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[16–31 December, 2024]

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SUBJECTIVE QUESTIONS

MCQS

WASTE TO WORTH: REUSING TREATED WASTEWATER

Context

- Recently, the Centre for Science and Environment (CSE) has put together a comprehensive report titled 'Waste to Worth', which emphasizes the importance of turning wastewater into a valuable resource rather than pollution.

Problem with Current Practices

- Currently, the discharge of effluent is adding to the water crisis by degrading available water through pollution.
- It also contributes to health crises as societies continue to drink water contaminated with sewage.
- Most cities either do not treat or safely dispose of the bulk of human excreta. It is because toilets are often confused with sanitation.
- Toilets are mere receptacles to receive waste, and when flushed, the waste flows into a piped drain, which may or may not be connected to a sewage treatment plant (STP).

Concerns of Using Waste-Water

- Impact on Soil:** Wastewater irrigation could lead to **temporal and long-term salinization** due to its salts (cations and anions) content. It can cause an adverse impact on soil structure.
 - Wastewater has a relatively high **Sodium Adsorption Ratio (SAR)** in comparison with fresh water. High SAR of irrigation water could have adverse impacts on crops and soil.
- Return Water From Farm Fields:** Since the quality of treated wastewater is dependent on the source of the water, type of usage and the treatment technology, the treated wastewater may still contain some pollutants or contaminants.
 - It has the potential of polluting surface/ground water sources while flowing back from the farm fields.
- Risk of Pathogen Exposure:** There are possibilities of pathogens being present even after treatment of waste water, if disinfection or advanced filtration treatment such as membranes are not part of the treatment system.

- Bio Accumulation:** Heavy metals present in the waste water can accumulate in the environment and enter the food chain.
 - Even at the low concentration levels, long term irrigation can pose risk for the environment and human health.
- Weeds & Mosquitoes:** A rise in weeds is observed in fields using wastewater for agriculture, thereby, increasing the amount of pesticide applied.
 - The practice of storing the wastewater before applying to the fields creates breeding grounds for the disease carrying mosquitoes.

Solutions and Best Practices

- One approach is to use individual septic tanks, which can retain sludge and discharge liquid through a soak pit.
 - However, these tanks need to be constructed well and regularly maintained.
- Another solution is to intercept sewage through tankers for transportation to treatment facilities, rather than relying on capital-intensive underground pipes.

Key Initiatives and Success Stories

- Wastewater Reuse:** The **Union Ministry of Jal Shakti** has mandated that cities must recycle and reuse at least 20% of the water they consume.
 - It aims to promote a circular economy and address freshwater scarcity.
 - Successful examples include cities that have transformed treated wastewater into a valuable resource, meeting urban water needs while alleviating climate-induced water stress.
- Excreta Management:** CSE emphasizes the importance of **connecting the dots between excreta production, pollution, and the opportunity** to reuse and recycle waste.
 - Best practices include the use of septic tanks and sewage treatment plants to safely dispose of and treat excreta.
- Solid Waste Management:** Various cities in India are adopting innovative methods to manage solid waste.

- It includes segregation at source, composting organic waste, and recycling materials like plastics and metals.
- These practices not only reduce landfill burden but also create economic opportunities through the sale of recycled products.
- **Energy from Waste:** Technologies like **anaerobic digestion and waste-to-energy plants** are being used to generate biogas and electricity from organic waste.
- It not only provides a renewable energy source but also reduces greenhouse gas emissions.

Policy and Community Engagement

- Programs like the **Swachh Bharat Mission and Smart Cities Mission** encourage cities to adopt sustainable waste management practices.
- Additionally, community engagement and awareness campaigns are essential to ensure public participation and support for these initiatives.

STUBBLE BURNING

Context

- According to the Indian Agricultural Research Institute (IARI), **Madhya Pradesh** is emerging as a hotspot for stubble burning, surpassing Punjab and Haryana.

About the Stubble Burning in India

- Stubble burning, the practice of setting fire to crop residues after harvest, remains a significant environmental and public health issue in India.
- Predominantly observed in the states of Punjab and Haryana, this practice contributes to severe air pollution, affecting not only the local population but also the air quality in the National Capital Region (NCR), including Delhi.

Causes of Stubble Burning

- The primary reason for stubble burning is the short window between the harvesting of paddy and the sowing of wheat.
- Farmers resort to burning crop residues to quickly clear their fields. The use of combine harvesters,

which leave behind substantial stubble, exacerbates the problem.

- Additionally, the lack of affordable and efficient alternatives for residue management forces farmers to burn the stubble.

Practice and Its Impacts

- Farmers in Punjab and Haryana resort to stubble burning primarily due to economic constraints and the lack of viable alternatives.
 - The high cost of machinery for residue management and the absence of sufficient incentives push farmers to burn the stubble, which is a quick and cost-effective method to clear fields for the next crop cycle.
- The smoke from these fires contains harmful pollutants, including particulate matter (PM2.5 and PM10), carbon monoxide, and volatile organic compounds, which contribute to the formation of ground-level ozone and smog.
 - It not only deteriorates air quality but also poses serious health risks, such as respiratory and cardiovascular diseases.

Government Efforts and Challenges

- The Union Agriculture Minister recently reported a significant decrease in stubble burning incidents, with a 35% reduction in Punjab and a 21% reduction in Haryana compared to the previous year.
- However, the problem is far from resolved, and continuous efforts are required to achieve sustainable solutions.

Innovative Solutions and Future Directions

- These include the promotion of *in-situ residue management techniques, such as the use of Happy Seeders and Super Straw Management Systems*, which allow farmers to sow the next crop without removing the stubble.
- Additionally, ex-situ solutions like converting crop residues into biofuels, compost, and other value-added products are being encouraged.

CLIMATE OBLIGATIONS AND INTERNATIONAL COURT OF JUSTICE (ICJ)

Context

- Recently, the International Court of Justice (ICJ) began public hearings in a case to provide its advisory opinion on the obligations and legal consequences of countries on climate change, and concluded hearings on the obligations of states regarding climate change.

Background and Significance

- The case was spearheaded by small island nations, such as Vanuatu, which are facing existential threats due to rising sea levels and extreme weather events.
- These nations argued that the failure of high-emitting states to meet their climate obligations constitutes an internationally wrongful act.
- Vanuatu's special envoy for climate change emphasized the dire consequences of inaction, stating that the outcome of these proceedings will determine the fate of vulnerable nations and the future of our planet.

