ANSWERS & EXPLANATIONS
GENERAL STUDIES (P) TEST – 4143 (2024)

Q 1.C

Botanical Survey of India

- **It is the apex research organization under the Ministry of Environment and Forests (MoEFCC) for carrying out taxonomic and floristic studies** on wild plant resources of the country. **Hence statement 1 is correct.**
- **It was established in 1890 during the tenure of Lord Landsdowne and** the **headquarter is located in Kolkata, West Bengal. Hence statement 2 is correct.**
- **Functions:**
  - Exploration, inventorying and documentation of phytodiversity in general and protected areas, hotspots and fragile ecosystems in particular.
  - Publication of National, State and District Floras.
  - **Identification of threatened and red list species and those in rich areas needing conservation and ex-situ conservation of critically threatened species in botanical gardens. Hence statement 3 is correct.**
  - Survey and documentation of traditional knowledge (ethno-botany) associated with plants.
  - Develop National database of Indian plants, including herbarium and live specimens, botanical paintings and illustrations, etc.

Q 2.C

Natural Heritage Sites in India

- Natural Heritage Sites in India, like India's Sundarbans, Western Ghats, and Kaziranga National Park, are vital ecosystems recognised by UNESCO. These sites conserve unique biodiversity, landscapes, and habitats. They are a global asset, contributing to scientific research and environmental balance.
- Three types of sites: Cultural, natural and mixed.

Here's a list of the Natural Heritage sites in India, sourced from UNESCO.

- Great Himalayan National Park Conservation Area (2014)
- **Kaziranga National Park (1985)**
- **Keoladeo National Park (1985)**
- Manas Wildlife Sanctuary **(1985)**
- **Nanda Devi and Valley of Flowers National Parks (1988, 2005)**
- **Sundarbans National Park** (1987)
- Western Ghats (2012)
- Khangchendzonga National Park (2016) is a **natural as well as cultural** world heritage site of UNESCO

- **Hence option(c) is the correct answer.**

Q 3.C

- **Recent context: The Warehousing Development and Regulatory Authority (WDRA) under the Department of Food and Public Distribution (DFPD)** on its **13thFoundation Day** held a seminar on the "Role of Financial Institutions in Promoting e-NWR based Pledge Finance" on 1st November.
- WDRA was formed to promote scientific storage and issuance of electronic-negotiable warehouse receipts (e-NWR) in the country and **only WDRA-registered warehouses can issue e-NWR.** WDRA has registered more than 4800 warehouses so far, loaning against e-NWR crossed more than Rs. 2400 crore in 2022-23 and there is ample scope for growth in both.
- Since August, 2019, **no warehouseman shall issue any negotiable warehouse receipt in physical form,** and shall register with one or more repositories registered with the Authority for issuing negotiable warehouse receipts in electronic form. **Hence, statement 1 is correct.**
- **The eNWR was launched in 2018.**
- Following are the characteristics of an eNWR:
  - An eNWR is available only in electronic form;
  - The single source of information for the eNWR will be the Repository;
  - Confidentiality, Integrity & Availability of the eNWR information will be provided by the repository;
  - **An eNWR has a time validity that is co-terminus with the shelf-life of the commodity or withdrawal of the commodity fully from the warehouse, after which it expires. Hence statement 2 is correct.**
  - An eNWR can be auctioned under certain conditions such as loan not repaid, delivery not taken on expiry and on damage or spoilage of the commodity in the warehouse;
  - All eNWRs can be traded through off-market or online trading platforms/exchanges;
  - **eNWR once entered with a transaction, be it pledge or transfer or withdrawal, cannot be simultaneously used for any other purpose. Thus, dual use of same eNWR is fully restricted. Hence statement 3 is correct.**

Q 4.B

- **Ecotones:**
  - An ecotone is a transitional area or boundary zone between two distinct ecosystems or habitat types. For example, it could be the transition between a forest and a grassland or between a wetland and a terrestrial environment.
- **Edge Effect:**
  - **The "Edge effect" refers to the ecological changes and variations that occur at the boundaries or edges of different ecosystems, specifically in ecotones. Hence option (b) is the correct answer.** These changes include alterations in environmental conditions and shifts in the composition of species, often leading to unique ecological dynamics.
  - The edge effect typically results in different environmental conditions than those found in the interior of the adjacent ecosystems. For instance, there may be variations in light, temperature, humidity, and wind patterns at these transition zones.
  - Species Composition in Ecotones often supports a unique mixture of species, including those adapted to both of the adjacent ecosystems. Some species thrive in these transitional areas due to the availability of resources from both ecosystems. This can lead to increased biodiversity and the presence of species not commonly found in either adjacent habitat.
  - Edge effects are essential in understanding ecosystem dynamics and biodiversity. They can influence species interactions, population dynamics, and the overall functioning of ecosystems. They also have implications for conservation efforts, as changes at ecotones can affect the vulnerability and distribution of species.
  - While edge effects occur naturally, human activities, such as habitat fragmentation and urban development, can exacerbate these effects.

Q 5.A

- **Food Safety and Standards Authority of India (FSSAI) has recognized Northeast's Mithun as a 'food animal'.** This will help farmers and tribal village communities as they **can now sell mithun meat for commercial purposes.** Until now, mithuns and their meat were sold only for very special occasions such as festivals or weddings. **Hence, statement 1 is correct.**
- **The Mithun or gayal (Bos frontalis) is considered a descendant of the Indian Gaur or bison.** It plays an important role in the socio-economic and cultural life of tribes such as the Nyishi, Apatani, Galo and Adi in Arunachal Pradesh.
- **It is distributed in Northeast India, Bangladesh, northern Myanmar and in Yunnan, China. It is known as the 'cattle of the mountain'. Hence, statement 3 is not correct.**
- The Indian Council of Agricultural Research launched the M-ANITRA app to register Mithun farmers as "buyers" and "sellers" with the aim of helping them do business at competitive prices.
- **Conservation status**
  - **IUCN: Vulnerable**
  - **CITES: Appendix** I
- **FSSAI is a statutory body established under the Food Safety and Standards Act, 2006 (FSS Act). The nodal ministry is Ministry of Health & Family Welfare. Hence, statement 2 is not correct.**

Q 6.A

Lemru Elephant Reserve, Chhattisgarh

- Lemru Elephant reserve was proposed to prevent human-animal conflict in the Korba region of Chhattisgarh as elephants regularly move from Jharkhand and Odisha to Chhattisgarh. The area proposed under this reserve is part of the Hasdeo Aranya forests, a very diverse biozone that is also rich in coal deposits. **Hence pair 1 is correctly matched.**

Chirang-Ripu Elephant Reserve – Assam

- Ripu and Chirang are two contiguous reserve forests, in extreme western Assam bordering West Bengal. They are part of the buffer zone of Manas TR. These forests have the largest known population of the endangered Golden Langur (EN).
- **Ripu-Chirang is a conservation link between Buxa Tiger Reserve (in WB)-Phipsu Wildlife Sanctuary (in Bhutan)-Royal Manas National Park (in Bhutan)-Manas National Park (India). Hence pair 2 is not correctly matched.**

Singphan Elephant Reserve- Nagaland

- It is the 30th elephant reserve in the country and **is located in Mon district of Nagaland. Hence pair 3 is not correctly matched.**
- It is strategically located in contiguity with the Abhaypur Reserve Forest of Assam. The creation of reserve will give better protection and conservation of elephants in the state.

Q 7.B

- **The Kole wetlands in Kerala, an internationally important Ramsar site known for its high biodiversity, are facing a new threat from an invasive alien plant species called Cabomba furcuta, also known as Pink Bloom. Hence, statement 2 is correct.**
- This species, **originating from Central and South America,** and has now become a menace to the Kole fields, alongside existing threats like water hyacinth and Salvinia molesta. **Hence, statement 1 is not correct.**
- **It has been introduced to Kerala as an aquarium plant and escaped to the wild.** Cabomba furcuta is characterized by its massive pink flowering. While its vibrant pink appearance may seem picturesque, it poses a significant threat to the biodiversity and agricultural productivity of the region. **Hence, statement 3 is correct.**
- **Kole Wetland**
  - Kole Wetland is located in Kerala. and It is one of the Ramsar Sites.
  - It is the largest brackish, humid tropical wetland ecosystem located in the state of Kerala.
  - Extending from the northern bank of Chalakudy River in the south to the southern bank of Bharathapuzha River in the north.
  - **It is situated in the Central Asian Flyway of migratory birds.**

Q 8.A

- The **Nature 2030 IUCN Programme**, marks the culmination of many years of deliberation across the Union. Adopted by democratic vote at the International Union for Conservation of Nature (IUCN) World Conservation Congress in Marseille, for the first time, sets its ambition over ten years.
- It is a call for mobilisation to the Members, Commissions, and Secretariat.
- This longer-term outlook aligns with the United Nations 2030 Agenda for Sustainable Development and the post-2020 global biodiversity framework.
- The Programme defines broad areas of work and sets aspirational targets as well as indicators to measure success.
- It will help the Union deliver for people, land, water, oceans, and climate through five pathways to transformative change: recognize, retain, restore, resource and reconnect.
- Over the next decade IUCN's 1,400+ State, Government Agencies, Indigenous Peoples, and NGO Members, our network of 15,000+ scientists, and our Secretariat of hundreds of dedicated staff will work together towards the Nature 2030 agenda.
- Through this global call to action, we commit to delivering clear and demonstrable contributions to the Sustainable Development Goals, the post-2020 global biodiversity framework and the Paris Agreement on Climate Change, as well as global recovery from the COVID-19 pandemic.
- **Hence, option (a) is the correct answer.**

Q 9.A

Constitutional Provisions for Forests Protection

- **Article 48 A in the Directive Principles of State policy,** mandates that the State shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country.
- **Article 51 A (g) of the Constitution** states that it shall be the **fundamental duty of every citizen to protect and improve the natural environment including forests and Wildlife.**
- Forests are **included in the Concurrent List in the (Seventh Schedule)** of the Constitution of India. **Through the 42nd Amendment Act, 1976 Forests and Protection of Wild Animals and Birds were transferred from State to Concurrent List.**
- **State Forest Departments have jurisdiction over two types of forests notified under the Indian Forest Act, 1927**
  - **Reserve Forests (RF), where no rights are allowed unless specified.**
  - **Protected Forests (PF), where no rights are barred unless specified.**

- Certain forests, such as villages or **nagarpalika forests, are managed by state Revenue Departments.**
- **Hence option (a) is the correct answer.**

Q 10.C

- **Population:**
  - **A population is a group of individuals of a single species that live in the same general area**. Members of a population rely on the same resources, are influenced by similar environmental factors, and have a high likelihood of interacting with and breeding with one another. The distinguishing characteristics of a population includes,
    - ✓ **Sharing similar resources:**
      - This is an essential aspect of a population. In a given geographical area, a population of individuals, whether they are of the same species or different species, **often shares and competes for similar resources like food, water, shelter, and other necessities.** This resource sharing and competition are critical in understanding the interactions and dynamics within a population. **Hence option 1 is correct.**
    - ✓ **Competing for similar resources:**
      - **Competition for similar resources is a defining feature of a population.** It occurs when individuals within the population vie for access to limited resources. **This competition can have a significant impact on population size, growth, and distribution.** In some cases, it may lead to the development of specific adaptations or behaviors to reduce competition, such as niche differentiation. **Hence option 2 is correct.**
    - ✓ **Interbreeding and reproduction:**
      - For individuals to be considered part of the same population, they should have the potential to interbreed and produce fertile offspring. T**his feature is crucial because it defines the genetic cohesion within a population.** Interbreeding ensures that the genetic diversity of the population is maintained and that traits are passed on to the next generation. **Hence option 3 is correct.**

Q 11.B

- **Fresh water ecosystem**
  - Water on land which is continuously cycling and has l**ow salt content is known as fresh water and its study is called limnology. Hence option (b) is the correct answer.**
- **Physical Characteristics:**
  - **Static and Running Water:**
    - ✓ Freshwater ecosystems can be further classified into two categories - static or still water (lentic) and running water (lotic). Lentic freshwater ecosystems include features like ponds, lakes, bogs, and swamps, which have relatively calm or stagnant water. Lotic ecosystems, on the other hand, include areas like springs, mountain brooks, streams, and rivers, where water is continuously flowing.
  - **Low Salt Content:**
    - ✓ One of the defining characteristics of freshwater ecosystems is their low concentration of dissolved salts. Unlike marine ecosystems, which have high salinity, freshwater ecosystems contain water with significantly lower salt levels.
  - **Temperature Variations:**
    - ✓ Freshwater ecosystems experience diurnal (daily) and seasonal variations in temperature. In tropical lakes, the surface temperature remains relatively warm, never going below 40°C. In temperate freshwater bodies, the temperature does not go above or below 40°C. In polar regions, lakes maintain temperatures below 4°C.
  - I**mportance of Light:**
    - ✓ Light plays a significant role in freshwater ecosystems. It influences the growth of aquatic plants and the overall ecosystem's productivity. However, in many cases, a substantial amount of suspended materials in the water can obstruct the penetration of light, affecting the ecosystem's dynamics.
  - **Aquatic Plants and Respiration:**
    - ✓ Aquatic plants in these ecosystems play a crucial role in photosynthesis, using dissolved carbon dioxide in the water for their energy production. Some aquatic animals, particularly those adapted to low-oxygen conditions, may float to the water's surface to access oxygen for respiration.

- **Distinct Zones in Lakes and Ponds:**
  - ✓ **Littoral Zone:** The littoral zone is the term for the shore region of a lake or pond. It includes everything around the shore or bank, from the dry land to the water's edge. For this reason it is generally the zone with the most aquatic or semi-aquatic vegetation such as reeds, grasses and algaes.
  - ✓ **Limnetic Zone:** The next layer is called the limnetic zone and is the surface or open water section of the lake. The limnetic zone is classified by the amount of light that penetrates the body of water. This upper water layer is also referred to as the euphotic zone, and is the part of the lake that is warmest and receives the most sunlight. Once the sunlight can no longer penetrate the lake, the zone ends. Like the Littoral zone, aquatic plants thrive in this region, due to the presence of sunlight. Oxygen levels are also higher in this section of the lake, meaning the majority of fish also live in this zone.
  - ✓ **Profundal Zone:** The profundal zone is the section that follows the Limnetic once the sunlight cannot penetrate the lake's surface any further. The temperature in these waters is also significantly colder, as the warmth from the sun is unable to reach these depths. The water clarity and composition has a significant effect on how deep the sunlight is able to reach, and therefore the size and depth of the profundal layer will vary from lake to lake. There is also a decreased amount of oxygen in this region of the lake, so the amount of fish in this area is also significantly less.
  - ✓ **Benthic Zone:** The benthic zone is essentially the area along the floor of the lake. It consists over everything in the bottom of the body of water, including the sediment, silt, and soil which builds up at the bottom of the lake. At this lowest point, bacteria live and work to decompose and break down any organic matter which has fallen to the lake floor. Everything from deceased fish and animals to dead plants, or animal droppings. Older lakes have larger or increased benthic zones as there is a larger amount of matter to be decomposed.

Q 12.B

- **The 2023 Production Gap Report:** "Phasing down or phasing up? Top fossil fuel producers plan even more extraction despite climate promises" finds that governments plan to produce around 110% more fossil fuels in 2030 than would be consistent with limiting warming to 1.5°C, and 69% more than would be consistent with 2°C.
- **The Production Gap Report** — first launched in 2019 — **tracks the discrepancy between governments' planned fossil fuel production and global production levels** consistent with limiting warming to 1.5°C or 2°C. **Hence statement 2 is correct.**
- The Report has been prepared by **United Nations Environment Programme (UNEP) and other institutes such as Stockholm Environment Institute, etc. Hence statement 1 is not correct.**
- The 2023 Report highlights that major countries' plans and projections would lead to an increase in global coal production until 2030, and in global oil and gas production until at least 2050. It includes countries like Australia, Brazil, Canada, China, India, UAE, etc.
- **Recommendations:**
  - Adopt near and long-term reduction targets in fossil fuel production.
  - An equitable transition away from fossil fuel production must recognize countries' differentiated responsibilities and capabilities.
  - Governments with greater transition capacity should aim for more ambitious reductions and help finance the transition processes in countries with limited capacities.

