Today's Prelims Topic

Manganese in water is causing cancer in Bihar's Gangetic plains

Context

Recently, a team of scientists has claimed that Manganese (Mn) contamination of water is causing cancer in the Gangetic plains of Bihar.

About Manganese (Mn)

- Manganese is the **fifth-most abundant** metal on earth. It exists in the form of **oxides, carbonates and silicates.**
- Manganese is not found as a free element in nature. It is often found in combination with iron.
- The most important manganese ore is **pyrolusite.**
- **Properties:**
  - Manganese is a silvery-gray metal that resembles iron. It is harder than iron but very brittle.
  - It is chemically reactive and decomposes slowly in cold water.
  - Manganese tarnishes slowly in air and oxidizes (rusts) like iron in water containing dissolved oxygen.
- **Uses of Manganese:** Basic raw material for manufacturing **steel alloys,** used in the manufacturing of **bleaching powder, insecticides, paints and batteries.**
- **Biological Importance**
  - Helps in enzyme activation.
  - Crucial for bone formation, metabolism of carbohydrates, amino acids and cholesterol. Also contributes to **antioxidant defense systems.**
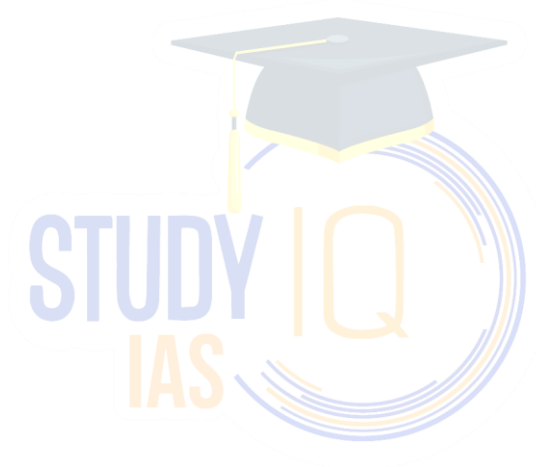
Toxicity of Manganese

- Small amounts are beneficial, excess manganese can be toxic.
- **Sources of Exposure:**
  - **Water:** Groundwater with high Mn levels (natural or industrial pollution).
  - **Air:** Industrial emissions from mining, welding and steel production.
  - **Soil and Food:** Geogenic sources or contaminated irrigation water.
- **Health Effects:**
  - **Neurological:** Chronic exposure can lead to Manganism, a condition similar to Parkinson's disease.
  - **Cognitive Impairments:** Memory loss, learning difficulties.
  - **Cancer Risk:** Recent studies indicate prolonged Mn exposure may contribute to carcinogenesis (e.g., the Bihar study on water contamination).

Facts
- **Worldwide Top Reserves:** South Africa, Australia & China **(India-7th)**
- **India Top Reserves:** Odisha (44%), Karnataka (22%) & Madhya Pradesh (12%)
- **India Top Producers:** Madhya Pradesh, Maharashtra & Odisha

Source:
- **Down to Earth - Manganese in water is causing cancer in Bihar's Gangetic plains: Study**

Gen Cast

Context

Google DeepMind has developed the first artificial intelligence (AI) model to predict the weather more accurately than the best system currently in use.

About Gen Cast

- It is a new AI-based weather forecasting model developed by Google DeepMind. It offers **faster and more accurate predictions** for up to **15 days** in advance.
- **Key Features of GenCast:**
  - **Probabilistic Ensemble Forecasting:**
    - Unlike traditional models that give a single "best guess," GenCast provides multiple possible weather scenarios.
    - This allows users to understand a range of potential outcomes and the uncertainty associated with predictions.
  - **Data and Training:** GenCast was trained on 40 years of historical weather data, including variables like: Temperatures, Wind speeds & Air pressure.
  - **Generative AI for Weather:**
    - GenCast uses generative AI, a type of AI commonly used for creating images, videos, and music, to "generate" multiple weather possibilities.
    - Instead of producing creative content, the model imagines and predicts how the weather might evolve over time.