Key Questions

- **Obligations of States:** What are the legal obligations of states under international law to ensure the protection of the climate system and other parts of the environment from greenhouse gas emissions?
- **Legal Consequences:** What are the legal consequences for states that fail to meet these obligations, especially for those that have caused significant harm to the climate system?
- **Impact on Vulnerable States:** How do these obligations and consequences affect states that are particularly vulnerable to climate change, such as small island developing states?
- **Rights of Future Generations:** What are the implications for the rights of present and future generations affected by climate change?

Key Arguments

- During the hearings, various countries presented their views on the legal responsibilities of states under international law.

- Brazil highlighted its commitment to reducing emissions despite facing significant challenges like poverty eradication.
- China, on the other hand, urged the ICJ to focus on existing frameworks such as the **Paris Agreement** and avoid creating new legal obligations.
- The **small island developing states (SIDS)**, represented by the **Alliance of Small Island States (AOSIS)**, called for the recognition of maritime zones and statehood even if territories are inundated.
- They stressed the principle of '**Common But Differentiated Responsibilities**' asserting that developed countries bear the greatest burden in addressing the climate crisis.

Potential Impact

- While the ICJ's advisory opinion will be non-binding, it is expected to shape the future of international climate law significantly.
- The proceedings have already brought global attention to the urgent need for stronger climate action and accountability.
- The case underscores the importance of international cooperation in combating climate change and protecting vulnerable communities.

DEEP SEA MINING

Context

- Recently, Norway said it has suspended plans to start giving licences for deep-sea mining in 2025.
- Earlier, Norway's parliament gave approval in January 2024 to allow mining rights in 280,000 sq km, to reduce reliance on countries like China for critical minerals and metals.

About the Deep Sea Mining

- It involves extracting valuable metals and minerals from the seabed, which are crucial for modern technologies such as smartphones, electric vehicles, and renewable energy systems.

Riches of the Deep

- The ocean floor is home to a variety of mineral deposits, including *polymetallic nodules*, *cobalt-rich*

ferromanganese crusts, and massive sulphide deposits. These resources are found in different geological settings:

- **Polymetallic Nodules:** These are potato-sized lumps scattered across the ocean floor, rich in manganese, nickel, cobalt, and copper.
- **Cobalt-Rich Ferromanganese Crusts:** These crusts form on seamounts and ridges, containing high concentrations of cobalt, nickel, and rare earth elements.
- **Massive Sulphide Deposits:** Found around hydrothermal vents, these deposits are rich in copper, gold, zinc, and silver.

Environmental Concerns

- **Habitat Destruction:** Mining operations can destroy habitats and the unique species that inhabit them.
- **Sediment Plumes:** The process of extracting minerals can create plumes of sediment that spread over large areas, affecting marine life.
- **Pollution:** Chemicals used in the mining process can contaminate the water, posing risks to marine organisms.

Regulatory Framework

- The **International Seabed Authority (ISA)**, established under the **United Nations Convention on the Law of the Sea (UNCLOS)**, is responsible for regulating deep sea mining activities.
- The ISA issues licenses for exploration and sets guidelines to ensure that mining is conducted responsibly. However, there is ongoing debate about the adequacy of these regulations and the need for stricter environmental safeguards.

Current Developments

- Several countries and companies have obtained licenses to explore deep sea mineral resources.
- Notable areas of interest include the *Clarion-Clipperton Zone in the Pacific Ocean, the Indian Ocean Ridge, and the Rio Grande Rise in the Atlantic Ocean.* These regions are believed to hold vast quantities of valuable minerals, making them prime targets for future mining operations.

COMPENSATORY AFFORESTATION

Context

- Around 21 gram panchayats in the **Gandhamardan hill region of Odisha** began protests after an Adani Group company acquired some 45 hectares around the villages.
- While the company claims that the land is for **compensatory afforestation**, people fear it would result in **bauxite mining** in the biodiversity-rich region.

About the Compensatory Afforestation

- It is a crucial environmental strategy aimed at mitigating the loss of forest cover due to non-forestry activities such as mining, infrastructure development, and industrial projects.
- It involves planting trees on non-forest land or degraded forest land to compensate for the forest area diverted for these activities.
- The goal is to ensure that the ecological balance is maintained and that the adverse effects of deforestation are minimized.

Process of Compensatory Afforestation

- The process of CA begins when a project proponent identifies land for afforestation and proposes it to the state forest department.
- If the proposal is approved, the project proponent pays for the land, which is then transferred to the forest department.
- The forest department undertakes the plantation work on this land, ensuring that the ecological functions of the lost forest are restored.

Legal Framework

- The **Forest (Conservation) Act, 1980**, is the cornerstone of India's compensatory afforestation policy.
 - It mandates that whenever forest land is diverted for non-forest purposes, the project proponent must provide an equivalent area of non-forest land for afforestation or undertake afforestation on degraded forest land twice the area of the diverted forest.

Implementation and Monitoring

- MoEFCC oversees the implementation of compensatory afforestation. It involves:
- **Identification of Land:** Non-forest land or degraded forest land is identified for afforestation.
- **Preparation of Afforestation Plan:** A detailed plan, including the type of species to be planted, the cost structure, and the timeline, is prepared.
- **Funding:** Funds for afforestation are provided by the project proponent and are managed by the **Compensatory Afforestation Fund Management and Planning Authority (CAMPA)**.
- **Execution and Monitoring:** The afforestation activities are carried out by the state forest departments, and the progress is monitored by both state and central authorities.

Challenges and Concerns

- **Land Availability:** Finding suitable non-forest land for afforestation can be difficult, especially in densely populated regions.
- **Quality of Afforestation:** Ensuring that the afforested land achieves the ecological functions of the original forest is challenging. Often, the newly planted forests do not match the biodiversity and ecological value of the natural forests they replace.
- **Monitoring and Maintenance:** Effective monitoring and maintenance of afforested areas are crucial for the success of CA. However, there are often gaps in these processes, leading to poor survival rates of planted trees.

OIL LEAKAGE

Context

- Recently, thousands of litres of fuel are reported to have been released because of a leak at a Hindustan Petroleum Corporation Ltd (HPCL) depot in Elathur, Kozhikode, Kerala.

About Oil Leakage

- It, often referred to as oil spills, is a significant environmental hazard that has far-reaching consequences for ecosystems, human health, and economies.

- These incidents can occur due to various reasons, including accidents during drilling, transportation mishaps, or operational failures at oil wells.
- One notable example is the Baghjan oil well blowout in Assam, India, which highlighted the severe impacts of such events.