Q 13.C

- **Metapopulation:**
  - The concept of metapopulation is a fundamental ecological idea that describes how populations of a species are connected within a region, and how they are influenced by local births, deaths, immigrations, and emigrations. The structure of metapopulations varies among species and can have significant implications for the survival and persistence of these populations.
- **Features of Metapopulation:**
  - **Population Dynamics:** Each population within a metapopulation is subject to changes in population size due to births, deaths, immigration (individuals moving into a population), and emigration (individuals leaving a population). Additionally, local populations may emerge and disappear over time.

- **Local Population Vulnerability:** When the numbers of individuals in local populations are low, they become vulnerable to extinction. Extinction events of local populations are not uncommon in some species.
- **Regional Persistence**: **The regional survival of species is often dependent on the existence of a metapopulation. Even if some local populations go extinct, the species can persist at the regional level. Hence option (c) is the correct answer.**
- **Source-Satellite Structure:** Metapopulations can have various structures. In some species, one stable source population serves as the supplier of individuals to less stable satellite populations. **For example, the checkerspot butterfly in California has a source population surrounded by smaller satellite populations.**
- **Shift in Source Populations**: In other species, the source population that provides recruits can shift over time. Local populations may take turns acting as stable sources depending on changing conditions, such as disease outbreaks or deteriorating environments.

Q 14.C

National Parks In India

- **Chapter IV "Protected Area" of the Wildlife (Protection) Act, 1972** lay down Provisions for declaration, conservation and management of Wildlife Sanctuaries, National Parks, Tiger Reserves and closed and protected areas.

Declaration of National Parks by Statel Government:-

- **Section 35 deals with the declaration of national parks by a State Government. It says:-**
- An area which by reason is ecological, has fauna, flora or with other benefits related to the wildlife needs to be constituted as a national park. To protect the wildlife, it may be constituted by the notification.
- If any area is intended to be declared as a national park **it is first applied to investigation of the land and determination of the claims.**
- **The State government has all the rights of lands to be included in the national parks and none can enter except the person who brings livestock for the animal. Hence statement 2 is correct.**
- **Only on the recommendation of the National Board for Wildlife (NBWL), the changes to the boundaries of national parks can be made. Hence statement 3 is correct.**

National Park declared by Central Government :-

- **Section 38** defines the power of the Central Government to declare areas as national parks. The central government, if satisfied with the conditions of the specified area, can declare it as a national park by the notification.
- **The central government has the power to declare sanctuaries or national parks if the government is satisfied by the conditions which are given in section 35. Hence statement 1 is correct.**

Q 15.C

- **Ecological Succession:** Ecological succession is the gradual and predictable process of change in the species composition and structure of an ecosystem over time. It typically involves a transition from a disturbed or barren area to a more stable and diverse community of organisms.
  - **Pioneer Stage:** The pioneer stage is the initial stage of succession, where the first colonizers, often hardy and adaptable species, establish themselves in a previously barren or disturbed area. These pioneer species can tolerate harsh conditions and help to improve the soil and environment for other species to follow.
  - **Climax Stage:** The climax stage represents the endpoint of succession, where a stable and self-sustaining community of species has established itself and remains relatively unchanged as long as environmental conditions are stable.
  - **Seral Stage:** The seral stage, sometimes called the intermediate or transitional stage, is the phase in between the pioneer and climax stages. During this stage, there is an ongoing and dynamic change in the community composition as various species establish themselves and interact with one another. These species are typically more diverse and specialized than the pioneers but have not yet reached the stability of the climax community. **Hence option (c) is the correct answer.**
    - ✓ **Role of Seral Stage:** The seral stage is a critical phase in succession because it represents the process of ecosystem development and recovery. It is during this stage that the environment gradually becomes more hospitable to a wider range of species. These species compete, evolve, and eventually lead to a community that is in equilibrium with its environment.

- ✓ **Facilitation:** The seral stage often involves facilitation, where one group of species prepares the environment for the next group to establish. For example, nitrogen-fixing plants may improve soil fertility for other species.

- **Environmental Factors:** The rate and nature of succession can be influenced by environmental factors, such as climate, soil conditions, disturbances, and human activities. In some cases, succession may be interrupted or altered by disturbances like wildfires or human intervention.

Q 16.C

Kaziranga National Park

- **Kaziranga National Park** is home to more than 2200 **Indian one-horned rhinoceros**, approximately **2/3rd of their total world population.**
- **Formed in 1908 on the recommendation of Mary Curzon, it is located in the edge of the Eastern Himalayan biodiversity hotspots – Golaghat and Nagaon district. In 1985, it was declared a World Heritage Site by UNESCO.**
- The park is the breeding ground of elephants, wild water buffalo, and swamp deer.
- **The tiger population has increased in Kaziranga, and so it was declared as Tiger Reserve in 2006. Also, the park is recognized as an Important Bird Area by BirdLife International for the conservation of avifaunal species.**
- Birds like lesser white-fronted goose, ferruginous duck, Baer's pochard duck lesser adjutant, greater adjutant, black-necked stork, and Asian Openbill stork specially migrate from Central Asia during the winter season.
- The park is equally rich in fauna with four main types of vegetation namely alluvial inundated grasslands, tropical evergreen forests, tropical moist mixed deciduous forests, and alluvial savanna woodlands.
- **Trees include Indian gooseberry, elephant apple, kumbhi, and cotton trees. Elephant grass, spear grass, and sugarcane are some of the common tall grasses available here.**
- **Hence option (c) is the correct answer.**

Q 17.B

- **A generative adversarial network (GAN)** is a class of **machine learning framework** and a prominent **framework for approaching generative AI.** In a GAN, two neural networks contest with each other in the form of a zero-sum game, where one agent's gain is another agent's loss.
- Given a training set, this technique learns to generate new data with the same statistics as the training set. For example, a GAN trained on photographs can generate new photographs that look at least superficially authentic to human observers, having many realistic characteristics. **GANs are similar to mimicry in evolutionary biology,** with an evolutionary arms race between both networks.
- Deepfakes are fake videos and image of people created using artificial intelligence by swapping faces or altering voices. The deepfake technology swaps the face of a person in a video or an image with another persons' face through AI algorithms. **The deepfake algorithm runs through a process called Generative Adversarial Networks (GANs).** Two machine learning models work together to create forgeries and to detect them, resulting in convincing fake videos.
- **Hence option (b) is the correct answer.**

Q 18.C

Conservation Reserves

- **Notified by: State Government after consulting with the central government and the local communities. Hence statement 1 is correct.**
- **Criteria: An inhabited area which typically act as buffer zone to or connectors and migration corridors between established national parks, wildlife sanctuaries and reserved and protected forests of India. Parts of the land in this area are privately owned. Hence statement 2 is correct.**
- Such areas are designated as conservation areas if they are uninhabited and completely owned by the Government of India but used for subsistence by communities.
- **Tamil Nadu government recently announced India's first conservation reserve for Dugongs in Palk Bay. Hence statement 3 is correct.**

Q 19.C

- **Tropical rainforests:**
  - **Tropical rain forests play an important role in natural vegetation in India**. These types of forests include the tropical evergreen forests and tropical semi-evergreen forests and they are mostly found in places where there is plenty of rainfall and sunshine throughout the year.
  - Growth of the trees is usually at its best where rainfall is in surplus of 200 cm, with a short dry season. **Such types of forests are found within rainy slopes of the Western Ghats, plains of West Bengal and Orissa and north-eastern India.**
  - Trees grow very briskly in these forests and attain heights of about 60 m and above. The number of species in these forests is too vast and too assorted to utilize each one of them commercially.
    - ✓ **Flora in the Tropical Rain Forests: Ebony, mahogany, rosewood, rubber,** cinchona, lianas and bamboo White Cedar Chestnut **are the main trees of these forests. Hence option (c) is the correct answer.**
  - **Fauna in the Tropical Rain Forests:**
    - ✓ The common animals found in these forests are **elephant, monkey, lemur and deer.** One-horned rhinoceroses are found in the jungles of Assam and West Bengal. Besides these animals, plenty of birds, bats, sloths, scorpions, and snails are also found in these jungles.

Q 20.D

- **The UN Decade on Ecosystem Restoration is a rallying call for the protection and revival of ecosystems all around the world,** for the benefit of people and nature. It aims to halt the degradation of ecosystems, and restore them to achieve global goals. Only with healthy ecosystems can we enhance people's livelihoods, counteract climate change, and stop the collapse of biodiversity.
- **The UN Decade runs from 2021 through 2030, which is also the deadline for the Sustainable Development Goals** and the timeline scientists have identified as the last chance to prevent catastrophic climate change.
- The United Nations General Assembly has proclaimed the UN Decade following a proposal for action by over 70 countries from all latitudes.
- **Led by the United Nations Environment Programme and the Food and Agriculture Organization of the United Nations,** The UN Decade is building a strong, broad-based global movement to ramp up restoration and put the world on track for a sustainable future. That will include building political momentum for restoration as well as thousands of initiatives on the ground.
- **Hence, option (d) is the correct answer.**

Q 21.C

- Scientists have catalogued 1.5 million species on Earth and estimate that there might be as many as 100 million more unidentified species. **Classification keys are tools** that provide a means to **correctly identify different organisms, based on observable traits.**
- **A dichotomous key** is an important scientific tool, **used to identify different organisms, based the organism's observable traits.** Dichotomous keys consist of a series of statements with two choices in each step that will lead users to the correct identification. **Hence option (c) is the correct answer.**
- For example whether a plant has (a) twig hairy or (b) twig not hairy. Answers to these questions then lead on to further questions until a definite identification is made. However,with just one mistake it's possible to take a completely wrong path and arrive at an inaccurate identification.
- A dichotomous key is usually used for
  - **Identifying and categorizing organisms**
  - Helping students easily understand harder scientific concepts
  - **Organizing large amounts of information to make identification of an organism much easier**

Q 22.D

- State governments exercise complete administrative control over all statutorily recognized forests and other government-owned lands in the country. The **state government's power to constitute reserved forests, national parks and wildlife sanctuaries is absolute but it has to seek prior approval of the Central Government for de-reservation, de-notification, diversion, logging, or leasing of forests for non-forestry activities.**
- The State Forest Department is vested with the task of administration and management of forests, including wildlife reserves. State Forest Departments are headed by Principal Chief Conservators of Forests (PCCF) who are officers of the Indian Forest Service (IFS).

- **The Chief Wildlife Warden (CWLW) is the statutory authority, under the Wildlife Protection Act, 1972** who heads the Wildlife Wing of the department and exercises complete administrative control over Protected Areas (PAs) within a state. Every PA is typically classified as a Wildlife Division and is headed by a Deputy Conservator of Forests (DCF).
- **Important provisions related to CWLW of Wild Life (Protection) Act, 1972:**
  - The Chief Wild Life Warden may, if he is satisfied that any **wild animal specified in Schedule I** has become dangerous to human life or is so disabled or diseased as to be beyond recovery, by Order in writing and stating the reasons therefor, **permit any person to hunt such animal or cause such animal to be hunted. Hence option (d) is the correct answer.**
  - It shall be lawful for the **Chief Wild Life Warden,** to grant a permit, by an order in writing stating the reasons therefor, to any person, on payment of such fee as may be prescribed, which shall entitle the holder of such permit to hunt subject to such conditions as may be specified therein, any wild animal specified in such permit, for the purpose of education, scientific research.
  - **No person shall cultivate a specified plant** except under and in accordance with a **licence granted by the Chief Wild Life Warden** or any other officer authorised by the State Government in this behalf:

Q 23.D

- **Recent context: Raising concerns over the use of World Bank's Worldwide Governance Indicators** in rating assessment by credit rating agencies, especially for emerging economies, Chief Economic Adviser V Anantha Nageswaran said there is a need for the World Governance Index to be more transparent and less subjective. The Worldwide Governance Indicators (WGI) are a long-standing research project to develop cross-country indicators of governance.
- The WGI consists of six composite indicators of broad dimensions of governance covering over 200 countries since 1996:
  - **Voice and Accountability,**
  - **Political Stability and Absence of Violence/Terrorism,**
  - **Government Effectiveness,**
  - **Regulatory Quality,**
  - **Rule of Law, and**
  - **Control of Corruption. Hence option (d) is the correct answer.**
- These indicators are based on several hundred variables obtained from 31 different data sources, capturing governance perceptions as reported by survey respondents, non-governmental organizations, commercial business information providers, and public sector organizations worldwide.

Q 24.D

- **Mangroves represent a characteristic littoral** (near the sea shore) forest ecosystem, and they are mostly evergreen forests that grow in sheltered low-lying coasts, estuaries, mudflats, tidal creeks backwaters (coastal waters held back on land), marshes, and lagoons of tropical and subtropical regions.
- The mangrove forests comprise trees and shrubs belonging to some 12 genera, and the dominant genera are **Rhizophora, Avicennia, Bruguiera, and Sonneratia.**
- Mangroves show the following adaptations to live on the water's edge and on saline and poorly aerated soils, which are fine grained and high in organic content:
  - **Prop roots and stilt roots: Prop roots** are aerial roots that provide support to the tree. **Stilt roots** are the roots that arise from the base of the plant and perform the function of supporting the plant.
  - **Pneumatophores:** Specialized roots that grow upwards from the soil and have numerous apertures which exchange gases. e.g., Avicennia, Sonneratia.
  - **Knee roots:** To exchange gases (Bruguiera).
  - **Vivipary:** The seedling grows while attached to the parent tree. When it is released, it either gets stuck in the mud or floats upright until it touches the bottom and settles down, e.g., Rhizophora, Bruguiera.
  - **Cutinized epidermis:** The epidermis is highly cutinized and the water storage tissue is extensive. In most species, there are salt secreting glands which help to get rid of excess salt.
- **Hence option (d) is the correct answer.**

Q 25.A

- **Biosphere Reserve (BR) is an international designation by UNESCO** for representative parts of natural and cultural landscapes extending over large area of terrestrial or coastal/ marine ecosystems or a combination thereof.
- They are special environments for both people and the nature and are living examples of how human beings and nature can co-exist while respecting each other's needs.
- **LIST OF BIOSPHERE RESERVES:**
  1) Cold Desert, Himachal Pradesh
  2) Nanda Devi, Uttrakhand
  3) Khangchendzonga, Sikkim
  4) Dehang-Debang, Arunachal Pradesh
  5) Manas, Assam
  6) Dibru-Saikhowa, Assam
  7) **Nokrek, Meghalaya**
  8) Panna, Madhya Pradesh
  9) **Pachmarhi, Madhya Pradesh**
  10) Achanakmar-Amarkantak, Madhya Pradesh-Chattisgarh
  11) Kachchh, Gujarat
  12) Similipal, Odisha
  13) Sundarban, West Bengal
  14) **Seshachalam, Andhra Pradesh**
  15) Agasthyamala, Karnataka-Tamil Nadu-Kerala
  16) Nilgiri, Tamil Nadu-Kerala
  17) Gulf of Mannar, Tamil Nadu
  18) Great Nicobar, Andaman & Nicobar Island

- **Hence option (a) is the correct answer.**

Q 26.A

- **Leith's Softshell Turtle is a large freshwater soft-shelled turtle** which is **endemic to peninsular India and it inhabits rivers and reservoirs.** The species has been subject to intensive exploitation over the past 30 years. **Hence, statement 1 is correct.**
    - It has been poached and illegally consumed within India. It has also been illegally traded abroad for meat and for its calipee.
    - **The population of this turtle species is estimated to have declined by 90% over the past 30 years such that the species is now difficult to find.**
    - **It is classified as 'Critically Endangered' by the IUCN. Hence, statement 2 is not correct.**

Q 27.A

- **Recent context:** A male tiger was found dead at the forest range in the Tirupur forest division located in Tamil Nadu recently.
- **The Indian porcupine (Hystrix indica)** is a hystricomorph rodent species native to southern Asia and the Middle East. It is listed as **Least Concern on the IUCN Red List.** It is **protected under the India Schedule IV of the Indian Wildlife Protection Act of 1972. Hence statement 3 is not correct.**
- The Indian porcupine is **highly adaptable to multiple environments.** Although they usually favor rocky hillsides, the species can also be found in tropical and temperate scrublands, grasslands, and forests. They are also found **throughout the Himalayan mountains, reaching up to elevations of 2400 meters. Hence statement 2 is not correct.**
- **Indian porcupines are nocturnal,** with the species seeking shelter in caves, between rocks, or in its burrow during the day. The main food source for the Indian porcupine is vegetable material of all kinds, including fruits, grains, and roots. The Indian porcupine uses crop plants extensively as a food resource, thus **leading to a significant loss for agriculture. Hence statement 1 is correct.**

Q 28.C

Types of Public Forest under the Indian Forest Act, 1927

- Reserved Forests
- Village Forests
- Protected Forests

Reserved Forests

- They are reserved by the Government. **More than half of the forest area in India is declared as a Reserve forest. 53% of the total forests in India are the Reserved Forests**. For their conservation the Government reserves these forests.
- The activities like hunting and cutting the trees are strictly banned in these forests. Only on special permissions by the higher authorities, these activities may be performed unless and until there is a valid reason for performing it.

