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GS 1: ART & CULTURE, HISTORY, INDIAN SOCIETY AND GEOGRAPHY

1. The hottest year

Context: The Indian Meteorological Department's (IMD) announcement that in 2024, the country experienced its hottest year since 1901 should be sobering for policy makers across the world. The IMD and WMO have warned that 2025 could be another hot year. By all accounts India is on track to meet its global climate targets. As the planet gets hotter, the challenge will be to address people's vulnerabilities without compromising on their developmental needs as more than 30% of the country's GDP is generated in sectors that are highly nature-dependent such as agriculture, forestry, water and power utilities, and construction.

Key points

- **Overview:** The world is witnessing a concerning trend of record-breaking temperatures across the globe, exacerbated by global warming. From the scorching 56.7°C recorded in Death Valley, California over a century ago to the recent 52.9°C reading in Delhi, temperature extremes are becoming more prevalent as the planet continues to heat up.
- **Historical High:** The highest temperature ever recorded on Earth was 56.7°C in Death Valley, California, in 1913. *United Kingdom* - Surpassed 40°C for the first time in July 2022, *China* - Recorded its highest temperature of 52°C in a northwestern town last year, *Europe* - Sicily, Italy, reached 48.8°C in 2021, a record for the continent, *India* - Rajasthan's Phalodi recorded the highest temperature of 51°C in 2016.
- **Global Trends:** An analysis shows nearly 40% of the Earth experienced its highest-ever daily temperature between 2013 and 2023. This includes diverse regions, from Antarctica to various parts of Asia, Europe, and the Americas. Global average temperatures are currently about 1.61°C higher than pre-industrial levels.
- **Global Warming's impact on Global Temperatures:** *Greenhouse Gases and Temperatures* - GHGs trap heat in the Earth's atmosphere, preventing it from escaping into space. Increased concentrations of these gasses enhance this effect, leading to more heat being retained and higher global temperatures.
Global Temperature Rise - The past decade has seen many of the warmest years on record, with 2023 and 2024 showing unprecedented temperature increases. The period from May 2023 to April 2024 was the warmest 12-month period, with global temperatures about 1.61°C above pre-industrial levels.
Urban Heat Islands (UHIs) - UHIs are metropolitan areas significantly warmer than surrounding regions due to heat-absorbing surfaces and energy use. As global temperatures rise, UHI intensity is expected to increase, amplifying heatwaves in cities.
- **Consequences of Rising Global Temperatures:** *Sea Level Rise* - As temperatures rise, glaciers and ice sheets melt, adding water to the oceans and causing sea levels to rise. This inundates coastal areas, displaces communities, and disrupts ecosystems.
Droughts and Heat Waves - Droughts and heat waves are expected to become more intense, while cold waves are expected to become less intense and less frequent.
Climate change - Extreme weather disrupts food production, leading to shortages and price hikes that harm vulnerable populations. Rising temperatures worsen air quality, increase heat-related illnesses, and facilitate disease spread. The economic consequences are severe, with high costs for repairing infrastructure, declining agricultural yields, and escalating disaster relief.
Biodiversity Loss - Rising temperatures and changing weather patterns disrupt ecosystems and habitats, pushing many plant and animal species towards extinction.
- **Way Forward:** *Six-Sector Solution* - Follow the United Nations Environment Programme's roadmap, which includes reducing emissions across sectors like energy, industry, agriculture, forests, transport, and buildings.
Carbon Offsetting - Invest in projects that draw down carbon from the atmosphere, such as reforestation or carbon capture and storage.
Reduction in Greenhouse Gas Emissions - Transition to renewable energy sources like Solar, wind, geothermal, and hydro power can significantly reduce our dependence on fossil fuels.

GS 2: POLITY, GOVERNANCE, SOCIAL JUSTICE, INTERNATIONAL RELATIONS/INSTITUTIONS

2. Should voter ID be linked with Aadhaar to combat voter fraud?

Context: On December 29, 2024, the Aam Aadmi Party (AAP) and the Bharatiya Janata Party (BJP) accused each other of manipulating the Delhi electoral rolls to win the Delhi Assembly elections, scheduled to be held in February. While the AAP has accused the BJP of submitting applications to the Election Commission of India (ECI) to get the names of voters removed from the list in its strongholds, the BJP has claimed that the AAP government is aiding Rohingya immigrants to settle in the capital so that it can secure their votes. According to the Election Commission (EC), over 60% of India's 94.5 crore voters have linked their Aadhaar number to their voter IDs.