Causes of Oil Leakage

- **Pipeline Failures:** Aging infrastructure, corrosion, and mechanical failures can lead to pipeline ruptures.
- **Operational Errors:** Human errors during maintenance or operational activities can cause accidental spills.
- **Natural Disasters:** Events like floods and cyclones can damage oil storage facilities and pipelines, leading to leaks.

Consequences

- **Environmental Damage:** Oil spills contaminate water bodies, soil, and air. They severely affect marine and terrestrial ecosystems, leading to the death of wildlife and destruction of habitats.
- **Health Hazards:** Exposure to spilled oil and its fumes can cause respiratory problems, skin irritation, and other health issues in humans.
- **Economic Losses:** The cleanup process is costly, and the affected areas often suffer long-term economic setbacks, particularly in industries like fishing and tourism.

Prevention and Mitigation

- **Enhanced Safety Standards:** Implementing and adhering to strict safety regulations during drilling and transportation.
- **Advanced Technology:** Utilizing modern technology for early detection and rapid response to leaks.
- **Emergency Preparedness:** Training personnel and equipping them with the necessary tools to handle emergencies effectively.

Mitigation Measures

- **Regular Inspections and Maintenance:** Ensuring pipelines and storage facilities are regularly inspected and maintained to prevent leaks.

- **Emergency Response Plans:** Developing and implementing effective emergency response plans to quickly address spills and minimize their impact.
- **Technological Innovations:** Using advanced technologies for leak detection and containment to reduce the risk and impact of oil spills.

FOREST FIRE

Context

- Recently, Kullu region in Himachal Pradesh was hit by multiple fire incidents, with flames engulfing nearly 100 hectares.
- The fires are reported to be a result of a three-month-long drought in Kullu, leaving the forest regions dry.

About the Forest Fire

- Forest fires, also known as wildfires, are uncontrolled fires that spread rapidly through vegetation, often causing significant environmental, economic, and social impacts.
- These fires can be triggered by natural causes such as lightning or human activities like unattended campfires, agricultural burning, and arson.

Causes and Consequences

- **Natural Causes:** Lightning strikes are a common natural cause of forest fires. In some ecosystems, such as the boreal forests of North America, lightning-induced fires play a crucial role in maintaining ecological balance by clearing old vegetation and promoting new growth.
- **Human Activities:** According to the **Forest Survey of India (FSI)**, around 95% of forest fires are caused by human activities. These include:
 - **Slash-and-Burn Agriculture:** Commonly practiced in the northeastern states, this method involves clearing land by burning vegetation, which can lead to uncontrolled fires.
 - **Negligence:** Careless disposal of cigarettes, campfires, and agricultural residue burning are significant contributors.
 - **Deliberate Acts:** In some cases, fires are set intentionally for land clearing or poaching.

- **Climate Change:** Rising global temperatures and prolonged droughts have increased the frequency and intensity of forest fires.
 - Warmer temperatures dry out vegetation, making it more susceptible to ignition.
 - Climate change also extends the fire season, leading to more prolonged and severe fire events.

Environmental Impact

- **Loss of Biodiversity:** Fires can destroy habitats, leading to the loss of plant and animal species. Some species may take years to recover, while others may be lost forever.
- **Air Quality:** Smoke from forest fires contains harmful pollutants, including particulate matter and carbon monoxide, which can affect air quality and human health.
- **Carbon Emissions:** Forest fires release significant amounts of carbon dioxide, contributing to global warming. The loss of forests also reduces the planet's capacity to absorb carbon dioxide, exacerbating climate change.

Socio-Economic Impact

- **Property Damage:** Fires can destroy homes, infrastructure, and agricultural land, leading to substantial economic losses.
- **Health Risks:** Exposure to smoke and pollutants from forest fires can cause respiratory problems, cardiovascular diseases, and other health issues.
- **Displacement:** Communities living in fire-prone areas may be forced to evacuate, leading to temporary or permanent displacement.

Mitigation and Management

- **Prevention:** Public awareness campaigns, strict enforcement of fire regulations, and the use of firebreaks can help prevent the occurrence of forest fires.
- **Preparedness:** Developing early warning systems, conducting regular fire drills, and training firefighters are essential for preparedness.
- **Response:** Rapid response teams equipped with modern firefighting tools and technologies are crucial for controlling and extinguishing fires.

International cooperation and resource sharing can also enhance firefighting efforts.

Mitigation Measures

- **Forest Fire Alert System:** The Forest Survey of India has developed the **Forest Fire Alert System (FAST) 3.0**, which uses satellite data to provide near-real-time alerts to state forest departments and other stakeholders.
- **Community Involvement:** Engaging local communities in fire prevention and control activities is crucial. Awareness campaigns and training programs help in educating people about the risks and prevention methods.
- **Policy and Legislation:** Strengthening forest laws and policies to penalize negligent and deliberate fire-setting activities is essential. MoEFCC plays a pivotal role in this regard.
- **Technological Interventions:** The use of drones, remote sensing, and Geographic Information Systems (GIS) for monitoring and managing forest fires is being increasingly adopted.

ILLEGAL RIVERBED MINING IN KASHMIR

Context

- Once a lifeline for households in the district, the **Doodh Ganga river in Budgam district, Jammu and Kashmir**, remains in a dire state even two years after the National Green Tribunal's blanket ban on riverbed mining.

Scope of the Problem

- Illegal riverbed mining involves the unauthorized extraction of sand, gravel, and other materials from riverbeds. It is rampant across many parts of India, including states like Uttar Pradesh, Haryana, and Jammu & Kashmir.
- The demand for construction materials has driven this illegal activity, often carried out with heavy machinery, leading to severe ecological and social consequences.

Environmental Impact

- **Ecosystem Disruption:** The extraction of riverbed materials disrupts the natural flow of rivers, leading

to erosion, altered river courses, and loss of habitat for aquatic life.

- For instance, in the **Sukhnag River in Kashmir**, illegal mining has caused significant damage to the river's flora and fauna, including the death of thousands of trout.
- **Water Quality Degradation:** Mining activities increase the turbidity of river water, affecting its quality and making it unsuitable for drinking and irrigation.
 - The increased sediment load can also harm aquatic plants and animals.
- **Biodiversity Loss:** The destruction of riverbeds impacts the biodiversity of the region.
 - Many species of fish and other aquatic organisms are directly affected by the loss of habitat and changes in water quality.