Protected Forests (Section 29)

- **The Indian Forest Act empowers the State Government to use any land as protected forest. Forests are not reserved under the state government.**
- **A protected forest can be a reserved forest but a reserved forest cannot be a protected forest. Hence statement 1 is correct.**
- The State also has some power to reserve some species of trees in these forests so that the state can have control over the trees, whose timber, fruits and non-wood products have revenue-raising potential.

Village Forests (Section 28)

- **The State Government can give the rights to any village group, which the Government has over any land which has been reserved. Rules for regulating the management of the forest to be made by the State Government. Hence statement 2 is correct.**
- Here two interchangeably terms are used- **'village forest'** itself and the other is a **'forest village' but both are different from each other. The village forest is in legal category whereas the forest village lies in the administrative category in the Act.**

Q 29.B

- **A Memorandum of Understanding (MoU) on "Enhancing Innovation Ecosystems through an Innovation Handshake" under the framework of India – U.S. Commercial Dialogue** was signed between the two countries on the 14th of November 2023 in San Francisco. The leaders' Joint Statement during the historic official State Visit of Prime Minister in June 2023 announced the establishment of the "Innovation Handshake". **Hence option (b) is the correct answer.**
- The MoU was signed at the kick-off industry roundtable titled, "Decoding the "Innovation Handshake": U.S. – India Entrepreneurship Partnership" in San Francisco. The MoU is signed with the objective to connect the two sides' dynamic startup ecosystems, address specific regulatory hurdles to cooperation, share information and best practices for startup fundraising and promote innovation and job growth, particularly in critical and emerging technologies (CET) as identified under **India -U.S. initiative for Critical and Emerging Technology (iCET).**
- The Commercial Dialogue (CD) is a cooperative undertaking at Ministerial level between India and the U.S. to facilitate regular discussion to deepen ties between business communities.

Q 30.A

- **Niche:**
  - A niche can be thought of as a species' "address" in the ecosystem, encompassing all the environmental factors and interactions that allow it to thrive. It defines what a species does, where it lives, what it eats, and how it reproduces. Essentially, a niche is the sum total of an organism's ecological requirements and contributions to its ecosystem.
- **Fundamental niche:**
  - Fundamental niche is the entire set of conditions under which an animal (population, species) can survive and reproduce itself.
  - The fundamental niche represents the theoretical or **potential ecological niche of a species,** considering only the influence of abiotic (non-living) factors. It encompasses the full range of environmental conditions, such as temperature, humidity, light, and other abiotic factors, where a species could survive and reproduce without competition from other species. **Hence option (a) is the correct answer.**
  - Think of it as the "perfect world" scenario for a species, where it can exploit all available resources and environmental conditions without any constraints. This is an idealized concept and often does not reflect the real-world ecological interactions and competition that occur.
  - The fundamental niche helps scientists understand the theoretical limits of a species' ecological tolerance and adaptability.
- **Realized niche:**
  - It is the set of conditions actually used by given animal (pop, species), after interactions with other species (predation and especially competition) have been taken into account.
  - It takes into account biotic interactions, such as competition and predation, which often narrow down a species' ecological range in nature. The realized niche is **where a species is actually found in a given ecosystem, considering both abiotic and biotic factor**s.

Q 31.C

- Recently, India successfully test-fired its surface-to-surface short-range ballistic missile (SRBM) 'Pralay' from the Abdul Kalam Island off the Odisha coast.
- The missile has been developed by the **Defence Research and Development Organisation (DRDO). Hence statement 1 is correct.**
- **'Pralay' is a 350-500 km short-range, surface-to-surface missile with a payload capacity of 500-1,000 kg. Hence statements 2 and 3 are correct.**
- 'Pralay' has been developed for deployment along the Line of Actual Control (LAC) and Line of Control (LoC). 'Pralay' missile can be compared with China's 'Dong Feng 12' and Russia's 'Iskander' missiles.

Q 32.B

- **Desert food chain:**
  - A desert food chain is a graphical representation showing who eats whom and thus the flow of energy in the desert biome. Like other food chains, there are two main types of organisms in a desert food chain: producers and consumers.
  - Producers are organisms that make their food. Usually, plants and microorganisms are producers. In contrast, consumers feed on producers for their livelihood. Based on their position in the food chain, consumers are divided into primary, secondary, tertiary, and quaternary consumers or apex predators.

- A desert food chain is unique due to its harsh environment. The Desert ecosystem food chain proceeds as follows,
    - **Desert Willow:** This is a plant and serves as the **primary producer** in the food chain. It captures sunlight and converts it into energy through photosynthesis. The other primary producers in Deserts are date palms, cacti, acacia, sagebrush, and desert milkweed.
    - **Desert Hare:** The **Desert Hare is an herbivore** that feeds on plants, including the Desert Willow. Herbivores are primary consumers in the food chain as they consume primary producers. The other primary consumers are Kangaroo rats, desert tortoises, ground squirrels, Arabian camels, and some insects feed only on plants to survive.
    - **Snake:** Snakes can be **both secondary and tertiary consumers**, depending on what they prey on. They may eat smaller herbivores like Desert Hares or smaller carnivores like birds. The other secondary consumers are izards, coyotes, rattlesnakes, mongooses, tarantulas, and scorpions.
    - **Falcon:** Falcons are higher-level carnivores that feed on other animals, including birds and rodents. They are tertiary consumers in the food chain. The other tertiary consumers are hyenas, sand cats, foxes, hawks, and eagles.
    - **Coyote:** Coyotes are at the top of the food chain, or at the highest "trophic" level. Coyotes prey on mesopredators, like raccoons, opossums, striped skunks, Falcons, and red foxes, which occupy the next lowest trophic level Carnivores are secondary consumers because they feed on herbivores.
- **Hence option (b) is the correct answer.**

Q 33.B

- **The Minamata Convention on Mercury** is a **global, legally binding treaty,** which was adopted in 2013 and entered into force on 16 August 2017. The core of the Convention is protection of human health, as stated in Article 1: "to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds". India has ratified the treaty in 2018. **Hence statements 1 and 2 are correct.**
- **The fifth meeting of the Conference of the Parties to the Minamata Convention (COP-5),** was held in Geneva from 30 October to 3 November 2023, made significant progress by adopting 23 decisions to keep protecting human health and the environment from the harmful effects of mercury.
- Key Decisions adopted at COP 5:
    - For the first time, COP pushed to reduce mercury supply sources and trade by strengthening capacities at national level and developing study on global supply, trade, production and use of mercury compounds.
    - Implementation of projects and programmes undertaken under Convention with participation of Indigenous Peoples and local communities.
    - **Limit of 15 mg/kg concentration of mercury is set as threshold for wastes contaminated with mercury or mercury compounds. Hence statement 3 is not correct.**
    - Amend Annex B of Convention to mandate phaseout of mercury in polyurethane production by 2025.

Q 34.C

Biosphere Reserves (BR)

- **The Man and the Biosphere (MAB) programme, launched in 1971 by UNESCO , is an intergovernmental scientific programme that aims to establish a scientific foundation for improving people's relationships with their environments. Hence statement 1 is correct.**
- **UNESCO has designated Biosphere Reserves (BR)** as representative parts of natural and cultural landscapes spanning large areas of terrestrial or coastal/marine ecosystems, or a combination of both**.** They strive to strike a balance between economic and social development, cultural preservation, and environmental preservation.

Criteria for Designation of Biosphere Reserve (BR)

- A site must contain **a protected and minimally disturbed core area** of value of nature conservation.
- **The core area must be a bio-geographical unit and should be large** enough to sustain a viable populations **representing all trophic levels.**
- **The involvement of local communities** and use of their knowledge in biodiversity preservation. **Hence statement 2 is correct.**
- **The MAB Programme is governed globally by its International Coordinating Council (ICC),** which reports to the UNESCO General Conference and its Executive Board.There is no law that governs the

Biosphere Reserves (BR) and in 1979, the world's first biosphere reserve was established. **Hence statement 3 is correct.**

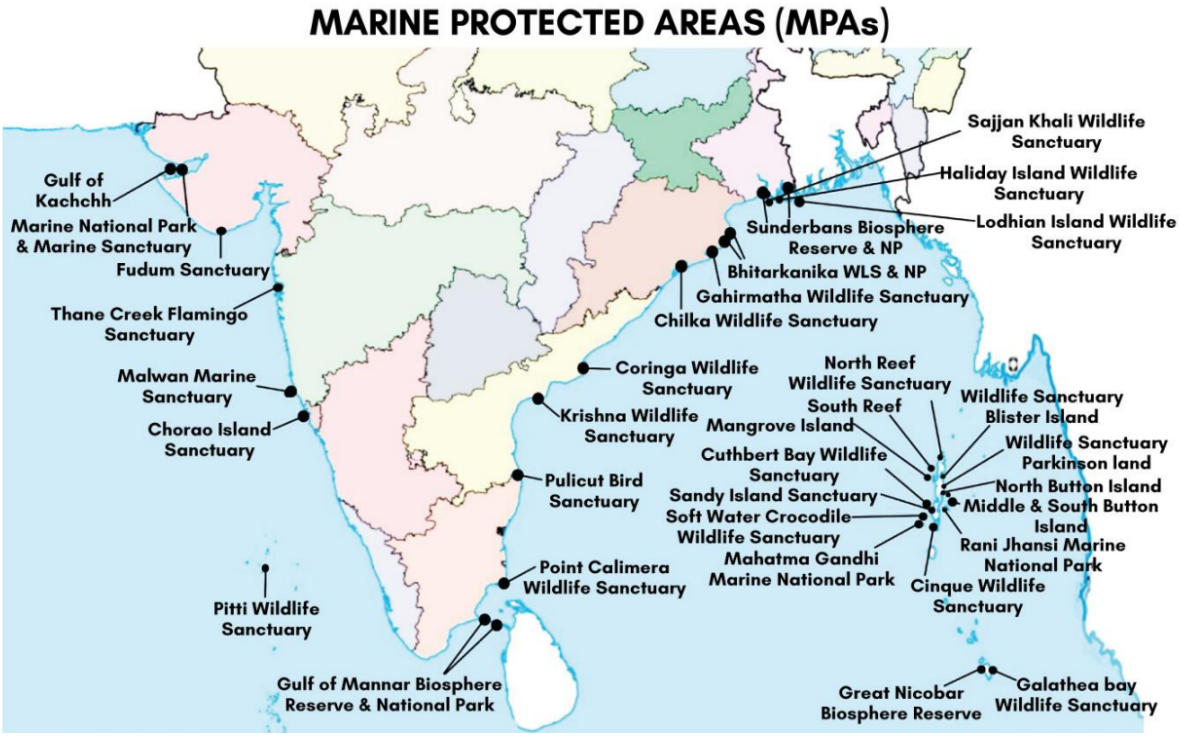
Q 35.B

- Species aren't evenly distributed around the planet. Certain areas have large numbers of endemic species — those found nowhere else. Many of these are heavily threatened by habitat loss and other human activities. **These areas are the biodiversity hotspots, 36 regions where success in conserving species can have an enormous impact in securing our global biodiversity.**
- The forests and other remnant habitats in hotspots represent just 2.5% of Earth's land surface.**To qualify as a biodiversity hotspot, a region must meet two strict criteria:**
  - **It must have at least 1,500 vascular plants as endemics —** which is to say, it must have a high percentage of plant life found nowhere else on the planet. A hotspot, in other words, is irreplaceable. **Hence statement 1 is not correct.**
  - **It must have 30% or less of its original natural vegetation.** In other words, it must be threatened. **Hence statement 2 is correct.**

Q 36.C

Marine Protected Areas (MPA):

- MPA is a section of ocean where a government has placed limits on human activity. Currently, an estimated 7.65% of ocean is covered by MPAs.
- **They are notified as either 'national parks' or 'wildlife sanctuaries' under Wildlife (Protection) Act, 1972. Hence statement 1 is correct.**
- They are given special protections for natural or historic marine resources by local, state, territorial, native, regional, or national authorities.
- **Recently, a total of 106 coastal and marine sites have been identified and prioritized as Important Coastal and Marine Areas (ICMBA) using globally used criteria by the Wildlife Institute of India. Hence statement 2 is correct.**
- **Important MPAs (coastal or marine)** of India are as given in image:-



Q 37.B

- **The Jerdon's Courser (Rhinoptilus bitorquatus) is a nocturnal bird found only in the northern part of the State of Andhra Pradesh in peninsular India. It is a flagship species for scrub jungle which is under extreme threat. The species was considered to be extinct until it was rediscovered in 1986 and the area of rediscovery was subsequently declared as the Sri Lankamaleswara Wildlife Sanctuary.**
- **Habitat**: Undisturbed scrub jungle with open areas.

- **Distribution**: Jerdon's Courser is endemic to Andhra Pradesh. However, 19th-century records do attribute its presence in the neighbouring areas of the State of Maharashtra.
- **Threats**: Clearing of scrub jungle, creation of new pastures, growing of dryland crops, plantations of exotic trees, quarrying and the construction of the Telugu-Ganga Canal. Illegal trapping of birds is also a threat.
- **Hence, option (b) is the correct answer.**

Q 38.A

- **Recent context:** Around 1.6 million people in **Somalia** could be **affected by the heavy seasonal downpours,** which have been worsened by the **combined impact of two climate phenomenons, El Niño and the Indian Ocean Dipole.**
- El Nino is a climate pattern that describes the unusual warming of surface waters in the eastern tropical Pacific Ocean. El Niño is the "warm phase" of a larger phenomenon called the El Niño-Southern Oscillation (ENSO). La Niña, the "cool phase" of ENSO, is a pattern that describes the unusual cooling of the region's surface waters. **El Niño and La Niña are considered the ocean part of ENSO, while the Southern Oscillation** is its atmospheric changes. It has an impact on ocean temperatures, the speed and strength of ocean currents, the health of coastal fisheries, and local weather from Australia to South America and beyond.
- El Nino is likely to be disastrous for many African regions. Rainfall in most of southern Africa will likely decline, especially in Angola, South Africa, Zambia, and Zimbabwe. Shortages of staple crops, such as corn, are likely. **The Horn of Africa, on the other hand, will likely see increased rainfall.** El Nino typically impacts Southeast Asia with drier-than-average conditions, usually stemming rainfall and leading to the threat of drought.
- **The Indian Ocean Dipole** - often called the "Indian Niño" because of its similarity to its Pacific equivalent - refers to the difference in sea-surface temperatures in opposite parts of the Indian Ocean. Temperatures in the eastern part of the ocean oscillate between warm and cold compared with the western part, cycling through phases referred to as "positive", "neutral" and "negative".
- **The dipole's positive phase means warmer sea temperatures in the western Indian Ocean region**, with the opposite in the east. The result of this strong positive dipole is **higher-than-average rainfall and floods in eastern Africa (including Horn of Africa)** and droughts in south-east Asia and Australia.
- **Hence option (a) is the correct answer.**

Q 39.D

- **Recent context:** The provisional payroll data of ESIC reveals that 18.88 lakh new employees have been added in the month of September 2023. Around 22,544 new establishments have been registered and brought under the social security umbrella of the Employees' State Insurance Corporation in the month of September 2023, thus ensuring more coverage.
- ESI Scheme provides social security to the working class of the country who come under the ambit of the ESI Scheme. The Scheme **applies to factories and establishments employing 10 or more persons** in the notified areas. Employees whose **monthly wages are up to ` 21,000/- fall within the purview of the ESI Act** (25,000/- in the case of persons with disability). Under the ESI Scheme, the Insured Persons are protected during contingencies such as sickness, maternity, death or disablement due to employment injury or occupational disease. Free medical care is provided to the Insured Persons and their family through a network of ESI Dispensaries and ESI Hospitals. **Hence statement 1 is not correct.**
- The contribution payable to the ESI Corporation in respect of an employee shall comprise of employer's contribution and the employee's contribution at a specified rate. The rates are revised from time to time. **Currently, the employee's contribution rate is 0.75% of the wages and that of employer's is 3.25% of the wages paid/payable in respect of the employees in every wage period. Hence statement 2 is not correct.**
- Employees' State Insurance Corporation ("ESIC") is a statutory corporate body set up under the ESI Act 1948, which is responsible for the administration of the ESI Scheme. It **functions under the Ministry of Labour and Employment. Hence statement 3 is not correct.**

Q 40.C

- **Recent context:** E-way bill generation in October has crossed 10 crore for the first time since its introduction. Data from the Goods and Services Tax Network (GSTN) showed e-way bill generation touched 10.03 crore, surpassing the previous high of 9.34 crore in August, this year.