Source:
- [**The Hindu - New AI model 'GenCast' can beat the best traditional weather forecasts**](#)

Switzerland suspends MFN clause in tax avoidance pact with India

Context

Switzerland has suspended the **Most-Favoured-Nation (MFN)** clause under the **Double Taxation Avoidance Agreement (DTAA)** with India, effective from **January 1, 2025**.

About Most-Favoured-Nation (MFN)

- MFN is a principle of trade that requires countries to treat all other World Trade Organization (WTO) members equally.
- Countries cannot discriminate between their trading partners, and must extend any favorable treatment given to one country to all other WTO members.
- **Exemptions:** The WTO provides the following exemptions from MFN provisions -
  - **Trade blocs:** Trade blocs like the European Union and the USMCA can discriminate against imports from outside the bloc.
  - **Trade barriers:** Countries can raise barriers against products from specific countries that are considered to be traded unfairly.
  - **Trade preferences:** Countries can extend trade preferences to developing countries.
  - **Free trade agreements:** Countries can set up free trade agreements that only apply to goods traded within the group.
- **Removal of MFN status:**
  - There is **no formal procedure** for suspending MFN treatment and it is not clear whether members are obliged to inform the WTO if they do so.
  - **E.g.** India revoked Pakistan's MFN status following the Pulwama attack in 2019. Pakistan has never granted India MFN status.

India-Switzerland Tax Treaty

- The **Double Taxation Avoidance Agreement (DTAA)** between India and Switzerland was signed in 1994 and amended in **2010 to prevent double taxation of income.**

DTAA is an international treaty between two or more countries designed **to prevent the same Income from being taxed twice.** India has signed such agreements with around 90 countries, benefiting individuals who reside in one country but earn Income in another.

- **Supreme Court ruling:**
  - In 2023, SC ruled that the DTAA's provisions require explicit notification under the Income-Tax Act to be enforceable.
  - This overturned a Delhi High Court decision that protected entities from double taxation.
- **Implications of the Suspension of the MFN Clause:**
  - **Higher tax rates:**
    - Dividends paid after January 1, 2025, will be taxed at a higher rate of 10% in the source state.
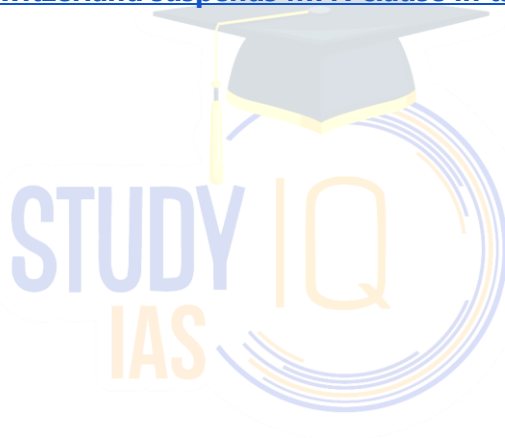
■ This will affect Swiss companies like Nestlé and challenge India's attractiveness as an investment destination.

○ **Investment Risks:**

■ Swiss investment in India could decline due to the increased tax burden.

■ **EFTA's $100 billion investment commitment over a 15-year period** may be at risk.

European Free Trade Association (EFTA)

● It is a group of 4 countries - **Iceland, Liechtenstein, Norway and Switzerland.**
● **Establishment**: In 1960 through the Stockholm Convention.
● **Aim**: To promote free trade and economic integration among its members.
● **Relationship with EU:** EFTA operates alongside the European Union (EU), with all members participating in the European Single Market and the Schengen Area but not in the EU Customs Union.

Source:

● **Indian Express - Switzerland suspends MFN clause in tax avoidance pact with India**

