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## New non-invasive formaldehyde sensor

**Context:** A new low-cost sensor made of metal oxide nanoparticles–reduced graphene oxide composite can detect formalin adulteration in fishes at room temperature.

- Food adulteration involves adding illegal or harmful substances to food for various reasons.
- Commercial formalin sensors for fish are often expensive and invasive in nature, facing challenges in low-level and selective detection.
- The Nanomaterials and Nanoelectronics Laboratory at Guwahati University developed a cost-effective formalin sensor.
- The sensor uses a tin oxide-reduced graphene oxide composite, addressing the low electrical conductivity challenge of graphene oxide.
- The tin oxide-decorated reduced graphene oxide sensor effectively detects formaldehyde vapor at room temperature.
- The sensor has been tested for adulterated fish in the Guwahati region, demonstrating the non-invasive detection of formalin.
- The prototype of this sensor is in development, offering potential breakthroughs in affordable formalin sensor devices for addressing food adulteration.

### ➤ Formaldehyde:

- Formaldehyde, with the systematic name methanal, is an organic compound represented by the formula  $CH_2O$  and structure  $H-CHO$ .
- It exists as a pungent, colorless gas that spontaneously polymerizes into paraformaldehyde, often stored as aqueous solutions known as formalin, primarily composed of the hydrate  $CH_2(OH)_2$ .
- As the simplest of the aldehydes ( $R-CHO$ ), formaldehyde serves as a crucial precursor in the commercial production of various materials and chemical compounds.
- Despite small natural occurrences, formaldehyde is known to be classified as a carcinogen, presenting health risks such as respiratory and skin irritation upon exposure.

### • Applications:

#### ▪ Industry:

- ✓ **Versatile Applications:** Integral in car manufacturing, explosives, plastics, resins, and artificial materials.
- ✓ **Sanitary Products:** Used in the production of paper towels, napkins, and tissues.
- ✓ **Disinfectant:** Employed as a disinfectant in industrial settings.

#### ▪ Medicine:

- ✓ **Antiseptic:** Valued for its ability to eliminate bacteria and fungi in medical applications.

- ✓ **Parasite and Wart Treatment:** Used in medical treatments for parasites and warts.
- ✓ **Vaccine Production:** Essential in vaccine production and sterilization.
- ✓ **Infection Treatment:** Applied in treating infections, preventing bacterial growth.
- **Building and Construction:**
  - ✓ **Wooden Products:** Key in manufacturing furniture, cabinetry, flooring, and other wooden products.
- **Food and Others:**
  - ✓ **Preservative:** Used as a preservative in food, paints, and cosmetics.
  - ✓ **Antiseptic and Disinfectant:** Widely utilized in medicine and funeral homes.
  - ✓ **Fuel Yield Improvement:** Enhances fuel yield in petroleum and natural gas industries.
  - ✓ **Ink Manufacturing:** Employed in ink manufacturing for writing and printing materials.

## T+0: Instant Settlement Cycle

**Context:** SEBI has suggested the implementation of an optional facility for the clearing and settlement of funds and securities on the same day (T+0) and an instant settlement cycle.

### ➤ Current Settlement Cycle:

- SEBI shortened the settlement cycle to T+3 in 2002 and subsequently to T+2 in 2003.
- The current settlement cycle is T+1, introduced in 2021 and fully implemented in January 2023.
- Funds and securities are settled by the next day of the trade (T+1).

### ➤ SEBI's Proposal:

- SEBI proposes to introduce an optional shorter settlement cycle in two phases.
- Phase 1: T+0 Settlement Cycle (optional) for trades till 1:30 PM, settling on the same day by 4:30 PM.
- Phase 2: Instant Settlement Cycle (optional) allowing immediate trade-by-trade settlement till 3:30 PM.

### ➤ Implementation Details:

- T+0 settlement initially available for the top 500 listed equity shares based on market capitalization.
- Implementation in three tranches of 200, 200, and 100 shares, from lowest to highest market cap.
- Exchanges to coordinate and publish a common list of securities and migration calendar under T+0 settlement.
- Surveillance measures applicable in T+1 settlement cycle will apply to T+0.

### ➤ Reasons for Shorter Settlement Cycle:

- Growth in Indian securities markets demands greater efficiency and safety, especially for retail participants.

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- Evolution of payment systems and advanced technologies present opportunities for shorter settlement cycles.
- Increased adoption of instant payment platforms like UPI.

