

Aluminium alternative emerges to costly catalysts in pharma

Prelims: General Studies Paper - 1
Current events of national and international importance

Mains: General Studies - 3
Awareness in the fields of IT, Space, Computers, robotics, nano-technology, bio-technology and issues relating to intellectual property rights.

1. What is the issue?

- Industries **use transition metals like palladium, platinum, and rhodium as catalysts.**

A **catalyst** is a substance that **increases the speed of a chemical reaction without being used up or permanently changed in the process.**

- These **metals are rare and very expensive and are important for making medicines and chemicals.**
- India depends heavily on imports** for these metals.
- This increases production cost and supply risk.

2. What is the new discovery?

- Scientists found that **aluminium can act like these metals.**
- The research was done in Shenzhen, China.
- Aluminium is cheap** and widely available.
- It could become a replacement for costly catalysts.

3. Transition Metals vs Aluminium in Catalysis

- Transition metals are special because **they can easily change oxidation states.**
- This **allows them to gain and lose electrons easily, enabling reactions.**
- They **help in breaking old bonds and forming new ones** through redox catalysis.

- Redox catalysis is a process where a catalyst speeds up a reaction by helping in the transfer of electrons (gain and loss of electrons) between substances.
- This **makes chemical reactions faster and more efficient.**
- In contrast, aluminium stays in a stable state, so it cannot easily do this, limiting its use as a catalyst.

5. How did scientists solve it?

- They added a **special molecule called a ligand.**
- The **ligand changed aluminium's chemical behaviour.**
- It allowed aluminium to act like a redox catalyst.
- Tested in a reaction forming benzene-based compounds.
- These compounds are used in pharmaceuticals and agrochemicals.

6. What are the limits and future scope?

- The discovery is **still in the early (lab) stage.**
- The catalyst is **sensitive to air and moisture.**
- Works only in limited conditions** and reactions.
- Needs more research and industry support.
- Has strong potential to reduce costs and imports in future.**

What is Anthropic's Claude Mythos model?

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1. Context

- On April 7, Anthropic (an AI company) announced its **most powerful AI model, Mythos**.
- Mythos can **find hidden bugs in old software that humans have missed**.
- It is **designed to scan decades-old code** for cybersecurity vulnerabilities.
- The model is not publicly available and is limited to a consortium of over 40 companies

2. Access and Usage of Claude

- Claude is a **Large Language Model developed by Anthropic**, similar to ChatGPT and Gemini.
- It is **known for high-quality outputs**, especially in coding and reasoning tasks.
- Claude can **be used through apps and a command-line interface on different platforms**.
- Anthropic's other models: Haiku, Sonnet, and Opus **offer increasing levels of sophistication and strong reasoning abilities**.
- Despite popularity, **Anthropic (like many AI firms) is not yet profitable**, and users often criticize its pricing and usage limits.

3. How Mythos Differs from Claude's Other Models?

- Mythos is **specially designed for cybersecurity, unlike Claude models that focus on general coding and reasoning**.
- Earlier models like Opus could find bugs, but **Mythos can detect many more serious vulnerabilities**.
- Mythos has already identified hundreds of severe security flaws in software systems.
- There are **concerns that such powerful tools could be misused by hackers instead of just helping defenders**.
- Anthropic launched **Project Glasswing, a cybersecurity initiative in partnership with major tech companies, to detect and prevent software vulnerabilities** using advanced AI tools.

3. Capability and Access Concerns of Mythos

- The full capability of Mythos is uncertain, as access is limited to a select group.

- Its **strong cybersecurity potential makes it highly valuable for major IT and software firms**.
- **Wide public access could be risky, as hackers might exploit the same tool** to find and attack vulnerabilities.
- Through Project Glasswing, Anthropic aims to give defenders an early advantage before such AI capabilities become widespread.

4. Implications of Mythos for India

- India's IT sector **depends heavily on foreign software platforms**, increasing exposure to vulnerabilities.
- Tools like Mythos **can help identify and patch bugs early, benefiting Indian companies**.
- However, **India-developed software may also become targets for advanced cyberattacks**.
- **No Indian firm is currently part of Project Glasswing**, limiting direct early access.
- The Data Security Council of India and Indian Computer Emergency Response Team are studying its implications.

What is the SIR controversy in West Bengal?