How a distant galaxy gave a glimpse of Milky Way in its infancy

Context

NASA's James Webb Space Telescope (JWST) has discovered a distant galaxy called **"Firefly Sparkle.**
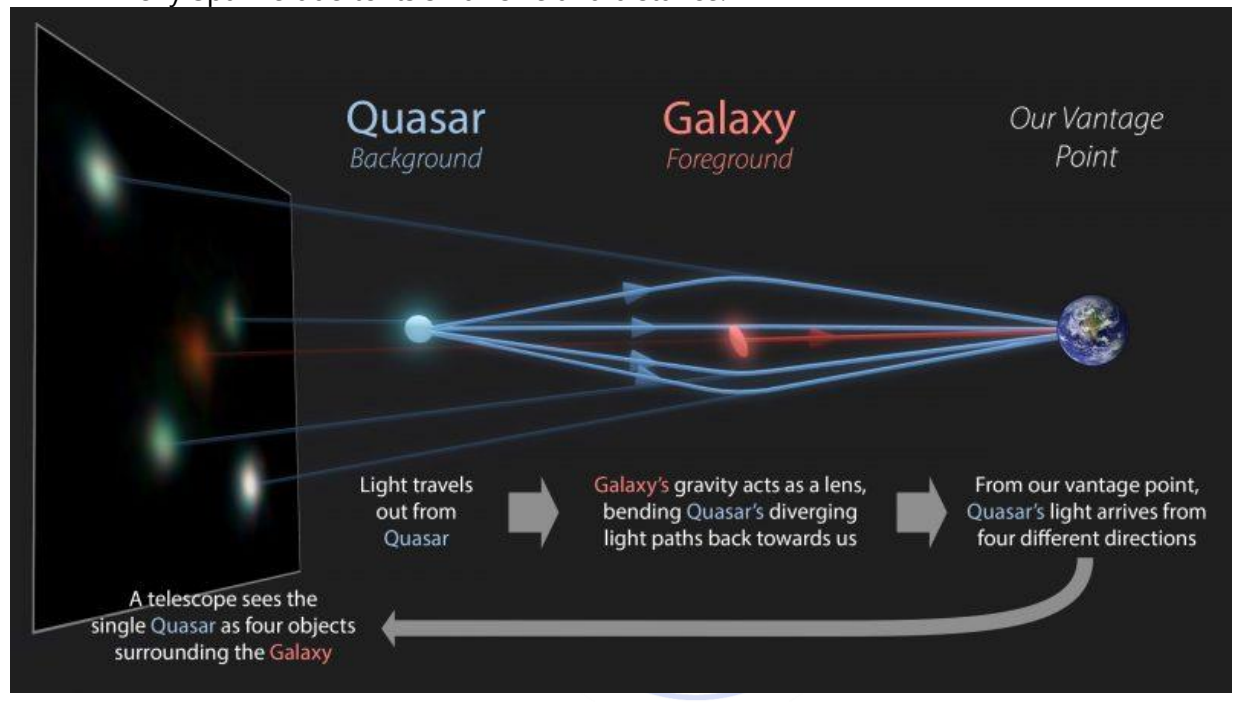
Key Features of Firefly Sparkle

- **Formation:**
    - The galaxy was formed 100–400 million years after the Big Bang.
    - Its current observed state shows it as an infant galaxy, still in the process of assembling.
- **Size and Structure:**
    - **Mass:** About 10 million stars, equivalent to the size of the Sun.
    - **Neighboring Galaxies:** Two smaller neighboring galaxies named Firefly-Best Friend and Firefly-New Best Friend.
- **Comparison with the Milky Way:** At this stage, Firefly Sparkle is 10,000 times less massive than the present-day Milky Way.

Significance of the Discovery

- **Insights into Galactic Formation:** Firefly Sparkle provides a direct look at how galaxies like the Milky Way might have looked like in their infancy. Its mass and structure align with theoretical models of early Milky Way-like galaxies.
- **Understanding Evolution:** Firefly Sparkle represents the early formation phase in the evolutionary process of galaxies.

Gravitational Lensing

- Gravitational lensing is a phenomenon that occurs when a massive celestial body bends and warps space, **causing light to bend and magnify.**
- This effect allows astronomers to observe objects that would otherwise be too faint or distant to detect.
- **Einstein's General Theory of Relativity** describes gravity not as a force between masses, but as the curvature of spacetime caused by mass and energy.
- **Gravitational Lenses:** The massive objects causing the bending of light are referred to as gravitational lenses. These can be individual stars, galaxies or clusters of galaxies.
- Without this effect, even the **advanced JWST** would not have been able to observe Firefly Sparkle due to its small size and distance.

