans from bots.
- **Origin**: Introduced in 2000s to combat fake accounts, spam, and data theft caused by bots.
- **Working Principle**: CAPTCHA is based on the Turing Test, proposed by Alan Turing in the 1950s.
  - It presents puzzles that are easy for humans but hard for computers, such as recognising distorted letters or selecting images with specific objects.

- **Security Applications**: Used on business, e-commerce, and financial websites to stop spamming, fake account creation, and credit card theft.
  - Plays a role in account recovery, online surveys, and polls to ensure only real users participate.

4. **Hadean protocrust:** A recent study led by Macquarie University in Australia challenges a key geological assumption, suggesting that chemical signatures previously linked to plate tectonics may have existed in the Hadean protocrust, before the onset of plate subduction.



- **About**: The Hadean protocrust is the name for the earth's crust — its outermost layer — when it first formed.
- **Hadean Aeon:** The 'Hadean' prefix refers to the planet's first geologic aeon.
- **Early Earth Conditions**: Within 200 million years of its genesis, the earth's surface was partially molten and almost constantly bombarded by rocks from space.
  - Many volcanoes raged, making the surface very hot and hellish.
- **Formation of Crust**: As parts of the magma ocean cooled, the first pieces of the crust began to take shape.
  - The crust was somewhat flaky, with parts sloughing off and new parts solidifying.
  - The thicker parts of the crust slowly formed the first continents, which moved like plates on the asthenospheric mantle, a layer of hot, gooey rock going 400 km down.
- **Plate Tectonics**: Plates began drifting into each other, sometimes sliding over or diving under.
  - Such plate tectonics have left unique chemical signatures in the crust over millennia.
  - Scientists have understood history of plate tectonics by studying these chemical signatures.
- **New Study's Findings**: The researchers reported that the signatures associated with plate tectonics actually existed in the Hadean protocrust, before the plates began to subduct.

5. **NAFTA (North American Free Trade Agreement):** In a bid to strike an early trade deal with the US and potentially sidestep the 26% reciprocal tariffs, the Ministry of Commerce and Industry has expanded its NAFTA division, which handles India's trade with the United States, Canada, and Mexico.

- This comes amid concerns that selective concessions to competing countries like Vietnam and Cambodia may affect India's competitiveness.
- **About:** Foreign Trade (NAFTA) Division deals with India's bilateral trade with the United States, Canada, and Mexico.
  - These three countries are part of the North American Free Trade Agreement (NAFTA), which was signed in 1994.
  - The region is one of the largest and most important trading blocs globally.
  - Since July 2020, NAFTA has been renamed as the USMCA (United States-Mexico-Canada Agreement).
- **About:** Reciprocal tariffs are calculated as the tariff rate necessary to balance bilateral trade deficits between the US and each of their trading partners.

6. **Ethanol Production:** Uttar Pradesh has emerged as the top ethanol-producing state in India.
   - **About:** Over the last eight years, the state has raised its ethanol production capacity to 2 billion liters per year, with a target to increase it to 2.5 billion liters/year.
   - **Benefits of Increased Ethanol Production:** Higher income for sugarcane farmers due to better prices.
     - New ethanol-based industries have been established, creating thousands of jobs.
     - It is boosting economic activities in both rural and urban areas.
     - Promoting Ethanol-Blended Petrol (EBP) helps to reduce dependence on petrol and diesel and lower pollution levels, contribute towards the net-zero emission target by 2070.
   - **Key Infrastructure:** Asia's largest ethanol plant has been set up in Gonda district, Uttar Pradesh.
     - Another ethanol production unit has been established at the Pipraich sugar mill in Gorakhpur.
   - **About Biofuel Policy-2022 (Uttar Pradesh):** Introduced to promote Ethanol-Blended Petrol (EBP), aims to increase farmers' income & clean the environment. The policy is a major step in developing Uttar Pradesh as a biofuel hub.
   - **About:** Ethanol (Ethyl Alcohol) is a biofuel derived from sources like: Sugarcane, corn, rice, wheat, and biomass. Molasses, a sugar industry by-product, is a major raw material for ethanol and rectified spirit production.

7. **Flowerpot Snake:** The Flowerpot Snake has a unique genome with three sets of chromosomes (trisomy), totaling 40 chromosomes in three subgenomes.
   - Research on its genome reveals DNA repair mechanisms that may help understand human gene evolution and trisomy conditions like Down syndrome.
   - **About Flowerpot Snake (Ramphotyphlops braminus):** Also known as Brahminy Blind Snake, found in tropical and subtropical regions, especially Southeast Asia, and introduced globally.
   - One of the smallest snakes, 10–20 cm in length. Non-Venomous & harmless to humans. Burrowing lifestyle, feeding on ants/termites.



   - **Unique Features: Blind** and **Earthworm-like appearance**
   - **Behavior:** Found in potted plant soil, hence the name "flowerpot snake", frequently discovered by gardeners.
   - **Reproductive and Genetic Uniqueness: Trisomic genome** - only known snake with **three chromosome sets** & **Asexual reproduction** - Reproduces without a mate (parthenogenesis).
   - **Scientific Significance:** Genome studies offer insights into: DNA repair in vertebrates → Evolution of asexuality in animals → Potential understanding of human chromosomal disorders like Down Syndrome.

8. **Ream Naval Base:** Recently, the Ream Naval Base was inaugurated by Cambodian PM Hun Manet with the Chinese Support.
   - **About:** It is located on Cambodia's **Gulf of Thailand** coast, near Sihanoukville.
   - **Proximity to Malacca Strait**: Base is close to one of the world's busiest maritime trade routes.
   - **Implications for India and Indo-Pacific**
     - **Strategic Encirclement**: Ream's expansion poses a threat to India's maritime interests, especially in the Indo-Pacific.
     - **Naval Disruption Risk**: Presence of People's Liberation Army Navy (PLAN) may hinder Indian Navy operations during regional tensions.