Key points

- **Overview:** The Election Commission of India has asked the Union government to change the Representation of the People Act, 1950, and voter registration forms. It wants to remove the requirement for voters to give reasons if they choose not to link their Aadhaar number with their voter ID card.
Representation of People Act, 1950 - The 1950 Act provides for allocation of seats and delimitation of constituencies for elections, qualifications of voters, preparation of electoral rolls.
Representation of People Act, 1951 - The 1951 Act regulates the actual conduct of elections and by-elections. It provides for the conduct of elections and offences and disputes related to elections. It also deals with the registration of political parties, the qualifications and disqualifications for membership of the Houses.
- **Status of Aadhaar Linking in India:** Tripura has the highest rate of Aadhaar linking, with over 92% of voters in the state providing their Aadhaar details to the EC. Gujarat has the lowest Aadhaar registration by voters, with only 31.5% of voters linking the document to their voter registration.
- **Government's Push for the linking:**
Update Database - The linking project would help the Election Commission, which conducts regular exercises to maintain an updated and accurate record of the voter base.
Remove Duplication - To weed out duplication of voters, such as migrant workers who may have been registered more than once on the electoral rolls in different constituencies or for persons registered multiple times within the same constituency.
Pan India Voter ID - As per the government, linkage of Aadhaar with voter IDs will assist in ensuring that only one Voter ID is issued per citizen of India.
- **Issues Related:**
Unclear Constitutional Status - In the Puttaswamy case (Right to Privacy), one of the questions that the Supreme Court explored was whether the mandatory linking of Aadhaar with bank accounts was constitutional or not.
Different Purpose - The preference for Aadhaar for the purposes of determining voters is puzzling as Aadhaar is only proof of residence and not proof of citizenship.
- **Conclusion:** Along with pursuing the Aadhaar-Voter ID integration, the government shall also look forward to enacting the Digital Personal Data Protection (DPDP) Bill, 2022. The DPDP regime must also apply to government entities and require them to obtain an individual's explicit consent before sharing their data across various government institutions.

Q. Examine the scope of Fundamental Rights in the light of the latest judgement of the Supreme Court on Right to Privacy.

GS 2: POLITY, GOVERNANCE, SOCIAL JUSTICE, INTERNATIONAL RELATIONS/INSTITUTIONS

3. Iran minister in Delhi for talks to boost ties, trade via Chabahar

Context: Iran's deputy Foreign Minister has reached New Delhi for talks Friday with External Affairs Minister S. Jaishankar and Foreign Secretary Vikram Misri. Iran is looking at increasing bilateral trade with India, including via the Chabahar port. From tourism to agriculture, Tehran wants to boost ties with Delhi and bilateral talks will take place before the Trump administration takes charge on January 20. According to sources Iran would also like to get a sense from Indian officials on dealing with sanctions as India has stopped buying oil from Iran due to the threat of sanctions but has continued to buy oil from Russia despite sanctions.

Key points

- **Overview:** Iranian Foreign Minister's first visit to India this week has many implications for bilateral relations.
- **Significance of the visit:** *Hate speech* - The visit was an opportunity for New Delhi to project that it has successfully assuaged the Islamic world with the actions taken against the spokespersons of the ruling party.
IAEA meet - It also coincides with the meeting of the Board of Governors of the IAEA in Vienna, which has passed strictures against Iran for its nuclear programme.
India's support - For Iran, the visit would be portrayed as a show of support from a powerful country.
Taliban issue - In addition, Iran and India discussed the situation in Afghanistan under the Taliban, just days after an Indian envoy made the first outreach to Kabul.
Chabahar port - India and Iran have discussed further operationalising the Chabahar port, where goods to Afghanistan were sent before the government in Kabul fell last year.
Russian war in Ukraine - Against the backdrop of the Russian war in Ukraine and western sanctions, Iran has been keen to convince New Delhi to restore its crude oil purchases, which it cancelled in 2019, after threats of U.S. sanctions.
- **India-Iran relation:** *Political relation* - India and Iran shared a border till 1947 and share several common features in their language, culture and traditions.
Economic relation - India-Iran economic and commercial ties have traditionally been buoyed by Indian import of Iranian crude oil.
Cultural relation - A MoU was signed in 2008 on holding of "Days of Culture" in two countries.
- **Issues hampering the relations:** *Comments on Prophet* - The comments made in India on the Prophet was criticised by the 57-member Organisation for Islamic Cooperation (OIC). The controversy has overshadowed India's other diplomatic engagements.
Delhi Summit - Also, the promises of India and Iran in the last summit in Delhi left unrealised.
Sanctions - Instead of increasing Indian oil imports, building up the Chabahar rail project and scaling up trade, India has drastically cut its Iranian engagement due to sanctions, while Iran has looked to China for more infrastructure investment.
Bilateral trade - Bilateral trade dropped to just over \$2 billion (2020-21) from \$17 billion (2017-18).
India-Israel ties - Ties appeared to have been hit by New Delhi's decision to join the Israel-India-UAE-U.S. group, portrayed as an "anti-Iran" coalition.