Social and Economic Consequences

- **Livelihoods at Risk:** Local communities that depend on rivers for their livelihoods, such as fishing and agriculture, are severely affected.
 - The decline in fish populations and the degradation of agricultural land due to mining activities threaten their economic stability.
- **Health Hazards:** The increased dust and pollution from mining operations pose health risks to nearby communities.
 - Respiratory problems and other health issues are common in areas affected by illegal mining.
- **Corruption and Violence:** The illegal mining industry is often linked with corruption and violence.
 - There are numerous reports of clashes between miners and local communities, as well as between different mining factions.

Legal and Regulatory Framework

- The National Green Tribunal (NGT) and the Supreme Court of India have issued several directives to curb illegal mining, but implementation on the ground is often lacking.

Steps Forward

- **Strengthening Enforcement:** There is a need for stronger enforcement of existing laws and regulations.
 - It includes regular monitoring of riverbeds, strict penalties for violators, and the use of technology to track illegal activities.
- **Community Involvement:** Empowering local communities to participate in monitoring and reporting illegal mining activities can be an effective strategy.
 - These can help in the sustainable management of river resources.
- **Sustainable Alternatives:** Promoting the use of alternative materials for construction and encouraging sustainable mining practices can reduce the pressure on riverbeds.
 - Research and development in this area are essential for long-term solutions.
- **Awareness and Education:** Raising awareness about the environmental and social impacts of illegal riverbed mining is crucial.
 - Educational campaigns can help in building public support for conservation efforts.

CHEMICAL POLLUTION AND IMPACT ON HUMAN

Context

- Chemical pollution is the most underrated and underreported risk of the 21st century that threatens all species and regions.

About

- Chemical pollution is a pressing environmental issue that poses significant risks to human health and ecosystems. It involves the release of harmful chemicals into the environment, which can originate from various sources such as industrial activities, agricultural practices, and household products.

Causes of Chemical Pollution

- **Industrial Activities:** Factories and manufacturing plants release a variety of pollutants, including heavy

metals, solvents, and toxic by-products, into the air, water, and soil.

- **Agricultural Practices:** The use of pesticides, herbicides, and fertilizers in agriculture contributes to chemical runoff into water bodies, affecting both aquatic life and human populations.
- **Household Products:** Everyday items such as cleaning agents, paints, and personal care products contain chemicals that can pollute indoor and outdoor environments.

Key Pollutants

- **BENZENE**
 - *Source:* Paints, industrial solvents
 - *Risk:* Impacts muscles, increases risk of leukaemia, blood disorders
- **MERCURY**
 - *Source:* Used in dental fillings, gold mining, ayurvedic medicines, battery
 - *Risk:* Toxic effects on the nervous, digestive and immune systems, on lungs, kidneys, heart, skin, eyes
- **PHENOLS (Phenols: Oxybenzone, Hydroquinone, Coal-tar dyes, Benzophenones)**
 - *Source:* In cosmetics as disinfectant, antiseptic
 - *Risk:* Endocrine disruptors
- **ORGANOCHLORINE PESTICIDES**
 - *Source:* Contaminated food, meat, dairy products
 - *Risk:* May damage the liver, kidney, central nervous system, thyroid and bladder; delayed development, may also cause cancer
- **DIOXINS (Polychlorinated Dibenzo-p-dioxins, Dibenzofurans), POLYCHLORINATED BIPHENYLS**
 - *Source:* Waste burning, contaminated food, such as fish, meat, dairy products
 - *Risk:* Can damage the immune system, cause reproductive and developmental problems, cancer

- **ASPARTAME**
 - *Source:* Sugar substitute used in soft drinks, desserts, ice creams,
 - *Risk:* Potentially carcinogenic
- **HEAVY METALS**
 - *Source:* Polluted food and water, cosmetics
 - *Risk:* Can cause brain damage, kidney and liver failure
- **PARABENS**
 - *Source:* Used as preservatives in cosmetics, foods, drugs
 - *Risk:* Endocrine disruptors
- **PHthalates/BISPHENOL A (BPA)**
 - *Source:* Food packaging, plastic packaging, toys
 - *Risk:* Endocrine disruptors, developmental problems
- **ACRYLATE**
 - *Source:* Industrial solvents used in cosmetics, paints, adhesive
 - *Risk:* Irritants for the skin, eyes and respiratory tract
- **OPFR (Organophosphate Flame Retardants)**
 - *Source:* Used in textiles, building materials, electronics, furniture since they are heat/fire resistant
 - *Risk:* Neurotoxic, developmental toxicity, damage to the reproductive organs, endocrine disruption, carcinogenic
- **PFAS (Per- and polyfluoroalkyl substances)**
 - *Source:* Air, food, water. These are used in packaging, cookware, clothes, furniture to make them non-sticky
 - *Risk:* liver damage, thyroid disease, obesity, fertility issues, cancer
- **ASBESTOS**
 - *Source:* Used in building materials, textile as it is fire resistant
 - *Risk:* Asbestosis, skin ailments, ovarian disorders, mesothelioma, lung cancer

Global Efforts

International Agreements and Conventions:

- **Stockholm Convention:** It aims to eliminate or restrict the production and use of **persistent organic pollutants (POPs)**, which are chemicals that remain in the environment for long periods, accumulate in living organisms, and pose risks to human health and the environment.
- **Rotterdam Convention:** It promotes shared responsibilities in relation to the importation of hazardous chemicals. It ensures that countries are informed about the risks associated with these chemicals and can make informed decisions about their importation.
- **Minamata Convention:** Focused on reducing mercury pollution, this convention addresses the entire lifecycle of mercury, including its mining, trade, use in products and processes, emissions, and disposal.

Regional Initiatives:

- **European Union (EU):** The EU has implemented the *REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals)* regulation, which requires companies to identify and manage the risks linked to the substances they manufacture and market in the EU.