Prelims: General Studies Paper - 1
Indian Polity and Governance-Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, etc.

Mains: General Studies - 2
Appointment to various Constitutional posts, powers, functions and responsibilities of various Constitutional Bodies. Statutory, regulatory and various quasi-judicial bodies.

1. Background & Purpose of SIR

- **Special Intensive Revision (SIR)** by the Election Commission of India aimed to:
 - ➡ Remove **duplicate, migrated, dead voters**
 - ➡ Identify **"illegal immigrants"**
- Conducted across **13 States/UTs**, but became controversial in **West Bengal**
- Led to **terms like adjudication, logical discrepancies, voter tribunals**
- Created a **"trust deficit"** between ECI and State government

2. Scale of Deletions & Discrepancies

- Initial voters: **7.66 crore** → **reduced to 7 crore**
- 63 lakh names deleted** under **ASDD (Absent, Shifted, Dead, Duplicate)**
- Additional issues:
 - ➔ **30 lakh “unmapped voters”**
 - ➔ **1.2 crore “logical discrepancies”**
- Under a **new AI algorithm**, the ECI identified five types of discrepancies:
 - ➔ **Spelling differences in names between 2002 and 2025 rolls**
 - ➔ **Cases where more than six voters linked themselves to a single ancestor**
 - ➔ **Age gaps between a voter and their parent falling beyond the 15-45 year range**
 - ➔ **Cases where the differences between the grandparents’ age and the voters’ age was less than 40 years**
 - ➔ **Instances where the voters’ gender did not align with the name provided.**

3. Adjudication & Judicial Intervention

- 60 lakh cases** remained **disputed**
- Marked as **“under adjudication”** → **excluded from voting**
- Supreme Court of India intervened due to **stalemate**
- Nearly **700 judicial officers** reviewed cases
- Outcome:
 - ➔ **27 lakh names struck down**
 - ➔ Others must approach **special tribunals**
- Final voter count: **6.77 crore**
- Many may **miss voting in upcoming elections**

4. Political & Social Controversy

- Bharatiya Janata Party supported SIR
- All India Trinamool Congress opposed:
 - ➔ Alleged **disenfranchisement of voters**
 - ➔ Criticised **timing & scale**

- Civil society concerns:
 - ➔ Allegations of **targeting Muslim voters**
 - ➔ High deletions in **Murshidabad, Malda, Uttar Dinajpur**
 - ➔ Claims of **women being disproportionately affected**
- Issue became a **major electoral plank for the assembly election**

How was the U.S.-Iran cease fire deal reached?

Prelims: General Studies Paper - 1
Current events of national and international importance

Mains: General Studies - 2
Effect of policies and politics of developed and developing countries on India's interests.

1. Context

- A **high-level Iranian delegation** led by **Mohammad-Bagher Ghalibaf** (Speaker of the Iranian Parliament) arrived in Islamabad in Pakistan.
- They were received by **Field Marshal Asim Munir** and **Foreign Minister Ishaq Dar**.
- The **U.S. team** led by **Vice President J.D. Vance**, along with **special envoy Steve Witkoff** and **Jared Kushner** (son-in-law of Donald Trump), also arrived.
- The **talks aim to formalize a permanent ceasefire** following the **two-week ceasefire between the U.S. and Iran**.

2. How the Two-Week Ceasefire Came About

- On **March 24**, The New York Times reported a **15-point U.S. plan** to end the war.
- The plan was delivered to Iran via Pakistan's military, especially Gen. Asim Munir, who maintained contact with the **Islamic Revolutionary Guard Corps (IRGC) of Iran**.
- The IRGC gained influence after the assassination of Supreme Leader of Iran **Ali Khamenei** in a U.S.-Israeli strike.
- On **April 8**, US President Donald Trump proposed a **“double-sided ceasefire”**:

- ➡ **U.S. halts attacks**
- ➡ **Iran reopens** the Strait of Hormuz
- **Iranian foreign minister Abbas Araghchi** agreed to **stop attacks if the U.S. and Israel paused theirs.**
- **Pakistan Prime Minister Shehbaz Sharif** announced a **ceasefire effective immediately**, including regions like Lebanon.