➤ **Features of T+0 Settlement Mechanism:**

- High percentage of retail investors bring upfront funds and securities before placing an order.
- Instant settlement ensures immediate receipt of funds and securities, eliminating settlement shortages.
- Strengthens investor protection by enhancing control over securities and funds, especially for UPI clients.

➤ **Benefits of the New Mechanism:**

- Provides flexibility for faster pay-out of funds against securities to sellers and vice versa.
- Establishes Indian equities as an asset class with resilience, low cost, and quick transaction times.

## INS Imphal Commissioned

**Context:** Vishakhapatnam Class INS Imphal has been commissioned into the Indian Navy.

➤ **Construction and Naming:**

- The Mazagon Dock Shipbuilders Limited (MDSL) undertook the construction of the Visakhapatnam Class guided missile destroyers as part of Project 15B, initiated in January 2011.
- The lead ship, INS Visakhapatnam, was commissioned in November 2021.
- The second ship, INS Mormugao, was commissioned in December 2022.
- The fourth ship, to be commissioned as INS Surat (D69), was launched in May.

➤ **Design and Development:**

- The design, conceptualized by the Indian Navy's Warship Design Bureau, focused on incorporating advanced capabilities.

- Project 15B aimed at building destroyers with similar tonnage, usage, and weaponry.

➤ **Technical Characteristics:**

- The Visakhapatnam Class destroyers have a length of 163 meters, a width of 17.4 meters, and a displacement of 7,400 tonnes.
- The propulsion system features a Combined Gas and Gas (COGAG) configuration with four gas turbines.
- The ships can achieve a maximum speed of 30 knots and have a range of 4000 nautical miles.

➤ **Crew and Accommodation:**

- Operated by a crew of approximately 350, including 50 officers and 250 sailors.
- The destroyers provide superior ergonomics and habitability compared to their predecessor classes.

➤ **Survivability and Control Systems:**

- Elaborate battle damage control systems contribute to improved survivability.
- The Total Atmospheric Control System (TACS) safeguards against chemical, biological, and nuclear threats.

➤ **Combat Management and Arsenal:**

- Equipped with a state-of-the-art combat management system for tactical evaluation.
- The arsenal includes BrahMos surface-to-surface cruise missiles and Barak-8 surface-to-air missiles.
- Features comprise a 127 mm main gun, AK-630 30mm guns, torpedo launchers, and anti-submarine rocket launchers.

➤ **Strategic Significance:**

- Guided missile destroyers play a pivotal role in protecting fleets and carrier battle groups.
- The Visakhapatnam class enhances operational efficiency with modern sensors and communication facilities.
- A high indigenous component provides a strategic edge to the destroyers in terms of reliability and control.

## NEWS IN BETWEEN THE LINES

### Kudankulam Nuclear Power Plant



Recently, India and Russia signed some "very important" agreements related to the construction of the future power-generating units of the Kudankulam nuclear power plant.

**About Kudankulam Nuclear Power Plant:**

- The Kudankulam Nuclear Power Plant (KNPP) is **India's largest nuclear power station** located in the Tirunelveli district of **Tamil Nadu**.
- It is being developed by the Nuclear Power Corporation of India (NPCIL).
- The plant is a joint collaboration between **India** and **Russia's Rosatom State Atomic Energy Corporation**.
- The project is executed in two phases: Phase 1 saw the operationalization of Units 1 and 2 starting **December 31, 2014**, while Phase 2 encompasses the ongoing construction of four additional reactors.
- Its construction began in **2002**, but was delayed by opposition from local fishermen.
- The plant has a capacity of **2,000 MW**, with an additional 2,000 MW under construction.
- It uses **AES-92**, also called the V-466 model, which is the latest version of the third-generation VVER-1000.

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## FEMA



Recently, the Reserve Bank of India released a draft 'Licensing Framework for Authorised Persons (APs)' under Foreign Exchange Management Act (FEMA), 1999.

### About FEMA:

- The Foreign Exchange Management Act (FEMA) is a **set of regulations** that **enable the Government of India to pass rules relating to foreign exchange**.
- It was introduced in **1999** and replaced the Foreign Exchange Regulation Act (FERA) in **2000**.
- Its primary goal is to regulate foreign exchange transactions in a way that promotes **economic growth and stability**.
- The act gives the Reserve Bank the authority to define the categories of capital account transactions and the exchange restrictions that apply to such transactions.
- It deals with provisions relating to **procedures, formalities, dealings**, etc. of foreign exchange transactions in India.
- It has **five zone offices**, each **led by a Deputy Director**, located in Delhi, Mumbai, Kolkata, Chennai, and Jalandhar.