Source:

- **Indian Express - How a distant galaxy gave a glimpse of Milky Way in its infancy**
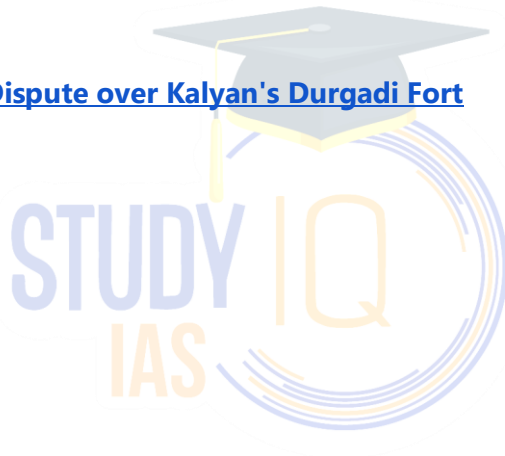
Durghadi Fort

Context

Recently The Kalyan civil court has ruled that Durgadi Fort is owned by the Maharashtra government, dismissing the claims of the Majlis-E-Mushawarat Trust.

About Durgadi Fort

- It was constructed in the 16th century during the Adil Shahi Sultanate (Bijapur) and was later **modified by the Marathas.**
- It is situated in **Kalyan, Maharashtra, near the Ulhas River.** During this time Kalyan was a **trading port.**
- In 1760, after the Marathas captured Kalyan, they built a wooden temple dedicated to **Durgadevi** and renamed it **Durgadi Killa.**
- After the British took control in **1818,** the temple ceased to function, and by 1876, the image of the goddess was stolen.

Source:

- **Indian Express - Dispute over Kalyan's Durgadi Fort**

White House reveals plan to tackle anti-Muslim and anti-Arab hate

Context

Recently the White House has unveiled the first-ever national strategy to combat Islamophobia, outlining 100+ actions to curb hate, violence, bias and discrimination against Muslims and Arab Americans.

About National Strategy

- **Key Objectives and Focus Areas:** The strategy focuses on 4 main pillars:
  - **Raising Awareness:** Enhancing public understanding of anti-Muslim and anti-Arab hate and recognising the contributions of these communities to American society.
  - **Ensuring Safety and Security:** Implementing targeted measures to protect vulnerable communities.
  - **Reducing Discrimination:** Promoting accommodation of religious practices and addressing biases in federally funded activities.
  - **Building Solidarity:** Encouraging cross-community collaboration to counter hate and discrimination.
- **Key Measures and Actions:**
  - **Data Collection and Education:** Enhanced data collection to monitor hate crimes. Launch of educational initiatives to promote awareness about Islamophobia and Arab discrimination.
  - **Hate Crime Reporting:** Dissemination of best practices for engaging communities in reporting hate crimes.

Source:

- **Indian Express - White House reveals plan to tackle anti-Muslim and anti-Arab hate**

First ice free day in Arctic could occur before 2030

Context

A new study, published in *Nature Communications*, predicts that the **Arctic Ocean** could witness its **first ice-free day** (less than **1 million square kilometers of sea ice**) by **2030**, or even as early as **2027** under specific conditions.

Key Findings of the Study

- **Sea Ice Decline Rate:**
  - Over the past 40 years, Arctic sea ice extent has been shrinking at a rate of **12.6% per decade,** an unprecedented decline in the last 1,500 years (MIT Climate Portal, 2023).
- **Key Contributors to Arctic Warming:**
  - **Alarming GHG Levels:** In 2023, global concentrations of carbon dioxide, methane,and nitrous oxide reached record highs (World Meteorological Organization).
  - **Arctic Warming Rate:** The Arctic is warming 4 times faster than the global average, threatening ecosystems, infrastructure and livelihoods.