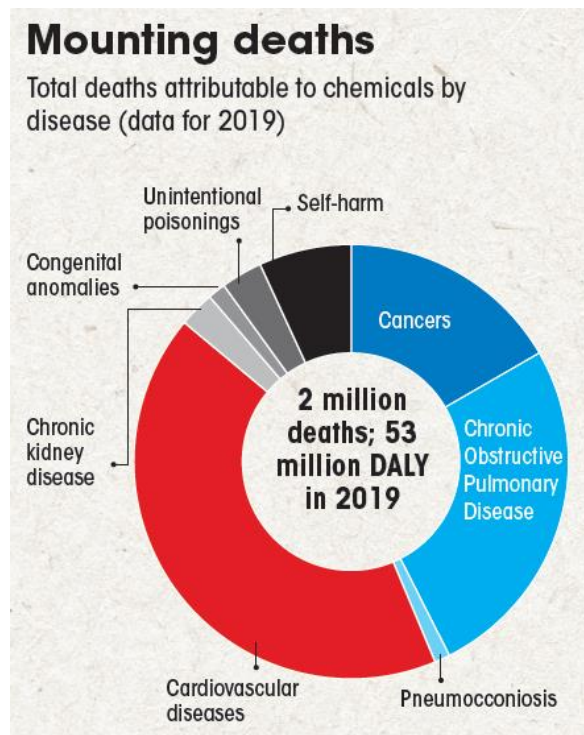
India's Efforts

- **Environment Protection Act, 1986:** It provides the framework for the protection and improvement of the environment. It empowers the central government to take measures to protect and improve environmental quality and control pollution.
- **Manufacture, Storage, and Import of Hazardous Chemicals Rules, 1989:** These rules regulate the handling of hazardous chemicals to prevent accidents and ensure safety in industrial operations.
- **National Green Tribunal (NGT):** It plays a pivotal role in adjudicating environmental cases and enforcing legal rights related to the environment.
- **Chemical Accidents (Emergency Planning, Preparedness, and Response) Rules, 1996:** These rules aim to prevent and mitigate chemical accidents through proper planning and preparedness.
- **Corporate Responsibility:** Indian industries are increasingly adopting sustainable practices and

technologies to reduce chemical emissions and waste. Companies are also engaging in corporate social responsibility (CSR) initiatives to support environmental conservation.

CHEMICALS BEING INVENTED, RELEASED TOO RAPIDLY FOR SCIENTISTS TO TRACK'

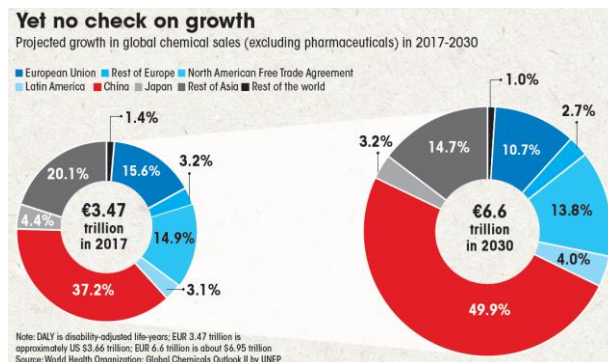
Context



- According to a report by **Planet Tracker**, since 2010, approximately 125 million tonnes of chemicals have been released from petrochemical facilities in **Europe’s trilateral chemical region—Belgium, Germany and the Netherlands.**

About

- The release of such vast quantities of chemicals has resulted in the loss of 24,640 years of healthy life and has potentially affected billions of species within ecosystems.
- Despite these severe impacts, the health consequences of petrochemical pollution often do not receive the attention they deserve.
- Local communities may remain unaware of the toxic chemicals being released in their vicinity, and even when data is reported, it often arrives too late to prompt timely action.



Challenges in Regulation

- Regulating the petrochemical industry is fraught with challenges. Economically, the sector is vital for many countries, providing significant employment and tax revenues.
- It gives the industry considerable influence over regulatory policies.
- Politically, there is a delicate balance to be struck between protecting public health and maintaining economic stability.
- Stricter regulations are often met with resistance from the industry, which argues that high regulatory costs could make them uncompetitive compared to regions with more lenient standards.

Need for Greater Transparency

- Currently, exemptions and claims of commercial sensitivity allow corporations to conceal their activities, making it difficult for regulators, communities, and investors to fully understand the impact of chemical releases.
- Enhanced transparency would enable more informed decision-making and foster greater accountability within the industry.

RIVER POLLUTION

Context

- According to the **Central Water Commission (CWC)**, as many as 81 rivers and tributaries of India have extremely high concentrations of one or more trace and toxic heavy metals.
- The heavy metals detected beyond safe limits included **arsenic, cadmium, chromium, copper, iron, lead, mercury and nickel.**

About The River Pollution

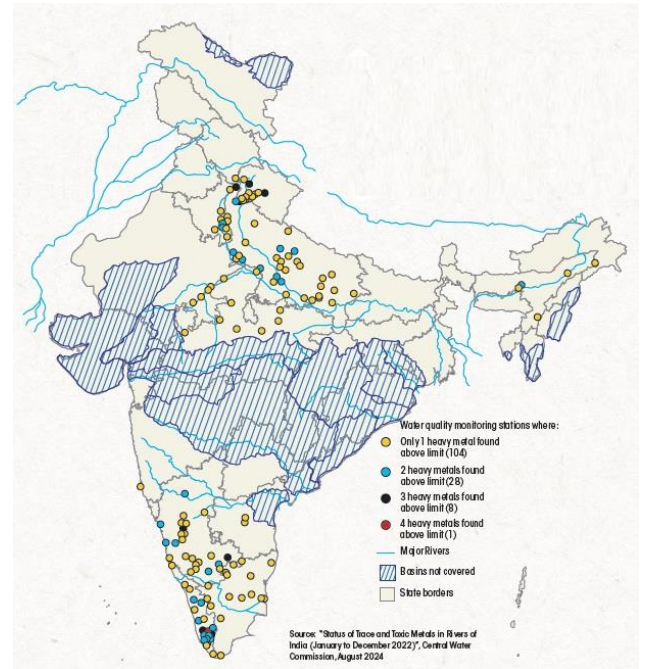
- It remains a significant environmental issue in India, affecting both major and minor rivers.
- Despite numerous efforts and substantial investments, the problem persists, posing serious threats to ecosystems, public health, and livelihoods.

Current State of River Pollution

- According to a report by the **Central Pollution Control Board (CPCB)**, nearly 46% of India’s 603 rivers are polluted.
- Major rivers like the Ganges and Yamuna often grab headlines, but smaller rivers and tributaries are equally affected.
- The focus on cleaning major rivers has overshadowed the need to address pollution in smaller water bodies, which eventually feed into larger rivers, exacerbating the problem.