4. Experts on GM crop panels to declare conflict of interest

Context: The Union Ministry of Environment, Forest and Climate Change has amended the rules governing the selection of experts to the Genetic Engineering Appraisal Committee (GEAC), the apex technical body regulating genetically modified (GM) seeds in India. Under the new rules, an “expert member” ought to disclose their “interest” that could conflict with their duties. The expert is also expected to take all steps necessary to ensure that any conflict of interest does not affect any decision of the GEAC. These rules come on the back of a Supreme Court order in July 2023 requiring that the Centre form a national policy on GM crops.

Key points

- **Overview:** The Supreme Court questioned the Centre on why reports of the court-appointed Technical Experts Committee (TEC) on the biosafety of genetically modified (GM) crops were not investigated by the Genetic Engineering Appraisal Committee (GEAC).
- **Genetic Engineering Appraisal Committee (GEAC):** The Genetic Engineering Appraisal Committee (GEAC) is the statutory committee constituted under the “Rules for the Manufacture, Use/Import/Export and Storage of Hazardous Microorganisms/Genetically Engineered Organisms or Cells (Rules, 1989)” framed under Environment (Protection) Act, 1986.
Functions - GEAC is responsible for the approval of activities involving large-scale use of hazardous living microorganisms and recombinants in research and industrial production from an environmental perspective. Clearance of GEAC is mandatory for the environmental release of GM crops.
Composition - GEAC is chaired by the Special Secretary/Additional Secretary of MoEF&CC and co-chaired by a representative from the Department of Biotechnology (DBT). Presently, it has 24 members and meets every month to review the applications in the areas indicated above.
- **Genetically Modified (GM) Plants:** GM plants are plants that have undergone intentional alteration of their genetic material through genetic engineering techniques. These modifications are carried out to introduce specific traits or characteristics that may not naturally occur within the plant’s genome. Example-
 - *Bt Cotton* - *Bacillus thuringiensis* (Bt) cotton is engineered to produce a protein from the bacterium *Bacillus thuringiensis* that is toxic to certain insect pests. The bacteria release specialized proteins referred to as “cry proteins,” which exhibit toxicity towards insects. This trait reduces the need for chemical insecticides and helps protect the cotton crop from damage.
 - *Golden Rice* - Golden rice is modified to produce higher levels of beta-carotene, a precursor of vitamin A. This modification aims to address vitamin A deficiency, a major public health concern in many developing countries.
- **Way Forward:** Genetically modified crops hold promise for addressing some of India’s most pressing agricultural challenges, including food security, climate resilience, and farm incomes. However, their adoption must be carefully managed to avoid potential environmental and socio-economic risks. As India moves forward with its policy on GM crops, it must strike a balance between innovation and caution, ensuring that the benefits of biotechnology are realized while safeguarding public and environmental health.

5. Indian researchers develop injectable hydrogel for targeted cancer treatment

Context: Researchers from the Indian Institute of Technology-Guwahati (IIT-G) and the Bose Institute, Kolkata have developed an advanced injectable hydrogel for localised cancer treatment. A statement issued by the IIT-G said this hydrogel serves as a stable reservoir for anti-cancer drugs, releasing it in a controlled manner while sparing healthy cells from harm. The findings of the research, expected to be revolutionary for breast cancer therapy. This work exemplifies how scientific innovation can address the pressing needs of cancer treatment. The hydrogel's properties allow it to work harmoniously with the biological environment, offering precision.

Key points

- **Hydrogel:** The hydrogel is a three-dimensional polymer network that is water-based. It is designed to absorb and retain fluids, mimicking living tissues. This unique structure makes it suitable for various biomedical applications, particularly in drug delivery systems.
- **Composition of the Hydrogel:** The hydrogel is composed of ultra-short peptides, which are biocompatible and biodegradable protein building blocks. Its formulation ensures that it remains insoluble in biological fluids, allowing it to stay localised at the injection site.
- **Mechanism of Action:** The hydrogel is engineered to respond to elevated levels of glutathione (GSH), a molecule commonly found in tumour cells. When the hydrogel encounters high GSH levels, it triggers a controlled release of the chemotherapy drug directly into the tumour, minimising interaction with healthy tissues and reducing systemic side effects.
- **Efficacy in Preclinical Trials:** In preclinical trials involving a murine model of breast cancer, the hydrogel demonstrated remarkable efficacy. A single injection containing the chemotherapy drug Doxorubicin resulted in approximately 75% reduction in tumour size within just 18 days.
- **Advantages Over Traditional Treatments:** This hydrogel delivery system enhances drug effectiveness while reducing the required dosage, which helps to minimise toxicity. It improves drug uptake by cancer cells, induces cell cycle arrest, and promotes programmed cell death, attacking tumours on multiple fronts.
- **Future Implications of the Research:** The researchers believe this hydrogel could change the landscape of cancer treatment. The ability to deliver drugs precisely to the tumour site while sparing healthy cells may lead to improved patient outcomes and fewer side effects compared to conventional therapies. The innovative approach exemplifies how scientific advancements can address critical healthcare challenges.