- A waybill is a receipt or a document issued by a carrier giving details and instructions relating to the shipment of a consignment of goods and the details include name of the consignor, consignee, the point of origin of the consignment, its destination, and route.
- An Electronic Way Bill (E-Way Bill) is basically a compliance mechanism wherein by way of a digital interface the person causing the movement of goods uploads the relevant information prior to the commencement of the movement of goods and generates e-way bill on the GST portal.
- As per Central Goods and Services Tax (CGST) Rules, 2017, **consignment value of more than ₹50,000** is required to generate an e-way bill. This is required for movements **between the two States and within a State.** However, a **State can decide the threshold for the value of goods** to be applicable for movement within its boundary. **Hence statements 1 and 2 are correct.**
- The validity of an e-way bill depends on the distance to be traveled by the goods. For a distance of less than 100 Km, the e-way bill will be valid for a day from the relevant date. For every 100 Km thereafter, the validity will be an additional one day from the relevant date.
- **No e-way bill is required to be generated in the following cases:**
  - Transport of goods as specified in Annexure to Rule 138 of the CGST Rules, 2017
  - **goods being transported by a non-motorized conveyance. Hence statement 3 is correct.**
  - goods being transported from the port, airport, air cargo complex and land customs station to an inland container depot or a container freight station for clearance by Customs;
  - Consignment value less than Rs. 50,000/.

Q 41.B

- **Recent context:** India accounts for 27 percent of the total TB cases in the world, according to the recently released **Global TB Report 2023 by the World Health Organisation.**
- **Key findings:**
- **Global:**
  - The reported global number of people newly diagnosed with TB was 7.5 million in 2022.
  - TB remained the world's second leading cause of death in 2022 after COVID-19.
  - Net reduction of TB incidence from 2015- 2022 was 8.7% far from the WHO End TB Strategy milestone of 50% reduction by 2025.
- **India's findings**
  - India, Indonesia, and the Philippines collectively account for nearly 60% of the reduction in number of people newly diagnosed with TB in 2020- 2021.
  - India has 27% of the world's TB cases.
- **TB is caused by bacillus Mycobacterium tuberculosis** which most often affects the lungs (pulmonary TB). The most **common medications to treat TB include isoniazid, rifampin, ethambutol, pyrazinamide, etc.** Currently, Bacillle Calmette-Guerin is the only licensed vaccine available for TB prevention. It spreads from person to person through air. **Hence option (b) is the correct answer.**
- TB Risk factors: Diabetes, HIV infection, Undernutrition, tobacco use.

Q 42.B

World Network of Biosphere Reserves (WNBR)

- **The World Network of Biosphere Reserves (WNBR) was formed in 1971, as a backbone for biodiversity conservation, ecosystem restoration, and living in harmony with nature. Hence statement 1 is correct.**
- It integrates people and nature for sustainable development through dialogue; knowledge sharing; poverty reduction and human well-being improvements; respect for cultural values and society's ability to cope with change - thus contributing to the Sustainable Development Goals.
- It promotes North-South and South-South collaboration and represents a unique tool for international co-operation.
- **There are 748 biosphere reserves in 134 countries, including 23 transboundary sites.**

Biosphere reserves in India

- **There are 18 Biosphere Reserves in the country and out of which 12 internationally recognised BRs. Hence statement 2 is correct.**
- **12 internationally recognised BRs of India:**
  - Nilgiri
  - Gulf of Mannar

- Sunderban
- Nanda Devi
- Nokrek
- Pachmarhi
- Similipal
- Achanakmar-Amarkantak
- Great Nicobar
- Agasthyamala
- Khangchendzonga
- Panna

- **In India, the first biosphere reserve was designated by UNESCO in 2000, namely, Nilgiri Biosphere Reserve s**tretching over Tamil Nadu, Karnataka and Kerala. **Hence statement 3 is not correct.**

Q 43.A

- **Recent context:** Based on our compliance and reporting, India has been removed from the Review of Significant Trade for Red Sanders. India was under **Review of Significant Trade (RST) process for Red Sanders since 2004.**

- At CoP19, the **CITES Secretariat launched the Review of Significant Trade (RST) Management System, developed by the United Nations International Computing Centre and funded by the European Union. Hence statement 1 is not correct.**
- RST is a process through which the CITES Standing Committee places increased scrutiny on the exports of a species from a country to determine if the Convention is being properly implemented. In the past, it has even led to a recommendation to suspend trade with India. Removing from the RST list is a major boost for the farmers who grow Red Sanders.
- **Red sanders (Pterocarpus santalinus)** is a high market value tree, **endemic to few districts in Andhra Pradesh in southern India.** The species has been listed as Appendix II under CITES since 1994. It is listed under **Schedule IV of the Wildlife Protection Act, 1972. Hence statement 2 is not correct and statement 3 is correct.**

Q 44.B

- **The Kunming-Montreal Global Biodiversity Framework (GBF) was adopted during the fifteenth meeting of the Conference of the Parties (COP 15) following a four year consultation and negotiation process.** This historic Framework, which supports the achievement of the Sustainable Development Goals and builds on the Convention's previous Strategic Plans, sets out an ambitious pathway to reach the global vision of a world living in harmony with nature by 2050. Among the Framework's key elements are 4 goals for 2050 and 23 targets for 2030. **Hence, statement 1 is not correct.**
- The countries will monitor and report every five years or less on a large set of indicators related to progress. The Global Environment Facility has been requested to establish a Special Trust Fund to support the implementation of the Global Biodiversity Framework ("GBF Fund").
- In the GBF, the world made a number of significant commitments to halt and reverse biodiversity loss.
  - It targets to protect 30 per cent of the terrestrial and marine environment.
  - **It targets to put 30 percent of land and marine area under active restoration by 2030 and mobilize US$ 30 billion by 2030. Hence, statement 2 is correct.**
  - It agreed to reduce – at least by half – nutrients introduced into the environment.
  - It agreed to reduce the risk from pesticides and hazardous chemicals by at least half.
  - **It agreed to reduce the rate of introduced invasive species by 50 per cent by 2030** and to eradicate and control those already introduced. **Hence, statement 3 is correct.**
  - And It agreed to eliminate, phase out or reform harmful subsidies, reducing them by US$ 500 billion per year by 2030 – starting with the most harmful.

Q 45.D

- **Carbon - Deep Oceans:**
  - The deep oceans are the largest carbon reservoir on Earth, holding an estimated 38,000 billion metric tons of carbon. This vast storage of carbon is primarily in the form of dissolved inorganic carbon, including bicarbonate (HCO3-) and carbonate (CO3^2-) ions, as well as organic carbon.
  - Carbon is cycled between the atmosphere, terrestrial ecosystems, and the oceans through various processes, including photosynthesis by marine phytoplankton, respiration by marine organisms, and the exchange of carbon dioxide (CO2) with the atmosphere.
  - The deep oceans act as a critical component in the global carbon cycle, helping to regulate atmospheric CO2 levels and playing a role in climate regulation. **Hence pair 1 is not correctly matched.**
- **Phosphorus - Sedimentary Rocks:**
  - Phosphorus is primarily found in sedimentary rocks, such as phosphate minerals like apatite. These rocks store phosphorus for geological timescales.
  - Over time, geological processes, including weathering, uplift, and erosion, release phosphorus from these rocks. This weathered phosphorus enters soils, rivers, and eventually oceans, where it can be used by aquatic organisms.
  - Phosphorus is a crucial element for life, as it is an essential component of nucleic acids (DNA and RNA) and plays a central role in energy transfer in biological systems. **Hence pair 2 is not correctly matched.**
- **Nitrogen - Atmosphere:**
  - The Earth's atmosphere is the largest reservoir of nitrogen, primarily in the form of atmospheric nitrogen gas (N2). Nitrogen gas is highly stable and makes up a significant portion of the atmosphere, accounting for about 78% of the air we breathe.

- While atmospheric nitrogen is abundant, it is in a biologically unavailable form for most organisms. Nitrogen gas needs to be converted into reactive forms, such as ammonia (NH3) or nitrate (NO3-), through a process called nitrogen fixation before it can be used by plants and other living organisms.
- Nitrogen fixation is carried out by certain nitrogen-fixing bacteria and lightning. Once fixed, nitrogen enters the soil and becomes accessible to plants, forming the basis of terrestrial and aquatic food webs.
- These nutrient reservoirs are essential for maintaining life on Earth and play key roles in biogeochemical cycles that impact ecosystems and the environment. **Hence pair 3 is not correctly matched.**

Q 46.B

About Indian elephant (Elephas maximus)

- **Characteristics:-** Highly intelligent animals characterised by strong family bonds, sophisticated forms of communication and complex behaviour, including tool use and the ability to feel grief and compassion.
- **It is the National Heritage Animal of India. The frieze of the circular abacus of Lion Capital is adorned with sculptures an elephant, agalloping horse, a bull and a lion separated by intervening Dharma Chakras. Hence statement 1 is correct.**

Conservation measures:

- **Project Elephant, a centrally sponsored scheme and was launched in 1992 by the Narsimha Rao government for the protection of elephants, their habitats, and corridors.**
- **Elephant census is conducted once in 5 years and there are around 33 Elephant Reserves in India. Hence statement 2 is correct and statement 3 is not correct.**
- **Monitoring the Illegal Killing of Elephants (MIKE),** an international effort for conservation of elephants in Asia and Africa.

Q 47.D

- **Trophic cascades are powerful indirect interactions** that can control entire ecosystems, occurring when a trophic level in a food web is suppressed. For example, a **top-down cascade will occur if predators are effective enough in predation to reduce the abundance,** or alter the behavior of their prey, thereby releasing the next lower trophic level from predation (or herbivory if the intermediate trophic level is a herbivore).
- A **top-down cascade is a trophic cascade where the top consumer/predator controls the primary consumer population.** In turn, the primary producer population thrives. The removal of the top predator can alter the food web dynamics. In this case, the primary consumers would overpopulate and exploit the primary producers. Eventually there would not be enough primary producers to sustain the consumer population. **Hence statement 2 is correct.**
- These trophic interactions shape patterns of biodiversity globally. Humans and climate change have affected these cascades drastically. One example can be seen with sea otters on the Pacific coast of the United States of America. Over time, **human interactions caused a removal of sea otters.** One of their main prey, the pacific purple **sea urchin eventually began to overpopulate.** The overpopulation caused increased predation of giant kelp. As a result, there was **extreme deterioration of the kelp forests along the California coast. Hence statement 1 is not correct.**

Q 48.A

- **Recent context: The World Meteorological Organization** released **the latest Greenhouse Gas Bulletin** and found that levels of carbon dioxide are similar to those found 3 to 5 million years ago.
- The **Greenhouse Gas Bulletin represents the latest analysis of observations from the WMO GAW Programme.** It shows **globally averaged surface mole fractions for carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) and compares them with the mole fractions during the previous year and with the preindustrial levels.** It also provides insights on the change in radiative forcing by long-lived GHGs (LLGHGs) and the contribution of individual gases to this increase. **Hence statement 1 is not correct and statement 2 is correct.**
- **It is published annually.** Since 2006, WMO has published annual Greenhouse Gas Bulletins. The Greenhouse Gas Bulletin of 2023 comes ahead of the UN climate change conference COP28 in Dubai. **Hence statement 3 is not correct.**

- The current bulletin estimates that the current trajectory "puts us on the pathway of an increase in temperatures well above the Paris Agreement targets by the end of this century," he added, referring to efforts to limit global temperature rise to 1.5 degrees Celsius.

Q 49.A

- Calling for international cooperation on **ensuring safe use of Artificial Intelligence (AI),** the Britain government published the **'Bletchley Declaration** agreement with countries like India, Australia, China, and the US among others, on November 1, the first day of the UK AI summit. **Hence option (a) is the correct answer.**
- The declaration, signed by 28 countries, outlines **an agenda for global efforts needed to address "frontier risks" posed by advanced AI models.** According to the declaration, these include foundational models capable of performing a wide variety of tasks or those exhibiting the potential to cause harm.
- The Declaration has also **acknowledged concerns around "unintended issues of control"** over general-purpose AI models that could be opposed to human intent. Calling for international cooperation, the declaration statement calls on countries to balance the **need for "pro-innovation and proportionate governance and regulatory approach that maximizes the benefits" with the risks associated with AI.**

Q 50.D

- An organism can be conserved in a natural/ artificial habitat or in the form of a germplasm (bacterial cultures, animal tissues, seeds etc.) by employing various methods. A number of efforts have been put forward by various governmental and non-governmental organizations aiming for the conservation of biodiversity. It includes certain **in-situ and ex-situ approaches. Emergence of in-vitro technology as an adjunct to ex-situ conservation** is being viewed with great expectations for conservation of threatened species.
- **In-vitro techniques** include the laboratory practices used for the conservation of plant/ animal and microbial diversity through its storage in germplasm banks, propagation via tissue culture methods, preservation using the technique of **cryopreservation, conversion into artificial seeds, maintenance as slow growth cultures, and long term perpetuation as DNA clones.**
- **Germplasm banks:** Germplasm banks or biobanks provide controlled storage facilities of temperature, humidity
  etc. for the material to be conserved. These are variously called as seed banks, gene banks, DNA banks etc. depending on the material that is conserved in them.
- **Seed banks:** In case of plant species, seeds are a convenient means of long term storage of genetic diversity,
  as the samples are small in size, easy to handle, require low maintenance and frequently remain viable for long periods. In seed banks, material in the form of seeds are stored at nearly -10 to -20°C, often using silica gel in the seed containers to reduce humidity.
- **Tissue culture:** It is an in-vitro technique, based on the **concept of "totipotency" of plant cells**. Cellular totipotency is the capability of a cell to give rise to a whole new plant. Mature cells undergo dedifferentiation to become meristematic and then undergo redifferentiation to form a whole new organism. Germplasm available in the form of microbial cultures, cells or organs in case of animal species and seeds, cuttings or vegetative propagules in case of plants is used for micropropagation.
- **Cryopreservation:** It is a technique of preservation of germplasm at ultra low temperature of -196°C i.e. the temperature of liquid nitrogen. The principle underlying cryopreservation involves bringing the culture to a state of non-dividing and zero metabolism, so that any biological activity, is effectively stopped. Cryopreservation also helps in storing tissues of animal origin such as cultured animal cells, spermatozoa, ovarian or embryonic tissues and whole embryos for livestock breeding programmes.
- **Artificial seeds:** Somatic embryos are cultured in vitro through embryogenesis and can be preserved as artificial
  or synthetic seeds by coating with gels like sodium alginate, calcium alginate, and polyacralamide gel etc. which prevent them from desiccating. These somatic embryos are then dehydrated to a suitable level and subjected to slow growth or cryopreservation in a manner similar to zygotic seeds. Production of sodium alginate beads by encapsulation of shoot tips and nodal segments of medicinally important plant Mentha arvensis helps in its in-vitro regeneration and conservation.
- **DNA clones:** DNA, the basic unit of heredity of a cell, can effectively be used for conservation of threatened
  plant species. Germplasm can be stored in the form of DNA segments cloned into a suitable vector such as cosmids, plasmids and bacteriophage. With the recent progress in the field of molecular biology such as

polymerase chain reaction (PCR), combined with gene cloning, small amounts of tissues can provide substantial collections of all the DNA of a plant genome.