Causes of River Pollution

- **Industrial Discharge:** Industries along riverbanks discharge untreated or inadequately treated effluents into rivers. This includes heavy metals, chemicals, and other toxic substances that degrade water quality and harm aquatic life.
- **Sewage and Domestic Waste:** Urbanization has led to increased sewage and domestic waste being dumped into rivers. Many cities lack adequate sewage treatment facilities, resulting in untreated waste entering water bodies.
- **Agricultural Runoff:** The use of fertilizers and pesticides in agriculture leads to runoff that carries these chemicals into rivers, causing nutrient pollution and eutrophication.
- **Solid Waste:** Improper disposal of solid waste, including plastics, contributes to river pollution. This waste clogs waterways and harms wildlife.



Impact on Health and Environment

- Polluted rivers pose severe health risks to communities relying on them for drinking water, bathing, and irrigation.
- Waterborne diseases such as cholera, dysentery, and hepatitis are prevalent in areas with polluted water sources.
- Additionally, the contamination of fish and other aquatic life affects food safety and biodiversity.

Measures to Combat River Pollution

- **National River Conservation Plan (NRCP):** The NRCP aims to reduce pollution in identified stretches of rivers across India. It includes projects for sewage treatment, riverfront development, and public awareness campaigns.
- **Namami Gange Programme:** It focuses on the rejuvenation of the Ganga River and its tributaries. It includes projects for sewage treatment, river surface cleaning, and rural sanitation.
- **Regulatory Framework:** The CPCB, in collaboration with State Pollution Control Boards (SPCBs), monitors water quality and enforces regulations to control pollution from industrial and domestic sources.
- **Community Participation:** Engaging local communities in river conservation efforts is crucial. Public awareness campaigns and community-led

initiatives play a significant role in reducing pollution.

Case Study: Hindon River

- The **Hindon River, a tributary of the Yamuna**, exemplifies the challenges of river pollution.
- Decades of industrial discharge and sewage dumping have turned it into a toxic waterway. Efforts to clean the Hindon have been sporadic and largely ineffective, leading to a public health crisis in the surrounding areas.

PESTICIDE REGULATION

Context

- Recently, Delhi-based Impact and Policy Research Institute, spoke about the need for a global framework to address challenges faced in research and trade of pesticides.

About

- Pesticides are designed to cause harm, merely on contact, unlike other chemicals, which might lead to problems when inhaled or consumed.
- Though they are sprayed on the crop or on the pest, **at least 97 to 99% goes into non-target areas and into the environment.**
- Apart from that, most pesticides are systemic poison, causing problems once they enter the human body or biodiversity.
- They kill the enzymes or inhibit some of the body functions, which is another feature of pesticides.

Global Perspective on Pesticide Regulation

- National laws and international treaties, such as the **Rotterdam and Stockholm Conventions**, aim to manage the use of hazardous chemicals.
 - However, these frameworks often fall short in addressing the full scope of the problem.
- The **Global Framework on Chemicals**, adopted in 2023, advocates for stronger governance mechanisms and international standards to protect human health and the environment.
 - Despite these efforts, the harmful impacts of pesticides on biodiversity, such as the decline of

honeybees and aquatic life, continue to be a significant concern.

Pesticide Regulation in India

- The country is under pressure to harmonize its regulations with international standards, particularly those of the United States.
- This pressure often leads to the approval of pesticides without adequate local testing, posing risks to both human health and the environment.
- The Supreme Court of India has questioned the government on the multiple committees reviewing pesticide bans, highlighting the need for a more streamlined and effective regulatory process.
 - Additionally, reports indicate the unauthorized use of highly hazardous pesticides, further complicating the regulatory landscape.

Need for Stronger Regulations

- **Comprehensive Testing:** Pesticides should undergo rigorous testing for safety and efficacy before approval.
- **International Collaboration:** Countries should work together to develop and enforce global standards for pesticide use.
- **Public Awareness:** Educating farmers and the public about the risks associated with pesticide use and promoting safer alternatives.
- **Accountability and Liability:** Establishing clear accountability mechanisms to ensure that manufacturers and users of pesticides are held responsible for any harm caused.

ONE NATION ONE SUBSCRIPTION

Context

- ‘One Nation One Subscription (ONOS)’ initiative set to begin on January 1, 2025, has sparked significant debate regarding its potential benefits and drawbacks.

About the ‘One Nation One Subscription (ONOS)’ Initiative

- It is designed to provide access to scholarly research articles in 13,000 journals published by 30 of the

biggest names in the global scientific publishing industry.

- It is expected to benefit approximately 18 million students and researchers across 6,300 government universities, colleges, research organizations, and Institutions of National Importance.

Financial Implications

- India has agreed to pay a single subscription fee of \$715 million (approximately ₹6,000 crore) for a three-year period.
- It is intended to reduce costs by eliminating the need for individual institutions to negotiate separate deals with publishers.
 - However, the high cost of this subscription has raised concerns about its financial sustainability and the potential for better allocation of resources.

Benefits of ONOS

- **Wider Access:** ONOS aims to provide equitable access to scientific knowledge, which could spur innovation and research across the country.
- **Cost Reduction:** By negotiating a single deal, the government hopes to reduce the overall expenditure on journal subscriptions.
- **Resource Optimization:** The initiative is expected to eliminate duplication and waste of resources through overlapping subscriptions.

Challenges and Criticisms

- **High Cost:** The \$715 million price tag is seen by some as excessive, especially given the declining budgets of many universities and research institutions.
- **Global Trends:** Critics point out that many top universities in wealthier nations, particularly in the US, are moving away from such deals in favor of open access models that promote free sharing of research.
- **Implementation Hurdles:** Ensuring seamless access to these journals across thousands of institutions may pose significant logistical challenges.

PERSISTENT HUNGER IN UNITED STATES

Context

- According to the World Health Organisation (WHO), one in seven households in the country — 47.4 million people, including 13.8 million children — experienced food insecurity in the United States.

Reasons

- **Systemic Inequality:** It is a significant driver of hunger in the US. Economic disparities mean that many people, especially those from marginalized communities, do not have sufficient income to afford adequate food.
 - It is often exacerbated by racial and ethnic disparities, with Black and Latino households being twice as likely to experience food insecurity compared to their white counterparts.
- **Low-Wage Jobs and Underemployment:** A substantial portion of the American workforce is employed in low-wage jobs that do not provide enough income to cover basic living expenses, including food.
 - Underemployment, where individuals work part-time or in jobs that do not match their skills, also contributes to financial instability and food insecurity.
- **High Cost of Living:** The high cost of living in many parts of the US, particularly in urban areas, means that even those with jobs may struggle to afford food.
 - Housing, healthcare, and education expenses often take precedence, leaving little for food budgets.
- **Inadequate Social Safety Nets:** While the US has various welfare programs aimed at reducing poverty and hunger, these programs often fall short.
 - The expiration of expanded social programs and benefits, such as those introduced during the COVID-19 pandemic, has worsened food insecurity for many families.
- **Inflation and Economic Instability:** Recent economic challenges, including inflation, have increased the cost of food, making it harder for low-income families to afford nutritious meals.

