

1. **GW231123** : Recently, an international team of astrophysicists announced the discovery of an exceptionally rare black hole merger, identified as **GW231123**.
 - **About Black Hole Merger** : Occurs when two black holes, incredibly dense regions with gravity so strong that not even light can escape, come close and begin orbiting each other.
 - As they orbit, they emit gravitational waves, ripples in spacetime predicted by Einstein's theory of general relativity, causing them to lose energy and gradually move closer.
 - Eventually, their orbits decay, leading to a final collision where they merge into a single, more massive black hole.
 - This powerful event releases a burst of gravitational waves, detectable by observatories like LIGO (USA), Virgo (Italy), and KAGRA (Japan).
 - **About GW231123**: Two black holes — one around **137 times** and the other **103 times** the mass of the Sun — merged to form a **supermassive black hole**.
 - The combined mass falls in the "**mass gap**" (100–150 solar masses), where existing models predict very few black holes should exist.
 - Both black holes were observed to be **spinning at extremely high speeds**, challenging current theories of black hole formation and angular momentum.
 - **About Black Holes** : Are **extremely dense cosmic objects** with gravitational forces so intense that **not even light can escape**. The existence of black holes was first **predicted by Albert Einstein in 1916** through his **general theory of relativity**.
 - Black holes grow by **accreting nearby matter**, pulling in stars, gas, and dust through their intense gravitational field.
 - The **central point** of infinite density where the black hole's entire mass is concentrated.
2. **Implementation Of The Protection of the Law** : Recently, the Union government's **2022 annual report on the Implementation Of The Protection Of Civil Rights Act (PCR Act), 1955**, revealed a decline in the number of criminal cases registered for offences related to "**untouchability**."
 - **Key Highlights** : Only **13 cases** were registered under the PCR Act in 2022, compared to **24 in 2021** and **25 in 2020**.
 - Cases in 2022 were reported from **Jammu and Kashmir (5)**, **Karnataka (5)**, **Maharashtra (2)**, and **Himachal Pradesh (1)**.

- **High Pendency and Low Convictions:** Over 97% of cases remain pending in courts.
 - ✓ Of 31 cases disposed of in 2022, only 1 resulted in conviction, while 30 ended in acquittals.
 - ✓ All 37 cases disposed of between 2019 and 2021 ended in acquittals.
- **Police Investigations:** Out of 51 cases pending with police, charge-sheets were filed in only 12 during 2022.
- **Untouchability-Prone Areas:** No State or Union Territory declared any area as “untouchability prone”.
- **Comparison with SC/ST (PoA) Act, 1989:** In contrast, 62,500 cases were registered under the SC/ST (Prevention of Atrocities) Act in 2022.
 - ✓ Pendency stood at over 17,000 cases with police and 2.33 lakh cases in courts.
- **Inter-caste Marriage Incentives:** 18,900 inter-caste couples received ₹2.5 lakh each in financial support under the PCR Act.
 - ✓ **States with No or NIL Data Submission:** Bihar, Punjab, Uttar Pradesh, Jharkhand: Did not submit data on inter-caste marriage incentives.
 - ✓ Arunachal Pradesh, Meghalaya, Mizoram, Nagaland, Lakshadweep: “NIL” reports.
- 3. **GE-F404 Engine :** Recently, India received the **second GE-F404 Engine** from the United States, marking a significant milestone in the country’s defence indigenisation efforts. The engine is part of the ongoing programme to power the **Light Combat Aircraft (LCA) Tejas Mk-1A**.
 - **About Tejas LCA Mk1A :** An upgraded variant of India’s indigenous **Light Combat Aircraft**, developed by **Hindustan Aeronautics Limited (HAL)**.
 - It includes **over 40 improvements** over the Mk1 variant, enhancing **combat performance, survivability, and operational efficiency**.
 - Equipped with **Active Electronically Scanned Array (AESA) radar** systems: Israeli EL/M-2052 AESA Radar and Indigenously developed Uttam AESA Radar
 - **Electronic Warfare Systems:** Features a **Unified Electronic Warfare Suite (UEWS)**
 - ✓ Includes an **Advanced Self-Protection Jammer Pod** for improved survivability
 - **Digital Fly-by-Wire System:** Uses an upgraded **Digital Flight Control Computer (DFCC Mk1A)** for better **maneuverability and flight stability**