- **Hence option (d) is the correct answer.**

Q 51.A

- Joint Forest Management (JFM) is an approach and program initiated in the context of the **National Forest Policy of 1988** wherein state forest departments support local forest-dwelling and forest fringe communities to protect and manage forests and share the costs and benefits from the forests with them. **Here, there is no legal sanction for JFM. Hence statement 2 is not correct.**
- Accordingly, JFM tries to harness the strengths and energy of local rural communities for protecting and managing forests through JFM Committees/ EcoDevelopment Committees and helps to meet their needs for subsistence and livelihood as well as generates local environmental services. **Hence statement 1 is correct.**
- Membership for a JFMC is open for all members of the gram sabha – i.e. voting adults. (in some states membership is open to one male and one female member of each household). The Executive Committee is responsible for managing the overall operations of the JFMC. The JFMC member will elect the Executive Committee from the JFMC/ EDC members, or as defined in the state guidelines.
- JFM has the potential to meet local subsistence needs, of fuelwood, fodder, other non-timber forest produce, small timber and timber etc., to provide livelihood through sale of produce, while at the same time, preventing degradation of the forests that provide local, national and global environmental benefits.

Q 52.B

- **Recent context:** Tamil Nadu Governor has withheld his assent to a batch of 10 Bills, even as at least four opposition-ruled states are before the SC seeking relief from the increasingly common practice of Raj Bhavans halting the elected government's lawmaking process.
- While **Article 163** of the Constitution deals with the powers of the Governor generally, **Article 200** specifically deals with the issue of granting assent to Bills. Both the provisions are read together to determine the contours of the power the Governor holds on this issue.
- When a bill is sent to the governor after it is passed by state legislature, he can:
  - Give his assent to the bill, or
  - Withhold his assent to the bill, or
  - Return the bill (if it is not a money bill) for reconsideration of the state legislature. However, **if the bill is passed again by the state legislature with or without amendments, the governor has to give his assent to the bill. Hence statement 3 is not correct.** or
  - Reserve the bill for the consideration of the president. In one case such **reservation is obligatory, that is, where the bill passed by the state legislature endangers the position of the state high court. Hence statement 2 is correct.**
- In addition, the governor can also reserve the bill if it is of the following nature:
  - Ultra-vires, that is, against the provisions of the Constitution.
  - Opposed to the Directive Principles of State Policy.
  - Against the larger interest of the country.
  - Of grave national importance.
  - Dealing with compulsory acquisition of property under Article the Constitution.
- However, the **Constitution does not prescribe a time limit for the Governor to assent, withhold assent or reserve the Bill** for the consideration of the President. **Hence statement 1 is correct.**

Q 53.C

Sacred Groves

- **Sacred groves are patches of natural vegetation preserved by ancient/indigenous societies on religious and cultural grounds. Hence statement 1 is correct.**
- They are rich in biodiversity and act as habitats of many endangered and threatened plant species.They consists of a dense cover of vegetation including climbers, herbs, shrubs and trees, with the presence of a village deity and is mostly situated near a perennial water source.
- They are considered to be symbols of the primitive practice of nature worship and support nature conservation to a great extent.
- **They are maintained by rural communities. No governments have been involved in their maintenance so far. Hence statement 3 is correct.**

- Many are protected and maintained by the village community by evolving certain taboos and restrictions. Some are also maintained by individual families. In some cases, individual and ancient trees also act as sacred groves, with the idol of a deity under the tree.
- People believe that any damage to the sacred grove would harm any living fauna there or cutting any tree or climber of the grove may cause diseases and failure of agricultural crops.
- Many villages have set apart sanctified land to propitiate the Vanadevadas, or forest spirits. The entire grove is considered sacred in certain areas and worshipped.
- **Sacred groves have been legally protected under 'community reserves' in the Wildlife (Protection) Amendment Act, 2002. Hence statement 2 is correct.**

Q 54.C

BIODIVERSITY HOTSPOTS IN INDIA

- **Himalaya:** Includes the entire Indian Himalayan region (and that falling in Pakistan, Tibet, Nepal, Bhutan, China and Myanmar). **pair**
- **Indo-Burma:** Includes entire North-eastern India, except Assam and Andaman group of Islands (and Myanmar, Thailand, Vietnam, Laos, Cambodia and southern China).
- **Sundalands:** Includes Nicobar group of Islands (and Indonesia, Malaysia, Singapore, Brunei, Philippines).
- **Western Ghats and Sri Lanka:** Includes entire Western Ghats (and Sri Lanka).
- **Hence option (c) is the correct answer.**

Q 55.B

- India has taken several steps to achieve the **National Biodiversity Target no. 6 and Aichi Biodiversity Target no. 11** which aim to conserve a substantial portion of the coastal and marine areas in the country and world respectively.
- Towards achieving these two targets, 106 coastal and marine sites have been identified and prioritized as **Important Coastal and Marine Areas (ICMBAs) by the Wildlife Institute of India.**
- **Sixty-two ICMBAs** have been identified along the **west coast of India, and 44** have been identified along **the east coast.** Of these, 22 ICMBAs have been prioritized for immediate conservation actions and proposed to be upgraded as Protected Areas under categories such as Conservation or Communities Reserve to increase participation of the local communities in governance.
- **Important ICMBAs:**
- **Koteshwar, Jacau, Gasabara, Madhavpur, Diu, Gopnath etc., are located in the state of Gujarat.**
  - **Koteshwar:** This intertidal mudflat is adjacent to the Narayan Sarovar Wildlife Sanctuary. It is located at the mouth of Kori Creek, at the northern extreme of Kachchh District. The site comprises widespread mudflats with stunted mangrove growth. The climate is arid and the area is devoic dense terrestrial vegetation. It is well known as the feeding ground for wetland birds. The entire area is under the control of the Bor Security Force and Naval Coastal Guard. **Hence pair 1 is correctly matched.**
- **Vaitarna creek, Dharamtar, Jaigad, Purnagad, Angria Bank etc., are located in Maharashtra.**
  - **Angria Bank:** This site is a submerged coral area in the Arabian Sea located nearly 105 km west of the coastline on the continental shelf, off Malvan. The site has a clear water plateau, with coral development and associated marine life forms atop an undulating basalt sea floor, at a depth of 20-50 m. Several coral-associated plants, including 57 species of seaweed, are among the important species of the flora. The site is well known as a spawning ground for numerous fishes. Several species of coral are also known to be founder here. **Hence pair 2 is not correctly matched.**
- **Kali estuary, Tadri, Murudeswar, Netrani island, Kundapur etc., are located in Karnataka.**
  - **Kali:** Kali estuary (Kalinadi), opens to the Arabian Sea with a tidal creek—Devgad or Mavin Hole. Fringing and patchy mangroves are found all along this estuary. Fishing (finfish and shellfish) and minor aquacultural practices are the notable livelihood activities around here. **Hence pair 3 is correctly matched.**
- **Kambala estuary, Kolavipalem, Kadalundi, Kumbalanghi etc., are located in Kerala.**
- **Jambudweep, Jambachar, Junput etc., are located in West Bengal.**
  - **Junput:** Junput is an intertidal area to the east of Midnapore District, between Digha and Haldia. The soft-sand-dwelling Red Crabs, molluscs and wetland birds are important faunal groups adding to the biodiversity value of this ecosystem. **Hence pair 4 is not correctly matched.**
- **Chandipur, Paradip, Gopalpur, Bahuda swamp etc., are located in Odisha.**
- **Gangavaram, Pennar, Pulicat, Krishnapatnam etc., are located in Andhra Pradesh.**

Q 56.C

- **Homeostasis:**
  - Ecosystems are capable of maintaining their state of equilibrium. They can regulate their own species structure and functional processes. **This capacity of ecosystem's self-regulation is known as homeostasis. In ecology, the term applies to the tendency for biological systems to resist changes. Hence option (c) is the correct answer.**
  - For example, in a pond ecosystem, if the population of zooplankton increased, they would consume large number of the phytoplankton and as a result, soon zooplankton would be short in supply of food. As the number of zooplankton is reduced because of starvation, the phytoplankton population starts increasing. After some time the population size of zooplankton also increases and this process continues at all the trophic levels of the food chain.
  - Note that in a homeostatic system, negative feedback mechanism is responsible for maintaining stability in an ecosystem.
  - However, the homeostatic **capacity of ecosystems is not unlimited as well as not everything in an ecosystem is always well-regulated. Hence option (a) is not correct.**
- In ecology, homeostasis means that ecosystems have mechanisms and processes in place that help keep their components in check and prevent extreme fluctuations. The key aspects are,

- **Self-Regulation:**
  - ✓ Ecosystems can adjust and regulate themselves to maintain a stable state. For example, if a certain species in an ecosystem experiences a population boom, natural predators or competitors might increase in response to keep that population in check.
- **Stability:**
  - ✓ Homeostasis ensures that ecosystems do not wildly oscillate in terms of population sizes or other key components. It helps maintain a sense of balance and equilibrium.
- **Resilience:**
  - ✓ Ecosystems with strong homeostatic mechanisms are often more resilient. When disturbances occur, such as natural disasters or disease outbreaks, the ecosystem can recover and return to its stable state more readily.
- **Adaptation:**
  - ✓ Homeostasis doesn't mean that ecosystems are static. They can adapt to gradual changes, like shifts in climate or the introduction of new species. This adaptive homeostasis involves shifts in species composition and ecosystem processes to accommodate changes while maintaining stability.
- **Feedback Loops:**
  - ✓ Homeostasis often involves feedback loops. For instance, if a particular species experiences a population boom, this can lead to a cascade of effects within the ecosystem. These effects can eventually bring the population back into balance.
  - ✓ **With the positive feedback loop, an increase in the population leads to more births, which increases the population even more. With the negative feedback loop, an increase in the population reduces the food supply. Less food means more deaths and fewer births.**
  - ✓ **Note that in a homeostatic system, negative feedback mechanism is responsible for maintaining stability in an ecosystem.**

Q 57.C

- The Thar Desert, also known as the Great Indian Desert, is an arid region in the north-western part of the Indian subcontinent that covers an area of 200,000 km2 in India and Pakistan. The Thar Desert is about 4.56% of the total geographical area of India. More than 60% of the desert lies in the Indian state of Rajasthan; the portion in India also extends into Gujarat, Punjab, and Haryana.
- The climate of this region is characterised by excessive drought, the rainfall being scanty and irregular.
  - The winter rains of northern India rarely penetrate into the region.
  - November to March is characterized by extreme varia- tions of temperature and the temperature is frequently below freezing point at night.
  - During April to June the heat are intense, frequent scorching winds prevail with great desiccating.
- The natural vegetation consists of tropical thorn forests and tropical dry deciduous forests, sandy deserts with seasonal salt marshes and mangroves are found in the main estuaries. **Typical shrubs are phog growing on sand dunes. Sewan grass covers extensive areas called pali. Hence statement 1 is correct.**
- Thar desert possesses most of the major insect species. 43 reptile species and moderate bird endemism are found here. No niche of the Thar is devoid of birds. The black buck was once the dominant mammal of the desert region, now confined only to certain pockets. **The gazelle is the only species of the Indian antelope of which the females have horns.** Nilgai the largest antelope of India and the wild ass, a distinct subspecies, is now confined to the **Rann of Kutch which is a breeding site in the Indian subcontinent for the flamingoes.** Other species like desert fox, great Indian bustard, chinkara and desert cat are also found. **Hence statements 2 and 3 are correct.**

Q 58.A

- The productivity of ecosystems can be expressed through many different parameters, viz. **Gross Primary Productivity (GPP), Net Primary Productivity (NPP), Net Community Productivity (NCP) and Secondary Productivity (SP).**
- Since photosynthesis is the first and the basic form of energy storage, it is referred to as primary production. The rate at which this occurs over time is referred to as primary productivity. **The total energy accumulated in the plant during primary productivity is known as Gross Primary Productivity.**
- **The energy remaining after respiration is stored as organic matter and is called Net Primary Productivity (NPP).**
- Net primary productivity can be expressed as NPP = GPP − R, where R is the energy used up in respiration.

- Net primary production accumulates over time as plant biomass**. The amount of accumulated organic matter found in an area at a given time is referred to as the standing crop biomass.** Biomass is usually expressed as grams of organic matter per square metre (g/m 2) or as calories per square metre (cal / m2). Biomass is different from productivity. It is the amount of organic matter present at any given time. Productivity is the rate at which organic matter is created by photosynthesis.
- The net primary productivity does not remain stable over a period of time in ecosystems. Heterotrophs, especially herbivores, feed upon plant biomass. As a result, there is a need to define another term − **the Net Community Production (NCP): It is the rate of production of organic matter not used by heterotrophs.** Thus, it is the net primary production minus heterotrophic consumption for the period under consideration. **Hence option (a) is the correct answer.**

Q 59.B

- **Water cycle (hydrological cycle).**
  - **Water received from the atmosphere on the earth returns back to the atmosphere as water vapour resulting from direct evaporation and through evapotranspiration, the continuous movement of water in the biosphere is called the water cycle (hydrological cycle).**
  - Water from oceans, lakes, ponds, rivers and streams evaporates from the sun's heat energy. Plants also transpire huge amounts of water. Water remains in the vapour state in the air and forms clouds which drift with the wind. Clouds meet with the cold air in the mountainous regions above the forests and condense to form rain precipitate which comes down due to gravity.
- **Distribution of water:**
  - Water is not evenly distributed throughout the surface of the earth. **Almost 95 % of the total water on the earth is chemically bound to rocks and does not cycle.** Out of the remaining 5%, nearly 97.3% is in the oceans and 2.1% exists as polar ice caps. Thus only 0.6% is present as fresh water in the form of atmospheric water vapours, ground and soil water. **Hence statement 1 is correct.**
  - **The driving forces for the water cycle are 1) solar radiation and 2) gravity. Hence statement 2 is correct.**
- **Evaporation and precipitation are two main processes involved in water cycle.** These two processes alternate with each other.
  - **On an average 84% of the water is lost from the surface of the through oceans by evaporation.** While 77% returns to it from precipitation. Water runoff from lands through rivers to oceans makes up 7% which balances the evaporation deficit of the ocean. In other words, **Precipitation in oceans is less than Evaporation. Whereas On land, evaporation is 16% and precipitation is 23%. Hence statement 3 is not correct.**

Q 60.B

Madhav National Park

- **It is situated in Shivpuri District, Madhya Pradesh. and is a part of the upper Vindhyan hills. It was the hunting ground of Mughal emperors and Maharaja of Gwalior. It got the status of a National Park in 1959. Hence pair 1 is not correctly matched.**
- Ecosystem: It has a diverse ecosystem consisting of lakes, dry deciduous & dry thorn forests. **The forest is home to tigers, leopards, Nilgai, and Chinkara (Gazella bennettii) and Chousingha (Tetracerus quadricornis) and Deers (Chital, Sambar and Barking Deer) among others.**
- **Tiger Corridor:** The Park falls within one of the 32 major Tiger Corridors of the country, which are operationalised through the Tiger Conservation Plan. Tiger Conservation Plan is implemented under the Wildlife (Protection) Act, 1972.
- **Madhav National Park is a part of the Ranthambhore-Kuno-Madhav (Madhya Pradesh and Rajasthan) Tiger Corridor of Central India & Eastern Ghats landscape.**

Kuno Palpur National Park:

- **It lies in Sheopur district of Madhya Pradesh in Central India near the Vindhyan Hills. Initially established as a wildlife sanctuary, it was only in 2018 that the government changed its status into a national park. Hence pair 2 is correctly matched.**
- Named after the **Kuno River (One of the main tributaries of the Chambal River) that cuts across it, Kuno is primarily a grassland region.**
- **Flora and Fauna:** The protected area of the forest is home to the jungle cat, Indian leopard, sloth bear, Indian wolf, striped hyena, golden jackal, Bengal fox and dhole, along with more than 120 bird species

- **Kuno National Park was selected under 'Action Plan for Introduction of Cheetah in India'.**

Sanjay Gandhi National Park:

- **It is located in the state of Maharashtra which was formerly known as Borivali National Park. The 2400-year-old Kanheri caves are sculpted out of the rocky cliff which lies within the park. Hence pair 3 is correctly matched.**
- Flora: Kadamba, Teak, Karanj, Shisham, and species of acacia, Ziziphus, euphorbias etc are found in this National Park.
- Fauna: Chital, Rhesus macaque, Bonnet macaque, Black-naped, Bengal Tiger etc.