- Economic instability also affects employment opportunities and wages, further exacerbating hunger.
- **Geographic Disparities:** Hunger is not evenly distributed across the US. Certain regions, particularly in the South, experience higher rates of food insecurity due to a combination of poverty, lack of access to resources, and inadequate state programs.
- **Health and Education:** Poor health and lack of education are both causes and consequences of hunger. Food-insecure individuals often face health issues that can limit their ability to work, while lack of education can restrict job opportunities and earning potential.

Prelims

BANNING THE EXPORT OF CERTAIN RARE MINERALS BY CHINA

Context

- Recently, China announced that it was banning the export of certain rare minerals to the US, a day after the latter placed export controls on Beijing.

About the Rare Minerals

- Introduction Rare minerals, often referred to as rare earth elements (REEs), are a group of 17 chemically similar elements crucial for various high-tech applications.
- These minerals are essential for the production of electronics, renewable energy technologies, and advanced defense systems.
- China controls a substantial portion of the world's supply of these materials, which are essential for various high-tech applications.

Implications for Global Supply Chains

- The list of banned minerals includes gallium, cadmium and antimony, which are used for a range of industrial applications including battery and solar panel manufacturing.
- The ban on these minerals is expected to **disrupt global supply chains** significantly.

- **Gallium and germanium** are vital for semiconductor production, while antimony is used in military explosives.
- Superhard materials, including synthetic diamonds and tungsten, are critical for industries such as cutting tools and protective coatings.

Strategic Responses

- Countries heavily reliant on these minerals, such as the United States, India, and European Union nations, are now exploring alternative sources and strategies to mitigate the impact.
- It includes increasing domestic production, diversifying supply chains, and investing in recycling technologies.

SVALBARD GLOBAL SEED VAULT

Context

- Recently, African countries including Sudan, Chad and Tanzania announced that they would deposit samples of seed varieties to the Svalbard Global Seed Vault.

About the Svalbard Global Seed Vault

- It is a critical facility located on the **Norwegian island of Spitsbergen** in the remote Arctic **Svalbard archipelago**.
- This secure backup facility is designed to preserve the genetic diversity of the world's crops, ensuring that humanity has a safeguard against potential agricultural catastrophes.
- It is often referred to as the **'Doomsday Vault'**.

Purpose and Importance

- To provide a safety net for the world's seed banks.
- It stores duplicates of seed samples from gene banks worldwide, protecting them from natural or man-made disasters.
- It is crucial as it helps maintain biodiversity, which is essential for food security and adapting to changing climate conditions.

Structure and Storage

- The vault is built into a mountainside and is designed to withstand both natural and human-made disasters.
- It maintains a constant temperature of -18 degrees Celsius, which is ideal for preserving seeds for long periods.
- The seeds are stored in special metallic pouches that keep them dry and are placed in three ice-covered caverns inside the vault.

RING-TAILED LEMURS, BROWN LEMURS, SPIDER TORTOISES

Context

- Recently, Thailand said it would return almost 963 ring-tailed lemurs, brown lemurs, spider tortoises and radiated tortoises to Madagascar, in what both countries call their biggest ever operation against wildlife trafficking.

Ring-Tailed Lemurs (aka Lemur Catta)

- They are **endemic to Madagascar**, inhabit the dry forests, spiny bush, and rocky areas of southern and southwestern Madagascar.
- They are highly adaptable and can be found in gallery forests and montane regions.
 - Madagascar's forests are rapidly disappearing due to slash-and-burn agriculture, charcoal production, and logging.
- **IUCN Red List: Endangered** (due to habitat loss, hunting, and the illegal pet trade).

Brown Lemurs (Eulemur Fulvus)

- They are fascinating primates **native to Madagascar**, inhabit the **tropical and subtropical forests** of Madagascar.
- **IUCN Red List: Vulnerable** (due to slash-and-burn agriculture, illegal logging, and hunting).

Spider Tortoises (Pyxis Arachnoides)

- They are **endemic** to dry, spiny forests in southwestern coastal regions of **Madagascar**, an area characterized by sandy soils and sparse vegetation. They are among the smallest tortoises in the world.
- **IUCN Red List: Critically Endangered**

GENETICALLY MODIFIED (GM) MAIZE

Context

- A study in Kerala found genetically modified (GM) maize in 15% of 34 samples, which is illegal in India.

Promise of GM Maize

- **Increased Yield:** GM maize is engineered to be resistant to pests and diseases, which can significantly increase crop yields.
 - It is particularly beneficial for farmers in regions prone to pest infestations.
- **Reduced Pesticide Use:** By incorporating genes that make the maize resistant to specific pests, the need for chemical pesticides is reduced, leading to lower production costs and less environmental pollution.
- **Nutritional Enhancement:** Some GM maize varieties are designed to have higher nutritional value, addressing malnutrition issues in developing countries.

Concerns and Risks

- **Biosafety Risks:** Studies have shown that GM maize can have unintended effects on non-target organisms and biodiversity.
 - There is the risk of gene transfer to non-GM crops, which can lead to contamination.
- **Regulatory Challenges:** In India, the cultivation and sale of GM maize are tightly regulated.
 - However, recent studies have detected illegal GM maize in processed and unprocessed food products, highlighting lapses in regulatory enforcement.
- **Economic Impact on Farmers:** Critics argue that GM maize can lead to increased dependency on multinational seed companies, which can be economically detrimental to small-scale farmers.

Current Status in India

- In India, the debate over GM maize is ongoing. While field trials are being conducted by several multinational companies, the commercial cultivation of GM maize has not yet been approved.

- The Food Safety and Standards Authority of India (FSSAI) has mandated a GM-free certification for certain food imports, reflecting the cautious approach of Indian regulators.