- o **Weapons Capability:** Equipped with **nine hardpoints** to carry a variety of weapons including:
 - ✓ **Beyond Visual Range (BVR) missiles**
 - ✓ **Air-to-Air and Air-to-Ground missiles**
 - ✓ **Advanced Short Range Air-to-Air Missiles (ASRAAM)**
- **About GE F404-IN20 Jet Engine:** Manufactured by **GE Aerospace**, powers the **Tejas LCA Mk1A**.
 - o Originally selected in **2004**, it is a **high-thrust variant** of the F404 engine family.
 - o **Key features include:** Higher-flow fans, Single-crystal turbine blades and Components tailored for the Indian Air Force (IAF).
- 4. **Patriot Missile :** Recently, U.S. President Donald Trump announced that **Ukraine will be provided with Patriot missile defence systems** as part of a new U.S. military aid package. The decision received strong approval from **Kyiv**, which continues to endure **persistent Russian aerial attacks**.
 - **About Patriot Missile :** Stands for **Phased Array Tracking Radar for Intercept on Target**.
 - o It is an **all-altitude, all-weather, surface-to-air missile defense system** developed by **Raytheon Technologies Corp.**
 - o Originally designed to counter **aircraft**, modern variants now defend against **ballistic missiles, cruise missiles, loitering munitions, and enemy aircraft**.
 - o It is the **most advanced air defence system** of the U.S. Army and is also used by **many allied nations**.
 - o **Technological Features:** Utilizes a **Track-Via-Missile (TVM)** guidance system.
 - ✓ Midcourse corrections are provided by the **mobile engagement control center**.
 - o **Interceptor Variants:** **PAC-2 interceptor:** Uses a **blast-fragmentation warhead**.
 - ✓ **PAC-3 interceptor:** Features **hit-to-kill technology** for precision targeting.
 - o **Range and Reach :** Reach altitudes of **over 24 kilometers**.
 - ✓ Strike targets at distances up to **160 kilometers**, depending on the version.
 - ✓ The **radar system** has a range of **over 150 kilometers (93 miles)**.
 - o First deployed during the **1991 Gulf War**, defending **Saudi Arabia, Kuwait, and Israel**.



- 5. Renewable energy of India:** Recently, India achieved a major milestone in its energy transition journey, with **over 50% of its installed electricity generation capacity** now coming from **non-fossil fuel sources**. This achievement comes **five years ahead** of India's **2030 target** under the **Paris Agreement**.
- **Key Highlights :** **Solar capacity** has seen a **4,000% increase** over the past decade.
 - Previous data (June 2025): Total capacity was 476 GW, with non-fossil fuels contributing ~49%
 - **Major Policy Drivers:** **PM-KUSUM Scheme:** Promotes solar-powered agriculture and feeder-level solarisation.
 - ✓ **PM Surya Ghar: Muft Bijli Yojana:** Launched in 2024, aims to install rooftop solar systems in **10 million households**.
 - ✓ **Solar Parks and Hybrid Renewable Policies:** Enabled **cost-effective, large-scale deployment**.
 - ✓ **Wind Energy:** Plays a major role in meeting **peak demand** in states like **Gujarat and Tamil Nadu**.
 - India aims to achieve **500 GW of non-fossil fuel capacity by 2030** and reach **net-zero emissions by 2070** as part of its long-term clean energy goals.
 - **About Paris Agreement :** A **legally binding international treaty** on climate change.
 - Adopted by **195 Parties** during the **UN Climate Change Conference (COP21)** in **Paris, France, on 12 December 2015**.
 - Officially **entered into force on 4 November 2016**.
 - **Objectives:** The primary goal is to **limit the global average temperature increase to well below 2°C above pre-industrial levels**.
 - ✓ It also aims to **pursue efforts to limit the temperature rise to 1.5°C** above pre-industrial levels.
- 6. Carbon Fibre Foot Prosthesis :** Recently, in a significant boost to the **Aatmanirbhar Bharat initiative**, India unveiled its first indigenously developed, advanced, and affordable **carbon fibre foot prosthesis**.
- **About Carbon Fibre Foot Prosthesis :** Part of the **Aatmanirbhar Bharat** campaign.

- o **Collaborating Institutions:** DRDO's Defence Research & Development Laboratory (DRDL) and AIIMS Bibinagar
- o **Full Name:** AIIMS Bibinagar – DRDL Indigenously Developed Optimised Carbon Foot Prosthesis (ADIDOC)
- o **Biomechanically tested** to support loads up to **125 kg**
- o Comes in **three variants** to suit patients of different weight categories
- o Offers **performance comparable to international models**

- **About Prosthetic Devices:** Artificial devices designed to replace a missing body part (limbs, hands, feet, etc.) to restore function and mobility.
 - o Aimed at helping individuals with **amputations or congenital limb loss**.

7. Splashdown and Post-Space Reconditioning: Recently, Group Captain Shubhanshu Shukla of the Indian Air Force safely returned to Earth after an 18-day mission aboard the International Space Station (ISS) as part of Axiom-4. He completed 288 orbits before safely splashing down in the Pacific Ocean with his crewmates aboard SpaceX's Dragon spacecraft 'Grace'.

- **About Splashdown :** Term used to describe the **landing of a spacecraft in water**, usually in the **ocean**, after it returns to Earth from space.
 - o **Enhanced Safety and Simplicity:** Spacecraft re-enter Earth at **extremely high speeds** (over 27,000 km/h).
 - ✓ Landing in water offers a softer impact than solid ground, as the ocean acts as a cushion, helping to protect both the crew and onboard equipment during the high-speed descent.
- **About Post-Space Reconditioning :** After spaceflight, astronauts follow a personalised recovery plan to restore balance, spatial orientation, and physical strength affected by microgravity.
 - o In space, the brain adapts by ignoring gravity signals, which disrupts balance on return, causing motion sickness, spinal discomfort, and muscle weakness.
 - o It involves physical, medical, nutritional, and psychological support to help astronauts readjust to Earth's gravity.
 - o **NASA Data on Post-Space Health :** Over 90% of astronauts face health issues post-mission, with 50% reporting disc herniation, muscle strain, fatigue, and balance problems.