Consequences of an Ice-Free Arctic

- **Climate Change Acceleration:**
  - **Albedo Effect:** Loss of reflective sea ice will increase solar energy absorption by darker ocean surfaces, further warming the Arctic. This will lead to more extreme weather events in mid-latitudes & Intensified global warming.
- **Rising Sea Levels:**
  - **Sea level rise is worsening:** The global sea level has risen 1.5x faster in the past decade compared to the 1990s.
  - **Greenland Ice Sheet:** Complete melting could raise sea levels by 6 meters, endangering coastal communities globally.
- **Ecosystem and Biodiversity Threats:**
  - Loss of sea ice and melting permafrost will affect species such as polar bears, walruses, arctic foxes, snowy owls and reindeer.
  - **Impacts on Arctic Communities:** Infrastructure, livelihoods and traditional practices of indigenous Arctic peoples are under significant threat.

Arctic

- It is a geographic region spreading around the North Pole.
- It includes the northern parts of Canada, the United States, Russia, Finland, Sweden, Norway, Iceland and Greenland.

Source:

- **Indian Express - First ice-free day in the Arctic could come by 2030, says new study:**
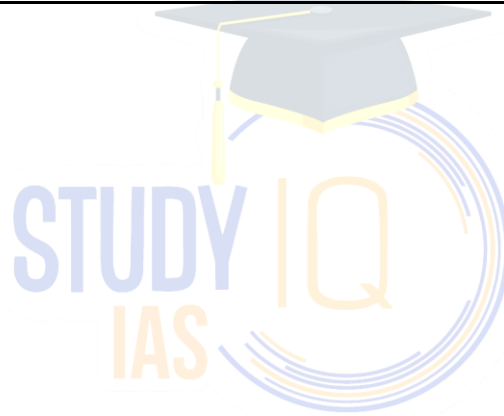
News in Shorts

Important Engineering Concepts used in F1 Cars

- **Aerodynamics:**
  - Aerodynamics is the study of how air flows around objects, particularly vehicles.
  - It focuses on minimizing air resistance (drag) and maximizing the vehicle's stability and efficiency.
  - It is used to design vehicles that move smoothly through the air, reducing the effort needed to move them forward and improving fuel efficiency.
- **Brake Regeneration (Kinetic Energy Recovery Systems or KERS):**
  - It is a technology that recovers the kinetic energy lost during braking and converts it into electrical energy.
  - This energy is stored in a battery or capacitor and can be used later to boost the vehicle's performance, particularly for acceleration.

Source:
- **Indian Express - F1 learnings beyond the grid**

Editorial Summary

Trump's return and the South Asia outlook

Context

- In January 2025, Donald Trump will be sworn in as the 47th President of the United States.
- His return to office has sparked curiosity and apprehension globally, though his policies in South Asia are expected to provide continuity with a focus on cooperation with India.

Factors Shaping U.S.-India Relations

- **Strong Trajectory Since 2000**
  - The U.S. recognized India as a **net-security provider** in 2009.

India as a Net Security Provider in Indo-Pacific Region (IOR): Incidents

- Vital water supplies to the Maldives in 2014
- Efforts to locate the missing Malaysia Airlines Flight MH370.
- Humanitarian Assistance to neighbouring countries during the 2004 Indian Ocean tsunami.
- In 2024, the Indian Navy successfully intervened in a piracy incident in the Indian Ocean Region (IOR) and rescued the crew of a hijacked fishing vessel.

  - Under the Biden administration (2021-24), relations remained strong due to China's assertiveness.
  - The U.S. aims to support India's regional leadership to counter China.
- **Key Examples of Cooperation**
  - **Millennium Challenge Corporation (MCC)** projects in Nepal.
  - Assisting **Sri Lanka** during its economic crisis.
  - Biden's limited engagement with **Pakistan** after the Afghanistan withdrawal facilitated mutual strategic vision between the U.S. and India.

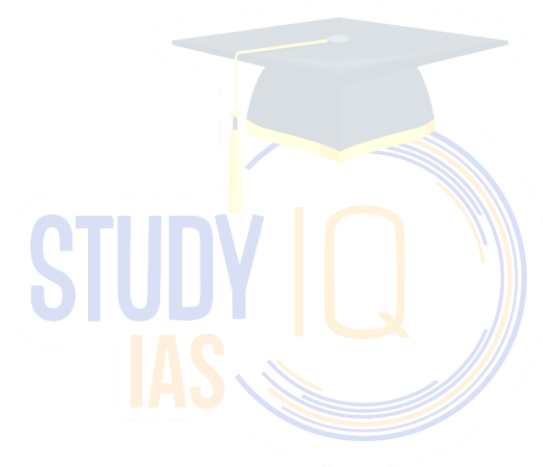### Divergences and Challenges

- U.S. scrutiny on **democracy and human rights** under Biden strained relations, especially regarding:
  - **Bangladesh** (Sheikh Hasina government).
  - **Myanmar** (military junta).
- U.S. sanctions against Indian firms collaborating with **Russia** and allegations of corruption against the **Adani Group** impacted Indian projects in **Sri Lanka**.