3. Challenges & Chances of Success

- The **main obstacle** is Benjamin Netanyahu and **Israel's stance** as the objective of **regime change in Iran** remains **unmet.**
- Israel reacted by **bombing nearly 100 targets** in Beirut, targeting **Hezbollah.**
- These attacks appeared aimed at:
 - ➡ **Provoking Iran**
 - ➡ **Undermining the ceasefire**
- Iran:
 - ➡ **Maintained ceasefire commitment**
 - ➡ Asserted continued support for allies like **Hezbollah**
- **International reactions:**
 - ➡ Italy and Spain **condemned Israeli strikes**
 - ➡ Gulf Cooperation Council supported **de-escalation**
 - ➡ Iran faces **trust deficit** with the United Arab Emirates
- Maintained links with:
 - ➡ Iran, U.S., Gulf states.
- **Civilian leadership handled diplomacy**; the military liaised with IRGC.
- IRGC's approval was crucial for the ceasefire.
- Multiple South Asian countries, including India, Nepal, Bangladesh, and Sri Lanka, engaged due to **energy security concerns** and the **safety of diaspora in the Gulf**, indicating broader international involvement beyond Pakistan alone.
- Other powers such as China, Saudi Arabia, Turkiye, Egypt, and Qatar supported ceasefire efforts, with China playing a key role in persuading Iran to negotiate.
- The talks were held in Islamabad due to **security risks**, including past attacks on negotiators and domestic terror threats, leading to a **local holiday declaration** for security arrangements.
- The negotiation process began at the **political level** and moved to **expert-level discussions** (economic, military, legal, nuclear), with the aim of **bridging gaps between U.S. and Iran proposals** for a long-term peace settlement.
- **Way forward:** Sustained diplomatic engagement, restraint by all parties (especially Israel and Iran), and convergence on key security and economic concerns will be essential to transform the fragile ceasefire into a durable peace agreement

4. Role of Pakistan & Other Powers + Negotiation Modality

- **Pakistan's Role**
- Long-standing mediator:
 - ➡ Helped in **1971 U.S.-China rapprochement.**
 - ➡ Facilitated **Doha Accord.**

The 2020 **Doha Accord (officially the Agreement for Bringing Peace to Afghanistan)** was a peace treaty signed by the **U.S. and the Taliban** on **February 29, 2020**, to end the 18-year war. It secured a **U.S. troop withdrawal**, a Taliban counterterrorism pledge, and initiated intra-Afghan negotiations. The agreement facilitated the Taliban's resurgence

KEYWORDS

iPRISM

- iPRISM (intensity-based phase-shift reflectometric interference spectroscopic measurement) is a **rapid point-of-care tool for detecting urinary tract infections (UTIs)**.
- It **works directly on unprocessed urine samples**, giving results in under 90 minutes.
- It **uses silicon photonic chips to detect bacterial growth** via light signals.
- It **also identifies effective antibiotics for targeted treatment**.
- It is accurate, portable, and low-cost, aiding quick clinical decisions.

Lanjia Saora Tribe

- The **Lanjia Saora are a Particularly Vulnerable Tribal Group (PVTG)** living in the forested Eastern Ghats of southern **Odisha, especially in Gajapati and Rayagada districts**.
- They are known for **their distinctive attire**, including a white loincloth with red fringes and a tail-like extension worn by men.
- Unlike many tribes, **they practice advanced terrace farming with efficient water management systems** instead of shifting cultivation.
- Their rich cultural traditions include **Idital wall paintings, the Sora language (a Munda language)**, and the **use of the Sorang Sompeng script**.
- Socially, they **follow a lineage-based system called Birinda and maintain cooperative labor practices known as Ansir**.

Central Industrial Security Force (CISF)

- The **Central Industrial Security Force (CISF)**, established under an **Act of Parliament in 1968**, has evolved into a **multi-faceted Central Armed Police Force (CAPF)**.

- Its **security mandate** spans the country's **critical infrastructure**, including **nuclear facilities, space establishments, airports, seaports, power plants**, and other **strategic installations**.
- The CISF also uniquely secures **key government buildings, historical monuments**, and **mass rapid transport systems** such as the **Delhi Metro**.
- Additionally, the force is responsible for the **security of the Central Jail in Jammu & Kashmir** and provides **protection to select categories of VIPs**.
- It has further been entrusted with safeguarding the **"Temple of Democracy" the Parliament House of India**.
- Notably, the CISF holds the distinction of having the **largest proportion of women personnel** among all **Central Armed Police Forces (CAPFs)**.