Kanger Valley National Park:-

- **It is located in the state of Chhattisgarh. The name of Kanger Ghati National Park is derived from the Kangar river, which flows in its length. It got the status of a national park in the year 1982. Hence pair 4 is not correctly matched.**
- It is a typical mixed humid deciduous type of forest, in which the Sal, Saugaun, teak and bamboo trees are available in abundance.
- The most popular species in this area is Bastar Maina (The state bird of Chattisgarh). Bastar Maina, is a type of Hill maina (gruncula Dhariosoa), which is capable of emulating the human voices.

Q 61.D

- The Convention on Biological Diversity (CBD) is the international legal instrument for "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" that has been ratified by 196 nations.
- Its overall objective is to encourage actions, which will lead to a sustainable future.
- The conservation of biodiversity is a common concern of humankind. The Convention on Biological Diversity covers biodiversity at all levels: ecosystems, species and genetic resources.
- The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives:
  - The conservation of biological diversity.
  - The sustainable use of the components of biological diversity.
  - The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.
- It also covers biotechnology, including through the Cartagena Protocol on Biosafety.
- In fact, it covers all possible domains that are directly or indirectly related to biodiversity and its role in development, ranging from science, politics and education to agriculture, business, culture and much more.
- The CBD's governing body is the Conference of the Parties (COP). This ultimate authority of all governments (or Parties) that have ratified the treaty meets every two years to review progress, set priorities and commit to work plans.
- The Secretariat of the Convention on Biological Diversity (SCBD) is based in Montreal, Canada. Its main function is to assist governments in the implementation of the CBD and its programmes of work, to organize meetings, draft documents, coordinate with other international organizations and collect and spread information. The Executive Secretary is the head of the Secretariat.
- **The Cartagena Protocol on Biosafety to the Convention on Biological Diversity is an international agreement which aims to ensure the safe handling, transport and use of living-modified organisms (LMOs)** resulting from modern biotechnology that may have adverse effects on biological diversity, taking also into account risks to human health. It was adopted on 29 January 2000 and entered into force on 11 September 2003. **Hence, statement 2 is not correct.**
- **The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity is an international agreement which aims at sharing the benefits arising from the utilization of genetic resources in a fair and equitable way.** It entered into force on 12 October 2014, 90 days after the date of deposit of the fiftieth instrument of ratification. **Hence, statement 1 is not correct.**
- **Hence, option (d) is the correct answer.**

Q 62.C

- Biota is the animal and plant life of a particular region, habitat, or geological period. The marine habitat is distinguishable into two zones:Marine biota can be classified broadly into those organisms living in either the pelagic environment (plankton and nekton) or the benthic environment (benthos). Some organisms,

however, are benthic in one stage of life and pelagic in another. Producers that synthesise organic molecules exist in both environments.

- The marine habitat is distinguishable into two zones:
- **Benthic Zone:** It forms the basin or floor of the ocean, regardless of depth. The benthic environment is divided into a number of distinctive ecological zones based on depth, seafloor topography, and vertical gradients of physical parameters. These are the **supralittoral, littoral, sublittoral, bathyal, abyssal, and hadal zones.**
- **Pelagic Zone:** It represents the free water zone, filling the basin. The water contained in the sea basin, constitute the pelagic zone which is further divided into the following zones:
  - The **neritic zone** situated above the sub littoral zone or the continental shelf.
  - **Deep open sea of the oceanic zone** which is divided on the basis of light penetration as discussed in the physico-chemical property of light of the oceans.
- **Biota of Oceans:**
- **Biota of Littoral Zone:**
  - It is the shore region which is continuously disturbed by waves, tides, temperature, salinity and light. The animals are largely dependent on planktons and detritus or dead particles. The non diatoms and other algae are also found in this zone. Crustaceans and worms burrow in the sand and other microscopic organisms such as copepods, protozoan and rotifers live in the water.
- **Biota of the Neritic zone:**
  - This zone occurs below littoral zone and **constitutes about 75% of total area of ocean.** The structure of community changes with change in depth. This zone show high productivity as the light can penetrate deeper and also exhibit higher species diversity due to presence of abundant nutrients.
  - The communities in neritic zone are richer and more diverse then the communities present in either open sea or even in the tropical rain forests. **The most common producers are phytoplanktons such as diatoms and dinoflagellates.** In addition, availability of light causes the development of different algal species, ranging from giant **kelp forest** to smaller communities of red, green and brown algae which are attached to the bottom, also significantly influence the productivity of neritic zone. **Hence statement 2 is correct.**
- **Biota of Pelagic Zone:**
  - This region constitutes 90 per cent of the total ocean surface and is **less rich in species and numbers of organisms than the above two regions.** The most abundant pelagic phytoplanktons are still the dinoflagellates and diatoms. **Hence statement 1 is correct.**

Q 63.C

- **TRAFFIC is an organization that was established in 1976 by WWF and IUCN as a wildlife trade monitoring network to undertake data collection, analysis, and provision of recommendations to inform decision-making on wildlife trade. Hence, statement 1 is correct.**
- For over 40 years TRAFFIC performed that function as a leader in wildlife trade research, as a joint program of WWF and IUCN.
- TRAFFIC became an independent non-profit organization in 2017, with WWF and IUCN sitting on its Board of Directors along with independent Board members.
- TRAFFIC is renowned globally for its expertise and influence in the wildlife trade and conservation arena, as a provider of objective and reliable information.
- Its expert staff implement innovative projects and create new tools to deliver the mission of protecting nature and supporting sustainable development, by resolving wildlife trade challenges.
- **TRAFFIC specializes in providing information analytics on illegal trade networks and supply chains, targeting the kingpins, illegal markets, and new trends in trafficking. Hence, statement 2 is correct.**
- **Project Spotlight -** To support enforcement detection of wildlife contraband within shipments at ports, airports, and border crossings, TRAFFIC is developing a transferrable technology to **expedite sniffer dog detection of illegal wildlife hidden in freight. Hence, statement 3 is correct.**
- The technology is an affordable, generic version of target odour filtering systems that rapidly extract and concentrate odours from freight containers for a dog's detection. The aim is to make open-source technology for conservation applications and wildlife law enforcement using locally sourced materials.

Q 64.C

- **The Convention on Biological Diversity (CBD)** is a legally binding multilateral environmental agreement that has 194 contracting Parties (Countries) as its members with three objectives – conservation of biological diversity, sustainable use of the diversity and ensuring fair and equitable sharing of benefits of such use.
- A three tiered structure has been established under the **Biological Diversity Act, 2002** at the national, state and local levels.
  - At the local level, the **Biodiversity Management Committees (BMCs)** are to be established by institutions of local self-government for implementation of specific provisions of the Act and Rules.
  - At the state level, the **State Biodiversity Boards (SBBs)** are established to deal with all matters relating to implementation of the Act and the Rules.
  - At the national level, the **National Biodiversity Authority (NBA)** is established to deal with all matters relating to implementation of the Act and the Rules. Each of these structure are required to be connected for decision making processes on various issues, including on issues of access and benefit sharing (ABS). **Hence statement 1 is correct.**
- To check misappropriation of Indian biological resources, the Act provides that access to Indian biological resources and associated knowledge are subject to terms and conditions, which secure equitable sharing of benefits. Further, it would be required to **obtain the approval of the National Biodiversity Authority before seeking any IPR based on biological material and associated knowledge obtained from India. Hence statement 2 is correct.**
- As per the **provisions of BD Act human genetic material is excluded from the definition of biological resources** and prior approval of NBA is not needed. **Hence statement 3 is correct.**

Q 65.D

- **Boreal or North Coniferous Forest:** Coniferous forests are also known as 'Taiga'. They extend as a continuous belt across North America and North Eurasia below the Arctic tundra.
  - The boreal forest is the **largest forest in the world**, comprising around 60 percent and wrapping right around Earth's entire northern hemisphere like a giant green headband. It **acts as the lungs of the planet, producing much of the air we breathe and influencing the world's climate.**
  - There is no counterpart of these forests in the southern hemisphere as there is no land at this latitude. Climate is cold with long, harsh winters, with a mean annual temperature below 0 degrees. The soils are acidic and poor in nutrients.
    - ✓ **Location:** Boreal forests are mainly found in the northern regions of North America and Eurasia, just below the Arctic tundra. These areas experience long, harsh winters with cold temperatures, and the forest is adapted to these conditions.
    - ✓ **Tree Types:** It consists of **evergreen, drought-resistant**, **woody coniferous trees, including species like spruce, fir, and pine.** These trees bear naked seeds in cones.
    - ✓ **Animal Species: The animal species found in this forest typically include red squirrels, deer, goats, mules, moose, and carnivores like timber wolves and lynxes.**
    - ✓ **Soil Characteristics:** T**he soils in the boreal forest are generally acidic and poor in nutrients.**
    - ✓ **Plant Adaptations:** The evergreen nature of the coniferous trees is an adaptation to the long, cold winters, allowing them to photosynthesize even during the winter months. Additionally, their needle-like leaves help reduce water loss, which is essential in cold climates.
    - ✓ **Animal Adaptations:** Many animals in the boreal forest, such as moose and lynxes, have adaptations to survive in cold environments. These adaptations can include thick fur or feathers for insulation, and they often have seasonal changes in fur color to blend in with the snowy landscape.
    - ✓ **Importance:** Boreal forests are significant for their role in carbon sequestration and as habitat for a variety of wildlife. They are also important for their contribution to the global carbon cycle.

Q 66.C

- **Ecological efficiency:**
  - **Ecological efficiency refers to the percentage of energy transferred from one trophic level to another in an ecosystem.** In other words, it measures how efficiently energy is converted and passed on from one group of organisms to the next in a food chain or food web. Ecological efficiency is an essential concept in ecology as it helps us understand the dynamics of energy flow and the structure of ecosystems. **Hence option (c) is the correct answer.**
  - It is clear from the trophic structure of an ecosystem that the amount of energy decreases at each subsequent trophic level. **This is due to two reasons:**

- ✓ **Energy Transfer:** In an ecosystem, energy is initially captured by primary producers, typically green plants, through photosynthesis. These producers convert solar energy into chemical energy stored in organic compounds (biomass). However, not all of the captured energy is available for consumption by higher trophic levels. **At each trophic, a part of the available energy is lost in respiration or used up in metabolism.**
- ✓ **Energy Loss:** As energy flows through the ecosystem, there are inefficiencies and losses at each trophic level. These losses occur primarily due to metabolic processes, respiration, and the fact that not all parts of a plant are consumed by herbivores. Some energy is lost as heat during various physiological processes. **A part of energy is lost at each transformation, i.e. when it moves from a lower to higher trophic level as heat.**

- o **Efficiency Percentage:** The ratio between the amount of energy acquired from the lower trophic level and the amount of energy transferred from higher trophic level is called ecological efficiency.
  - ✓ Lindman in 1942 defined these ecological efficiencies for the 1st time and proposed 10% rule e.g. if autotrophs produce 100 cal, herbivores will be able to store 10 cal. and carnivores 1cal. However, there may be slight variations in different ecosystems and ecological efficiencies may range from 5 to 35%.

Q 67.C

- **National Board for Wildlife** - It is established **under section 5A of the Wildlife Protection Act** and serves as an apex body for the review of all wildlife-related matters and for the approval of projects in and around national parks and sanctuaries. **Hence, option 1 is correct.**
- **Central Zoo Authority - It was established under section 38A of the Wildlife Protection Act** and consists of a total of 10 members including the Chairperson and a Member-Secretary. The authority provides recognition to zoos and is also tasked with regulating the zoos across the country. It lays down guidelines and prescribes rules under which animals may be transferred among zoos nationally and internationally. **Hence, option 2 is correct.**
- **Wildlife Crime Control Bureau** - The **Wildlife Protection Act under section 38Y** provides for the constitution of WCCB to combat organized wildlife crime in the country. **Hence, option 3 is correct.**
- **Wildlife Institute of India - Established in 1982 by government order,** the Wildlife Institute of India (WII) is an internationally acclaimed Institution, which offers a training program, academic courses and advisory in wildlife research and management. The Institute is actively engaged in research across the breadth of the country on biodiversity-related issues. **Hence, option 4 is not correct.**

Q 68.D

- Mimosa pigra, commonly known as the giant sensitive tree, is a species of plant of the genus Mimosa, in the family Fabaceae. The genus Mimosa contains 400–450 species, most of which are native to South America.
- Mimosa pigra is on the list on the **world's 100 worst invasive species** in the Invasive Species Specialist Groups Global Invasive Species Database.
- In Australia, Mimosa pigra has been declared a noxious weed or given similar status under various weed or quarantine acts. It has been ranked as the tenth most problematic weed and is listed on the Weeds of National Significance. It is currently restricted to the Northern Territory where it infests approximately 80,000 hectares of coastal floodplain.
- **Hence, option (d) is the correct answer.**

Q 69.A

Karlapat Wildlife Sanctuary

- **It is a wildlife sanctuary located in the Kalahandi district in Odisha. The sanctuary is famous for the lush green dry deciduous forest. Hence pair 1 is correctly matched.**
- **Flora:** The sanctuary consists of flora like Sal, Bija, Asan, Harida, Amala, Bahada, Bamboo and varieties of medicinal plants.
- **Fauna:** The sanctuary is home to a plethora of wildlife animals such as leopard, gaur, sambar, nilgai, barking deer, elephants, mouse deer, soft claws ottawa, and a wide variety of birds.
- **Waterfalls:** It is famous for the Phurlijharan waterfall.

Nagi- Nakti Bird Sanctuary

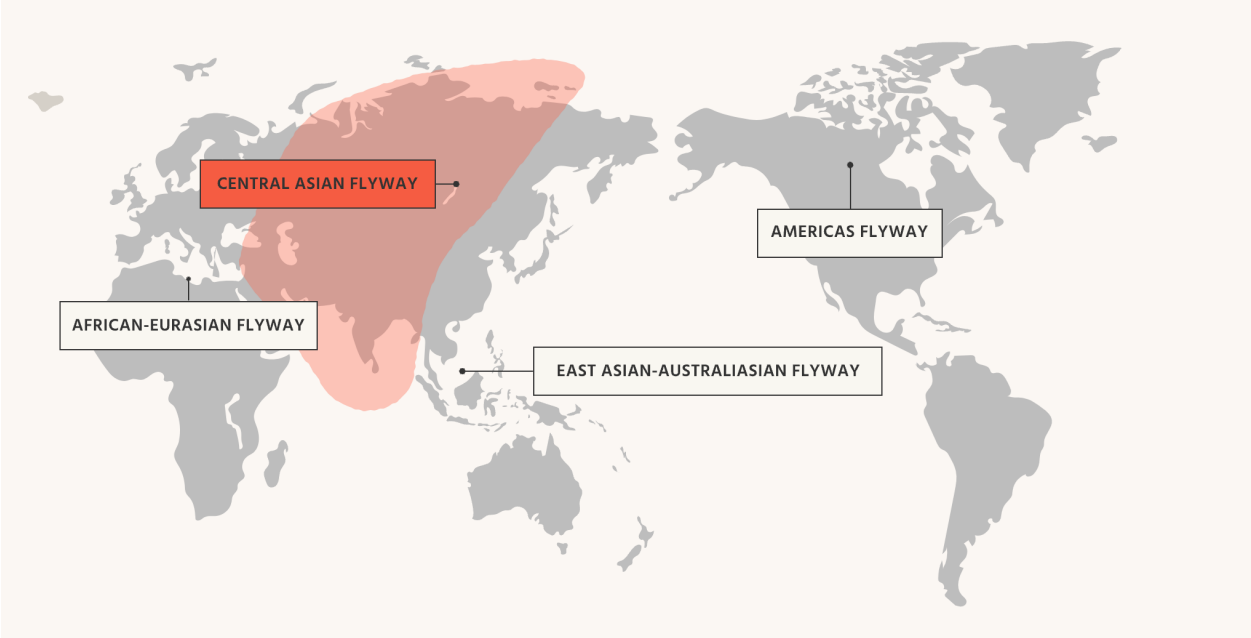
- **Location: It is located in the Jamui district, Bihar. Hence pair 2 is not correctly matched.**
- They are although two different sanctuaries but they can be taken as one bird area due to their closeness. These notified sanctuaries are surrounded by rocky hillocks, formed by the damming of streams.
- **Important Bird Area:** Birdlife International has declared it as an important bird area due to a rare phenomenon. I.e., **the appearance of Around 1,600 bar-headed geese at this sanctuary which is about 3% of the global population of this variety.**
- **Fauna:** These sanctuaries are home to a wide variety of indigenous species and migratory birds that turn up during the winters from places like Eurasia, Central Asia, the Arctic Circle, Russia, and Northern China.
- **Significance:** The sanctuary is unique for its rock formation, "tor" in the Jamui area. In India, this rock formation is available only in Hampi in Karnataka.