FOREVER CHEMICALS

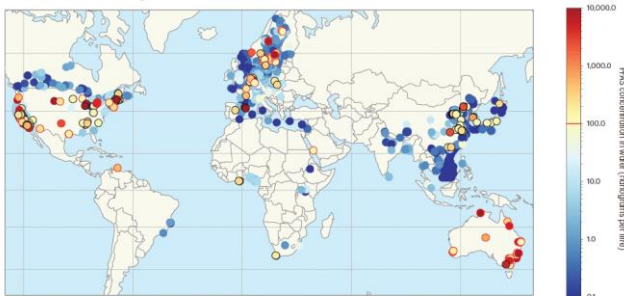
Context

- A paper in Nature Geoscience looks at global presence of PFAS and finds that 31% of the groundwater samples had the chemical present in levels considered harmful to human health.

About

- **Forever chemicals**, scientifically known as **per- and polyfluoroalkyl substances (PFAS)**, are a group of synthetic chemicals that have been widely used in various industrial and consumer products due to their resistance to water, oil, and heat.
- These chemicals are found in items such as non-stick cookware, water-repellent clothing, stain-resistant fabrics, and firefighting foams.
- Some 14,000 chemicals have been classified as PFAS so far.
- However, their persistence in the environment and potential health risks have raised significant concerns globally.

Global map of PFAS concentration in water



Source: 'Underestimated burden of per- and polyfluoroalkyl substances in global surface waters and groundwaters', Nature Geoscience April 2024

Health Risks

- Chronic exposure to PFAS has been linked to a host of health issues, including cancer, liver damage, thyroid disease, and reduced immune responses.
- They have also been associated with low birth weights and several kinds of cancer.
- PFAS are pervasive in the environment and have been detected in soil, dust, and drinking water around the world.

- Studies suggest they're in 98% of Americans' bodies.

Environmental Impact

- PFAS have been found in rainwater and snow in even the most remote locations on our planet.
- They can accumulate in plants and animals as they move through the food chain, so they may end up in the foods we eat including milk and eggs.
- For instance, research from 2014 and 2019 showed traces of PFAS were still present in most rivers, lakes and groundwater in the UK.

Related Efforts

- Scientists are working on methods to capture these synthetic chemicals and destroy them, but it isn't simple.
- The latest breakthrough, published in the journal Science, shows how one class of PFAS can be broken down into mostly harmless components using **sodium hydroxide, or lye**, an inexpensive compound used in soap.
- The **National Green Tribunal (NGT)** has recently directed MoEF&CC and the Central Pollution Control Board (CPCB) to establish standards for PFAS in water to protect public health.

GLOBAL PLASTICS TREATY

Context

- Recently, more than 170 countries converged in Busan to negotiate a new legally binding global treaty to end plastic pollution, including marine pollution.

About the Global Plastics Treaty

- It seeks to establish legally binding commitments to reduce plastic production, eliminate harmful uses, and promote recycling, which has been under negotiation since 2022.

Need for a Global Plastics Treaty

- Plastic pollution has become a global environmental crisis, affecting marine life, human health, and ecosystems.

- Countries like Brazil, China, India, and the United States are responsible for a significant portion of global plastic waste.
- The treaty aims to address this by setting clear targets and timelines for reducing plastic waste and promoting sustainable alternatives.

Key Challenges and Negotiations

- Despite the urgency, reaching a consensus has been challenging. Economic interests, particularly from oil-producing and refining countries like Saudi Arabia, the United States, Russia, India, and Iran, have created hurdles.
 - These nations are reluctant to commit to hard deadlines for eliminating plastic production due to the economic implications.
- A coalition of African countries, supported by several European nations, advocates for a timeline around 2040 to ensure a gradual reduction in plastic production.
 - However, there is also debate on whether decisions should be made by consensus or voting, with the former giving every country a veto.

India's Stance

- India, while supportive of the treaty's goals, emphasizes the need for a balanced approach.
- India advocates for addressing the availability, accessibility, and affordability of alternatives, along with capacity building, technology transfer, and financial assistance.
 - It aligns with the principle of 'common but differentiated responsibility' which suggests that while all countries should work towards a common goal, those with more resources should take on stricter targets and support others.

Subjective Questions

1. Discuss the potential benefits and challenges of reusing treated wastewater in a developing nation, focusing on the social, economic, and environmental implications.
2. Critically analyze the effectiveness of Compensatory Afforestation Fund Act (CAMPA) in achieving its

objectives of ecological restoration and biodiversity conservation in India.

3. Critically analyze the socio-economic and environmental consequences of illegal riverbed mining, focusing on the impact on local communities and the long-term sustainability of river ecosystems.
4. Discuss the multifaceted impact of chemical pollution on human health, considering both acute and chronic effects, and explore potential mitigation strategies to minimize these adverse consequences.
5. Critically analyze the potential benefits and drawbacks of the 'One Nation One Subscription' policy for both consumers and broadcasters in India. Discuss the ethical considerations and potential policy adjustments that could improve its implementation.

MCQs

1. Recently, the *Clarion-Clipperton Zone* was in news, is located in:
 - (a) Indian Ocean
 - (b) Pacific Ocean
 - (c) Atlantic Ocean
 - (d) Arctic Circle
2. Rivers like *Doodh Ganga and Sukhnag*, sometimes appeared in news, are located in which of the following Indian States/Union Territories?
 - (a) Uttarakhand
 - (b) Punjab
 - (c) Jammu & Kashmir
 - (d) Himanchal Pradesh
3. *Phthalates*, a chemical pollutant acting like endocrine disruptor, is primarily sourced from:
 - (a) Paints and industrial solvents
 - (b) Building materials and electronics
 - (c) Meat and dairy products
 - (d) Food and plastic packaging
4. Consider the following countries:
 1. Belgium
 2. Italy
 3. Germany

4. United Kingdom
5. Netherlands
6. France

Which of the above countries are part of Europe's trilateral chemical region?

- (a) 1, 3 and 5 only
- (b) 1, 2, 3 and 5 only
- (c) 1, 2, 3 and 4 only
- (d) 2, 3 and 5 only

5. With reference to the *Svalbard Global Seed Vault*, consider the following statements:

1. It is located on the Norwegian island of Spitsbergen.
2. It is designed to preserve the genetic diversity of the world's crops.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

6. Consider the following pairs:

<i>Species</i>	<i>IUCN Red List</i>
1. Ring-Tailed Lemurs	Endangered
2. Brown Lemurs	Vulnerable
3. Spider Tortoises	Critically Endangered

How many of the above *is / are* correctly matched?

- (a) Only one pair
- (b) Only two pairs
- (c) All three pairs
- (d) None of the above

Answer Keys: 1 (b) 2. (c) 3. (d) 4. (a) 5. (c) 6. (c)