Future Outlook

- Trump's foreign policy may **prioritize strategic cooperation over human rights concerns**.

○ This will allow India to take a more proactive role in regional leadership without facing as much pressure from the U.S. on domestic governance issues.

Source: The Hindu: Trump's return and the South Asia outlook

Value Addition

How Railway Amendment Bill Could Impact The National Transporter

Context

The government intrLok Sabha on Wednesday (December 13) passed the The Railways (Amendment) Bill, 2024.

Why Was the Bill Introduced?

- **Simplifying Legal Framework**: The Indian Railway Board Act, 1905 continued to exist alongside the Railways Act, 1989, even after the latter repealed the Indian Railways Act, 1890.
  - The new Bill aims to integrate the provisions of the 1905 Act into the 1989 Act, streamlining the legislative process and avoiding the need to refer to two different laws.
- **Efficiency and Modernization**: The government believes that merging these acts will result in a **"paradigm shift"** by enhancing efficiency and the development of the railway network.
  - The Bill intends to modernize and simplify governance within the railways.
- **Reducing Bureaucratic Redundancy**: The amendment seeks to avoid duplication of roles and streamline the powers and functions of the Railway Board.

Key Provisions of the Bill

- **Amendment to Section 2 of the Railways Act, 1989**: The Bill introduces **Chapter IA**, which pertains to the Railway Board.
  - It allows the Central Government to grant the Railway Board powers and functions related to the management of railways.
- **Authority of the Railway Board**: The Central Government may delegate any or all of its powers under the Railways Act, 1989 to the Railway Board.
  - These powers may be delegated either **unconditionally** or subject to specific conditions.
- **Continuity of Appointments**: Existing appointments of the Chairman and members under the 1905 Act will now be considered appointments under the amended Railways Act, 1989.
  - The Bill does not create a new body; the Railway Board remains as it is.
- **Impact on Passengers**: The Bill is expected to improve the efficiency of the Railway Board, potentially leading to better development and operation of the railway network.

Criticisms of the Bill

- **Lack of Decentralization**: The Bill does not address concerns about decentralizing power to **zonal and divisional levels**. Many MPs argue that greater autonomy at these levels is necessary for more efficient railway operations.
- **Concerns Over Independence**: Critics fear the Bill compromises the **independent functioning** of the Railway Board by keeping significant control with the Central Government.
  - There are calls for making the Railway Board an autonomous body with decision-making powers.
- **Limited Deliberation**: The Bill was introduced without forming an **all-party committee** for broader consultation, which some believe would have improved the legislation's effectiveness.
- **Exclusion of Expert Recommendations**: The Bill fails to incorporate recommendations from several expert committees, such as the **2015 Committee on Restructuring of Railways**, which suggested creating an **independent regulatory body** for railways.
- **Social Inclusion and Merit-Based Appointments**: Concerns have been raised regarding the need for representation of **Scheduled Castes (SCs), Scheduled Tribes (STs), Other Backward Classes (OBCs), and women** in the Railway Board.
  - Critics emphasize that appointments should be based on **qualifications and domain expertise**, not political affiliations.
- **Safety and Operational Issues**: The Bill does not address critical challenges like:
  - **Railway safety** and accident prevention.
  - **Filling vacancies** within the railway workforce.
  - **Technical upgrades** and bureaucratic inefficiencies.
- **Centralized Control**: There are apprehensions that the Bill strengthens the Centre's control over railway operations, potentially bypassing parliamentary oversight.

Source: [Indian Express: How railway amendment bill could impact the national transporter](#)