Dehing Patkai wildlife sanctuary

- It is also known as the Jeypore Rainforest. It is a **part of the Dehing Patkai Elephant Reserve.** Dehing is the name of the river that flows through this forest and Patkai is the hill at the foot of which the sanctuary lies.
- **Location: It is located in the districts of Dibrugarh and Tinsukia in Assam. Hence pair 3 is not correctly matched.**
- **Flora:** It is a deciduous rainforest interspersed with semi-evergreen and lush green flora. **It is the only patch of virgin rainforest in Assam.**
- **Fauna:** It includes Chinese pangolin, Flying fox, Rhesus macaque, Assamese macaque, Himalayan black bear, Lesser Adjutant Stork, White and Slender-billed Vulture, Leopard, Golden Cat, Jungle Cat, and Marbled Cat.

Q 70.B

- Migration remains one of the most compelling aspects of the avian world. Twice a year, billions of birds migrate vast distances across the globe. Typically, these journeys follow a predominantly north-south axis, linking breeding grounds in arctic and temperate regions with non-breeding sites in temperate and tropical areas.
- Many species migrate along broadly similar, well-established routes known as flyways.
- **Recent research has identified eight such pathways: the East Atlantic, the Mediterranean/Black Sea, the East Asia/East Africa, the Central Asia, the East Asia/Australasia, and three flyways in the Americas and the Neotropics. Hence, statement 1 is not correct.**
- **The Central Asian Flyway is the shortest flyway in the world. Hence, statement 2 is correct.**
- **Lying entirely within the Northern Hemisphere, it connects a large swathe of the Palaearctic with the Indian subcontinent.**
- Separating the subcontinent from the Tibetan Plateau to the north are the Himalayas, which rise to over 8km and stretch 200km from north to south. Many of the migratory birds that breed in the mid-Palaearctic choose to avoid this formidable barrier and instead make a longer, south-westerly flight to Africa for the northern winter.
- There are however several Palaearctic breeders that do migrate to South Asia.
- Most 'squeeze' into the Indian subcontinent via routes at the two ends of the Tibetan massif.
- **Others, like the Bar-headed Goose Anser indicus, follow a route directly over the Himalayan range. The species is the world's highest-altitude migrant, capable of clearing even Mount Everest. Hence, statement 3 is correct.**



Q 71.C

- **Tree Nymph butterfly (Idea malabarica)**
  - IUCN Red list Status – Near Threatened
  - Found in Southern India, especially the Western Ghats. It is one of the l**argest butterfly species of India**, with a wingspan up to 160 cm. Can be easily identified with black spots on an off-white grey-colored body, it has a gliding flight and habit of hovering over a particular spot.
- **Orange oak leaf or dead leaf butterfly (Kallima inachus)**
  - IUCN Red list Status – Least concern in India
  - Found all over north, northeastern, central, and few parts of western India. Looks like a dead leaf when the wings are closed but spectacular blue and orange colored patterns are seen when the wings are open.
- **Tamil lacewing (Cethosia nietneri)**
  - IUCN Red List Status – Not evaluated
  - An **endemic butterfly** found in parts of the Western Ghats mountain range in India. Among the 332 butterfly species found in the Western Ghats, 36 species are found nowhere else in the world.
- **Great windmill Swallowtail Butterfly (Byasa dasarada)**
  - IUCN Red List Status – Not evaluated
  - Found in northern and northeast India. The wavy tail wing with prominent red and white spots is what gives this **butterfly** its captivating beauty. The pupa or chrysalis of this butterfly is yellow-green in colour with blue bands. The pupa squeaks when touched!
- **Hence, option (c) is the correct answer.**

Q 72.D

- **Bioaccumulation:** It refers to how pollutants enter a food chain. In bioaccumulation there is an increase in concentration of a pollutant from the environment to the first organism in a food chain.
- **Biomagnification:** It refers to the tendency of pollutants to concentrate as they move from one trophic level to the next. Thus in biomagnification there is an increase in concentration of a pollutant from one link in a food chain to another.
- We are concerned about these phenomena because together they enable even small concentrations of chemicals in the environment to find their way into organisms in high enough dosages to cause problems. In order for biomagnification to occur, the pollutant must be
  - **long-lived;**
  - **mobile;**
  - **soluble in fats;**
  - **biologically active. Hence option (d) is the correct answer.**
- If a pollutant is short-lived, it will be broken down before it can become dangerous. If it is not mobile, it will stay in one place and is unlikely to be taken up by organisms. If the pollutant is soluble in water, it will be excreted by the organism. Pollutants that dissolve in fats, however, may be retained for a long time.

- It is traditional or customary to measure the amount of pollutants in fatty tissues of organisms such as fish. In mammals, we often test the milk produced by females, since the milk has a lot of fat in it and because the very young are often more susceptible to damage from toxins (poisons). If a pollutant is not active biologically, it may biomagnify, but we really do not worry about it much, since it probably, will not cause any problems.

Q 73.C

- **Decomposition:**
  - Decomposition is an important process in an ecosystem. It will keep the ecosystem clean and make our soil fertile. The decomposition process is done by the organisms called decomposers and it is a five-stage process in which dead organisms or substances are broken down into simpler organic or inorganic matter. It maintains the balance of an ecosystem.
- **Decomposition Process**:
  - **Fragmentation**:
    - ✓ Fragmentation is the first stage of the decomposition process. In this process, the invertebrates (Detitivoes) feed on the dead remains of plants and animals(Detritus). The complex organic matter passes through the digestive tract of detritivores and is degraded into small particles.
  - **Leaching:**
    - ✓ Leaching is the second stage of the decomposition process. In this process, the water-soluble organic particles are transferred to the soil horizon and it gets precipitated as unavailable salt.
  - **Catabolism**:
    - ✓ Catabolism is the third stage of the decomposition process. After breaking down the complex organic matters and removing water-soluble nutrients, the detritus is converted into small inorganic compounds. This process is done by various bacteria and fungi(Decomposers)
  - **Humification**:
    - ✓ The above three stages are simultaneous. After that, the detritus is converted into humus. The process of formation of humus is known as humification and it is a rich fertilizer for the soil. It is highly resistant to microbial actions so it decomposes at an extremely slow rate. This stage of decomposition takes more time than other stages.
  - **Mineralization**:
    - ✓ This is the last stage of the decomposition process. In this, the humus (colloidal nature) is converted into inorganic nutrients by some microbes. The inorganic nutrients are again used by plants and again the food chain begins.
- **Hence option (c) is the correct answer.**

Q 74.B

- The United Nations has adopted the **High Seas Treaty, the first-ever international treaty to govern the high seas. It is aimed at protecting and governing activities such as fishing, mining, and oil extraction in international waters. Hence, statement 3 is correct.**
- The treaty, officially known as the Biodiversity Beyond National Jurisdiction Treaty (BBNJ), has been signed by nearly 200 nations after 15 years of discussions. However, the treaty still needs to be ratified by at least 60 member nations to take effect. The next ocean conference in June 2025 in Nice, France, is expected to witness the completion of ratifications.
- The high seas are the parts of the ocean that are **not included in the exclusive economic zones, territorial sea or internal waters of a State. Hence, statement 2 is not correct.**
  - Water beyond 200 nautical miles from the coast of a country is known as high sea.
  - High seas are the areas of the ocean for which no one nation has sole responsibility for management.
- **This treaty will be legally binding in nature. Hence, statement 1 is correct.**
- Important features:
  - It establishes Marine protected areas (MPAs) and puts more money into marine conservation and new rules for mining at sea.
  - Arrangements for sharing marine genetic resources, such as biological material from plants and animals in the ocean.
  - Richer nations have pledged money for the delivery of the treaty.
  - It also includes guidelines to measure the environmental impacts of high sea activities like fishing and mining and requires countries to present an assessment of those impacts to the UN about any activities that the country is doing in international waters.

Q 75.A

- **Nitrogen cycle:**
  - Nitrogen is an essential component of protein and is required by all living organisms including human beings. Our atmosphere contains nearly 79% of nitrogen but it can not be used directly by the majority of living organisms. Broadly like carbon dioxide, nitrogen also cycles from the gaseous phase to solid phase then back to gaseous phase through the activity of a wide variety of organisms. Cycling of nitrogen is vitally important for all living organisms. **There are five main processes in the nitrogen cycle which are,**
- **Nitrogen fixation:**
  - This process involves **conversion of gaseous nitrogen into Ammonia,** a form in which it can be used by plants. Atmospheric nitrogen can be fixed by the following three methods:-
    - ✓ **Atmospheric fixation:** Lightening, combustion and volcanic activity help in the fixation of nitrogen.
    - ✓ **Industrial fixation:** At high temperatures (400oC) and high pressure (200atm.), molecular nitrogen is broken into atomic nitrogen which then combines with hydrogen to form ammonia.
    - ✓ **Bacterial fixation:** There are two types of bacteria-
    - ✓ **Symbiotic bacteria:** E.g. Rhizobium in the root nodules of leguminous plants.
    - ✓ **Freeliving:** e.g. 1. Nostoc 2. Azobacter 3. Cyanobacteria can combine atmospheric or dissolved nitrogen with hydrogen to form ammonia.
- **Nitrification:**
  - It is a process by which **ammonia is converted into nitrates or nitrites** by Nitrosomonas and Nitrococcus bacteria respectively. Another soil bacteria Nitrobacter can convert nitrate into nitrite. **Hence Pair 1 is not correctly matched.**
- **Assimilation:**
  - Assimilation involves the conversion of gaseous nitrogen, typically atmospheric nitrogen (N2), into ammonia (NH3) or ammonium ions (NH4+). This process is vital because most plants cannot directly use atmospheric nitrogen. **Hence Pair 2 is correctly matched.**
- **Ammonification:**
  - **Ammonification is the process by which nitrogenous waste products, such as urea and uric acid, and the remains of dead organisms are converted into inorganic ammonia (NH3) or ammonium ions (NH4+)**. This process is carried out by various decomposer organisms, particularly ammonifying bacteria. By breaking down organic nitrogen-containing compounds into ammonia, ammonification recycles nitrogen back into the ecosystem. This ammonia can then be further transformed in the nitrogen cycle. **Hence Pair 3 is correctly matched.**
- **Denitrification:**
  - The **conversion of nitrates back into gaseous nitrogen is called denitrification.** Denitrifying bacteria live deep in soil near the water table as they like to live in oxygen-free medium. Denitrification is the reverse of nitrogen fixation. **Hence Pair 4 is not correctly matched.**

Q 76.B

- **Recent context: Union Minister for Commerce and Industry,** Consumer Affairs, Food and Public Distribution and Textiles, Shri Piyush Goyal, participated in the **Investor Forum of the Partnership for Global Infrastructure and Investment (PGII) & Indo-Pacific Economic Framework for Prosperity (IPEF).**
- **The Partnership for Global Infrastructure and Investment (PGII) is a collaborative effort by Group of Seven(G7)** to fund infrastructure projects in developing nations based on the trust principles of the Blue Dot Network. **Hence statement 1 is not the correct answer.**
- It is considered to be the bloc's counter to China's Belt and Road Initiative and a key component of the "Biden Doctrine". The partnership plan was announced for the first time in June 2022 during the 48th G7 summit in Germany.
- **The Partnership for Global Infrastructure and Investment (PGII)** is a shared G7 commitment to **advance public and private investments in sustainable, inclusive, resilient and quality infrastructure.** Through this partnership, the G7 aims to mobilize up to USD 600 billion by 2027 in order to narrow the infrastructure investment gap in partner countries. **Hence statement 2 is correct.**
- All PGII projects will be driven by "four priority pillars that will define the second half of the 21st century".
  - First, the G7 grouping aims to tackle the climate crisis and ensure global energy security through clean energy supply chains.

- Second, the projects will focus on bolstering digital information and communications technology (ICT) networks facilitating technologies such as 5G and 6G internet connectivity and cybersecurity.
- Third, the projects aim to advance gender equality and equity, and
- lastly, to build and upgrade global health infrastructure.

Q 77.A

- **Recent context:** The district court of The Hague, in the Netherlands, has rejected a plea by the Indian government to set aside a compensation award of $111 million made by a tribunal in favour of foreign investors in the Bengaluru satellite services start-up firm Devas Multimedia over the cancellation of a 2005 satellite deal with ISRO's Antrix Corporation in 2011.
- Three **Mauritius-based investors in Devas Multimedia** were awarded $111 million in compensation by **the United Nations Commission on International Trade Law (UNCITRAL) tribunal in The Hague** on October 13, 2020, over the failed Devas-Antrix satellite deal.
- The United Nations Commission on International Trade Law is the **core legal body of the United Nations system** in the field of international trade law. **The United Nations Commission on International Trade Law (UNCITRAL) was established by the General Assembly in 1966. Hence statement 1 is not correct.**
- The Commission carries out its work at annual sessions, which are held in alternate years at United Nations Headquarters in New York and at the Vienna International Centre at Vienna. Each working group of the Commission typically holds one or two sessions a year, depending on the subject matter to be covered; these sessions also alternate between New York and Vienna.
- It has 70 members. The membership is representative of the various geographic regions and the principal economic and legal systems of the world. **Members of the Commission are elected by the General Assembly for terms of six years,** the terms of half the members expiring every three years. **Hence statement 2 is correct.**
- The issues dealt with by the WTO and UNCITRAL are different. The WTO deals with trade policy issues, such as trade liberalization, abolition of trade barriers, unfair trade practices or other similar issues usually related to public law, whereas UNCITRAL deals with the laws applicable to private parties in international transactions. As a consequence, **UNCITRAL is not involved with "state-to-state" issues such as anti-dumping, countervailing duties, or import quotas. Hence statement 3 is not correct.**

Q 78.C

About Indian Tiger or Royal Bengal Tiger (Panthera Tigris)

- **Tiger is a species native to India and is flagship species of India, also declared as the National Animal of India. It is both an Umbrella species and a Keystone species (has a disproportionately large effect on its natural environment relative to its abundance). Hence statement 1 is correct.**
- **Habitat: Largest population is in India,** smaller groups in Bangladesh, Nepal, Bhutan, China and Myanmar.
- **Distribution of Tiger population in India:** Habitats ranging from the high mountains, mangrove swamps, tall grasslands, to dry and moist deciduous forests, as well as evergreen and shola forest systems.
- **Madhya Pradesh has the maximum number of tigers followed by Karnataka and Uttarakhand.**

About Project tiger

- **A Centrally Sponsored Scheme of the Ministry of Environment, Forests and Climate Change, launched in 1973 which provides central assistance to tiger range States for in-situ conservation of tigers in designated tiger reserves. Hence statement 2 is correct.**
- Implementing Agency: Statutory body National Tiger Conservation Authority (NTCA), established through Wild Life (Protection) Amendment Act, 2006.