## Wildlife Protection Society of India



Recently, Wildlife Protection Society of India revealed that India lost a record 204 tigers this year from January 1-December 25.

### About Wildlife Protection Society of India:

- The Wildlife Protection Society of India (WPSI) is **an organization** that provides information and support to government authorities to combat poaching and the illegal wildlife trade.
- It was **founded in 1994** by **Belinda Wright**, its Executive Director, who was an award-winning wildlife photographer and filmmaker.
- The **Wildlife Protection Act of 1972** aims to protect and conserve wildlife in India.
- The act prohibits the **hunting, poaching and trading** of endangered species, and establishes penalties for such activities.
- The Act consists of **60 Sections** and **VI Schedules**.
- In **2005 and 2006**, **WPSI and the UK-** based Environmental Protection Agency (EIA) carried out a joint investigation into the **tiger and leopard skin trade** in the Tibet Autonomous Region and other provinces in China.

## AS-24 Killjoy



Recently, in the ongoing aerial offensive against Ukraine, Russia utilized its AS-24 KILLJOY hypersonic missile.

### About AS-24 KILLJOY:

- The AS-24 KILLJOY is a **hypersonic missile** that Russia recently used in an aerial strike on Ukraine.
- It is a nuclear-capable missile that can travel at **speeds of up to Mach 10** and has a range of **1,500–2,000 km**.
- In March **2018**, Russian President Vladimir Putin announced the Kinzhal as one of **six "next generation"** weapons.
- The missile is reportedly a ballistic missile that was used on **December 14, 2023** to target a military airfield in central Ukraine.
- Hypersonic missiles can travel through the atmosphere and maneuver while in flight, making them difficult to detect and intercept.
- Hypersonic missiles fly at **least five times** the speed of sound, which is **Mach 5**.

## Pasteurization



December 27, commemorates the birth anniversary of **Louis Pasteur**, a famous French scientist known as the "**Father of Microbiology**."

He is known for his discoveries of the principles of **vaccination, microbial fermentation and pasteurization**.

### Pasteurization:

- Pasteurization is a **food preservation process** that involves heating food products to kill harmful **bacteria and pathogens**.
- It **deactivates microbes** and **reduces enzyme activity** by reducing the temperature.
- Some types of pasteurization methods including, **Vat Pasteurization** (low temperature), **High Temperature/Short Time (HTST)**, **Ultra pasteurization (UP)** and **Ultra-High-temperature (UHT)**.
- UHT pasteurization involves heating milk or cream to **138–150 °C (280–302 °F)** for one or two seconds.
- Pasteurization and sterilization both involve heating a food to break down its bacterial load.
- However, sterilization almost **completely eliminates the bacterial load**, while **pasteurization only reduces it**.

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## Place in News

### France

Recently, a charter plane carrying 276 passengers, mostly Indians, which was grounded in France for four days over suspected human trafficking, landed in Mumbai.

#### France (Capital: Paris)

**Location:** France is a country located in Western Europe.

**Boundaries:** France shares its border with **Switzerland** and **Italy** (East), **The English Channel** and **Bay of Biscay** (West), **Belgium**, **Luxembourg** and **Germany** (North) and **Andorra** and **Spain** (South).

#### Physical Features:

- **The Alps and the Pyrenees are the highest points in France.**
- The **Alpine peak of Mont Blanc** is the highest point in Western Europe.
- The **Seine river** flows through Paris and into the **English Channel**.
- The **Loire** is the longest river in France, famous for its chateaux along its course.
- France's mineral resources encompass **coal** in **Nord-Pas-de-Calais** and Lorraine, **iron ore** in Lorraine, bauxite in Provence-Alpes-Cote d'Azur, potash in Alsace and Lorraine.
- Some smaller reserves of **uranium**, salt, limestone, lead, zinc, copper, **gypsum** and **fluorspar** also scattered across the country.



## POINTS TO PONDER

- Namdapha flying squirrel, that was recently in news, is endemic to which Indian State/UT? - **Arunachal Pradesh**
- Recently, which Indian airport received recognition at UNESCO's 2023 Prix Versailles? - **Kempegowda International Airport**
- Which country has recently announced to leave Organization of the Petroleum Exporting Countries (OPEC)? - **Angola**
- Church of Epiphany, that has recently secured prestigious UNESCO Asia-Pacific Award for Cultural Heritage Conservation, is located in which state? - **Haryana**
- As per the India Skills Report 2024, which state is the most preferred state to work? - **Kerala**

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