Alteration and de-notification of tiger reserves

- **The boundaries of tiger reserves cannot be altered without the recommendation of National Tiger Conservation Authority and the approval of the National Board for Wildlife. Hence statement 3 is correct.**

Q 79.C

- **Nagoya Protocol:**
  - The Nagoya Protocol, a pivotal component of the Convention on Biological Diversity (CBD), was established to address the critical issue of **biopiracy and ensure the just and equitable sharing of benefits derived from the utilization of genetic resources. Hence option (c) is the correct answer.**
- **Key elements of Nagoya Protocol:**
  - **Preventing Biopiracy:**
    - ✓ Biopiracy involves the unauthorized exploitation of genetic resources, which can encompass various biological materials, from plants to microorganisms, without the informed consent of the countries or communities where these resources originate. The Nagoya Protocol aims to prevent such exploitative practices.
  - **Scope of Genetic Resources**:
    - ✓ The Protocol's scope includes any non-human genetic resource. This broad definition encompasses a wide range of biological materials used in research, development, and commercial activities.
  - **Rights of Provider Countries**:
    - ✓ Under the Nagoya Protocol, countries where genetic resources exist have the rights to control access to these resources. These provider countries fall into two categories:
      - Originating countries where the genetic resource exists in situ, meaning it's found in its natural habitat.
      - Originating countries where the genetic resource exists ex situ, indicating that the resource was obtained from its natural habitat and then preserved outside of it.
  - **Burden on Users**:
    - ✓ Users of genetic resources, such as researchers and organizations, bear the responsibility of demonstrating that they have legally obtained the genetic resources they are studying. To do this, they must:
      - Obtain prior informed consent from the providing country (the in situ country) before accessing genetic resources.
      - Provide a fair and equitable share of the benefits arising from the utilization of these resources, with the terms mutually agreed upon. These benefits can be both commercial and non-commercial, including sharing data or transferring intellectual property rights.
  - **Legal Implications:**
    - ✓ The Nagoya Protocol establishes a legal framework that makes it illegal to engage in research and development on genetic resources that have not been accessed in compliance with its provisions. If a user cannot prove that a genetic resource has been accessed following the Protocol's guidelines, they must cease all activities involving that resource.
  - **Fair and Ethical Use**:
    - ✓ The Protocol emphasizes the fair and ethical utilization of genetic resources, promoting collaboration, respect for traditional knowledge, and the sharing of benefits to support the conservation of biodiversity and the well-being of indigenous and local communities.
- **Other options:**
  - **Kyoto Protocol:** The Kyoto Protocol is an **international treaty related to climate change.** It aims to address global warming by setting targets for industrialized countries to reduce their greenhouse gas emissions. It is primarily concerned with mitigating climate change and promoting sustainable environmental practices.
  - **Stockholm Convention:** The Stockholm Convention on Persistent Organic Pollutants (POPs) is an **international treaty that deals with the elimination or restriction of the production and use of persistent organic pollutants.** These pollutants are highly toxic chemicals that persist in the environment and can have detrimental effects on human health and ecosystems.
  - **Montreal Protocol:** The Montreal Protocol is an international treaty aimed at **protecting the ozone layer.** It deals with the phase-out of the production and consumption of substances that deplete the ozone layer, such as chlorofluorocarbons (CFCs). The primary goal is to prevent further ozone layer depletion and reduce harmful UV radiation.

Q 80.C

- The monotremes are a group of highly specialised egg-laying predatory mammals, containing the platypus and echidnas. **Hence, statement 1 is correct.**
- **There are only five living species of monotreme. Endemic to Australasia - an important point to note as it means that they represent a whole subclass of extant mammalian life in a single**

geographic region which means that all of them are found only in Australia and New Guinea. Hence, statement 2 is correct.

- **While the platypus is semi-aquatic, the echidnas are all terrestrial.**
- Their respective distributions and habitats are as follows:
  - Platypus - Confined to Eastern Australia and Tasmania; freshwater streams, rivers, and some lakes.
  - Short-beaked echidna - Australia and New Guinea; most habitats, from semi-arid to alpine.
  - Long-beaked echidna - New Guinea; mountainous terrain.
- Males have a spur on their ankles, which bears poison in the platypus.
- Toothless - platypuses have a leathery electrosensory bill, with crushing horny plates to break through the tough exoskeleton of arthropods; echidnas have an elongate horny rostrum with a long sticky tongue for collecting insects.

Q 81.B

- **Photosynthetically Active Radiation (PAR): Photosynthetically active radiation (PAR) is light of wavelengths 400-700 nm and is the portion of the light spectrum utilised by plants for photosynthesis.** Except for the deep sea hydro-thermal ecosystem, the sun is the only source of energy for all ecosystems on Earth. **Of the incident solar radiation less than 50 percent of it is photosynthetically active radiation (PAR). Hence statement 1 is not correct.**
- **Plants capture less than 10 percent of the PAR energy:**
  - While PAR represents a substantial portion of solar radiation, it's important to understand that plants are not able to capture and convert all of this energy into biomass. Photosynthesis is an energy-intensive process, and not all incoming PAR is converted into chemical energy.
  - Many factors influence the efficiency of photosynthesis, including the type of plant, environmental conditions, and the availability of other resources like water and nutrients.
  - **Plants capture only 2-10 percent of the PAR and this small amount of energy sustains the entire living world. Hence statement 2 is correct. T**his means that the vast majority of PAR energy is either reflected, transmitted through leaves, or used in other metabolic processes within plants.

Q 82.C

Zoological Survey of India

- **It was established on 1st July, 1916 to promote survey, exploration and research** leading to the advancement in our knowledge of exceptionally rich faunal life. **It acts as a custodian of the National Zoological Collections a**nd the headquarters are at Kolkata. **Hence statement 1 is correct.**
- **It prepares Red Data Book, Fauna of India and does chromosomal mapping and DNA finger printing of fauna. Hence statement 2 is correct.**

Q 83.B

- Biosphere reserves are sites established by countries and recognized under **UNESCO's Man and the Biosphere (MAB) Programme** to promote sustainable development based on local community efforts and sound science.
- The purpose of the formation of the biosphere reserve is to conserve in situ all forms of life, along with its support system, in its totality, so that it could serve as a referral system for monitoring and evaluating changes in natural ecosystems. **Presently, there are 18 notified biosphere reserves in India.**
- The Cold Desert Cultural Landscape of India is situated in the Himalayas and stretches from Ladakh in the north to Kinnaur (in the state of Himachal Pradesh, or H.P.) in the south. Administratively, it can be said to comprise the Leh and Kargil districts of Ladakh, Spiti region of the Lahaul and Spiti district in H.P. and a part of Kinnaur District in the state of H.P. It has been declared as the 16th Biosphere Reserve of India in 2009.
- It includes **Pin Valley National Park and surroundings, Chandratal and Sarchu, and the Kibber Wildlife Sanctuary in H.P.** The **Changtang Cold Desert Wildlife Sanctuary** in district Leh, J&K is another protected habitat for flora and fauna in the region. It is located adjacent to the Himalayan Mountains. It lies in the rain shadow of the Himalayas. **Hence option (b) is the correct answer.**
- Some of the representatives of the flora are medicinal plants such as aconitum rotundifolium, arnebiaeuchroma and hyoscymusniger. The fauna also has its representatives, such as woolly hare, Tibetan gazelle, **snow leopard, Himalayan black bear, Himalayan brown bear, red fox, Tibetan wolf, Himalayan ibex,** Himalayan marmot, Himalayan blue sheep, red billed chough
- **Kitam Bird Sanctuary is located in Sikkim.** Sited beside the Rangeet River, It is home to various birds such as Indian Peafowl, Scarlet Minivet, Green Magpie, Himalayan Flame etc.

Q 84.C

Different Types of Forests under India Forest Act, 1927:

- **Reserved Forests:** They are the **most restricted forests and are constituted by the State Government on any forest land or wasteland** which is the property of the Government. **Local people are prohibited,** unless specifically allowed by a Forest Officer in the course of the settlement.
- **Protected Forests:** The State Government is empowered to constitute any land other than reserved forests **as protected forests over which the Government has proprietary rights and the power to issue rules regarding the use of such forests.** This power has been used to establish State control over trees, whose timber, fruit or other non-wood products have revenue-raising potential.
- **Village forest:** Village forests are the one in which the State Government may assign to 'any village community the rights of Government to or over any land which has been constituted a reserved forest'.

Undemarcated Protected Forest

- **Undemarcated Protected Forests are also called the Orange areas, a**re the result of an administrative logjam that remained a bone of contention between the Revenue and the Forest departments since the abolition of the zamindari system in 1951.
- **Undemarcated protected forests cannot be used for non-forest purposes without clearance under the Forest Conservation (FC) Act, 1980. Hence option (c) is the correct answer.**

Q 85.C

- Nitrogen exists in organic and inorganic (ammonia, nitrate) forms and in different oxidation states. Nitrogen is a highly interchangeable compound and hence undergoes transformations from one oxidation state to another according to the use of organisms. The **transformations include nitrogen fixation, nitrification, denitrification and ammonification carried out by the microorganisms especially the bacteria and fungi.**
- Dinitrogen is made biologically available through nitrogen fixation. The conversion process is very energy demanding and only few prokaryotes can convert N2 into biological nitrogen.
- Lightning and certain industrial process also break the dinitrogen into biological available nitrogen. Some **nitrogen fixers are free living and some exhibit symbiotic relationship with the host plant eg. Rhizobium in leguminous plants; Cyanobacteria in aquatic systems.** The nitrogenase enzyme present in the nitrogen fixers catalyzes the reduction of N2 to NH3 (ammonia).
- The **ammonia is oxidized to nitrite and nitrate by the nitrifying bacteria through the process of nitrification. Two distinct steps are involved in nitrification.** First step involves the oxidation of ammonia to nitrite via an intermediate, the hydroxylamine carried out by ammonia oxidizing bacteria.
- Ammonia oxidizing bacteria are autotrophic and involve two enzymes viz. ammonia monooxygenase and hydroxylamine oxidoreductase.
- The second step involves the oxidation of nitrite to nitrate carried out by a specific group of bacteria **nitrite oxidizing bacteria. Nitrospira, Nitrobacter, Nitrococcus, and Nitrospina are few of the nitrite oxidizing bacteria.** Nitrate is highly soluble in water and hence gets leached out into the water body. **Hence option 1 is not correct.**
- The biological nitrogen is returned back to the atmosphere by the process of denitrification. **Denitrifying bacteria converts the nitrate to dinitrogen under anaerobic conditions** with a series of intermediate nitrogen compounds such as NO2, NO, N2O. Denitrification is carried out by anaerobic bacteria in soils, sediments, lakes and oceans. Denitrifying bacteria are chemoorganotrophs and require carbon for its growth. **ThioBacillus, Paracoccus and Pseudomonas** are some of the examples of denitrifying bacteria. **Hence option (c) is the correct answer.**

Q 86.A

- The number of species surviving in the world today is the outcome of two processes- **Speciation and Extinction.** Speciation is a key driver of the incredible diversity of life on Earth. It is the process that has led to the vast array of species we observe in different ecosystems and environments.
  - **Speciation is the process by which new species are formed from existing ones and evolution is the mechanism by which speciation is brought about. Hence option (a) is the correct answer.**
- **Process of Speciation:**
  - Speciation is the process through **which a single ancestral species gives rise to two or more distinct, separate species**. This occurs over a significant span of time and involves evolutionary changes. They are as follows,

- **Isolation:** Speciation often begins with the isolation of a population, meaning that some members of a species become physically or reproductively separated from the rest of the species. Isolation can result **from various factors, such as geographical barriers (geographic isolation), behavioral differences (behavioral isolation), or genetic changes (genetic isolation).**
- **Accumulation of Genetic Differences:** Over time, isolated populations accumulate genetic differences. These differences can occur through mutation, genetic drift, and natural selection. **These changes can lead to differences in the physical traits, behaviors, and genetics of the isolated populations.**
- **Reproductive Isolation:** As genetic differences accumulate, the isolated populations may become reproductively isolated. This means that they can no longer interbreed and produce fertile offspring. **Reproductive isolation is a critical step in the formation of new species.**
- **Formation of New Species:** Once reproductive isolation is established, the isolated populations are on their way to becoming separate species. They can continue to evolve independently, and over time, they may become distinct enough to be classified as different species.

Q 87.A

- **The Economics of Ecosystems and Biodiversity (TEEB) is a global initiative focused on "making nature's values visible". Hence, statement 1 is correct.**
- Its principal objective is to mainstream the values of biodiversity and ecosystem services into decision-making at all levels.
- It aims to achieve this goal by following a structured approach to valuation that helps decision-makers recognize the wide range of benefits provided by ecosystems and biodiversity, demonstrate their values in economic terms, and, where appropriate, suggest how to capture those values in decision-making.
- **TEEB finds its institutional home at the United Nations Environment Programme in Geneva, Switzerland, and sets up an office to manage day-to-day operations and communications activities. Hence, statement 2 is correct.**
- **The Government of India launched The Economics of Ecosystems and Biodiversity TEEB-India Initiative (TII) in 2015 to highlight the economic consequences of the loss of biological diversity and the associated decline in ecosystem services. Hence, statement 3 is not correct.**
- The Initiative focussed on three ecosystems, namely forests, inland wetlands, and coastal and marine ecosystems.

Q 88.D

- **Recent context:** Recently, the **UN General Assembly voted by a large margin against the US' economic and trade embargo against Cuba.** A total of 187 states voted for the resolution put forward against the embargo with only the US and Israel voting against and Ukraine abstaining.
- **Established in 1945 under the Charter of the United Nations,** the General Assembly occupies a central position as the chief deliberative, policymaking and representative organ of the United Nations. **Comprised of all 193 Members of the United Nations,** it provides a unique forum for multilateral discussion of the full spectrum of international issues covered by the Charter. **Each of the 193 Member States of the United Nations has an equal vote. Hence statement 1 is correct.**
- The UNGA also makes key decisions for the UN, including:
  - appointing the Secretary-General on the recommendation of the Security Council
  - **electing the non-permanent members of the Security Council**
  - approving the UN budget. **Hence statement 3 is correct.**
- The **Assembly meets in regular sessions from September to December each year,** and thereafter as required. It discusses specific issues through dedicated agenda items or sub-items, which lead to the adoption of resolutions. **Hence statement 2 is correct.**
- **A Credentials Committee is appointed at the beginning of each regular session of the General Assembly.** It consists of nine members, who are appointed by the General Assembly on the proposal of the President. The Committee reports to the Assembly on the credentials of representatives. **Hence statement 4 is correct.**

Q 89.C

Biodiversity Cold Spots

- **Cold spots are areas where the fitness of at least one of the two species is determined by interactions with the other. Hence statement 1 is correct.**

- They support critical global and local ecosystem processes, contain unique evolutionary lineages and rare species, encompass the last major wilderness landscapes, support a diverse range of animal species. All cold spots would benefit from increased protection, conservation management, and restoration.
- **While coldspots are relatively empty, they are also dry and unstable environments.** This is why once new species emerge and evolve, they move to more comfortable environments — like the tropical biodiversity hotspots. **Hence statement 2 is correct.**
- A new study published in Science calls this the **'paradox of diversity'. It concludes that extreme environments like deserts, mountains or other 'coldspots' would be better equipped to handle rapid diversification of species than tropical regions, which are already crowded with existing species. Hence statement 3 is correct.**

Q 90.D

- The National Tiger Conservation Authority (NTCA) has been constituted under section 38 L (1) of the Wildlife (Protection) Act, 1972. Further, as per section 38 L, sub-section 2 of the said Act, the authority consists of the Minister in charge of the Ministry of Environment and Forests (as Chairperson), the Minister of State in the Ministry of Environment and Forests (as Vice-Chairperson), three members of Parliament, Secretary, Ministry of Environment and Forests and other members.
- **Tiger Reserves are notified by State Governments as per provisions of Section 38V of the Wildlife (Protection) Act, 1972 on the advice of the National Tiger Conservation Authority.**
- The following steps are involved in the notification:
  - Proposal is obtained from the State.
  - In-principle approval is communicated from the National Tiger Conservation Authority, soliciting detailed proposals under section 38V of the Wildlife (Protection) Act, 1972.
  - National Tiger Conservation Authority recommends the proposal to the State after due diligence.
  - **The State Government notifies the area as a Tiger Reserve. Hence, statement 1 is not correct.**
- Can tiger reserves be altered and de-notified?
  - These processes are governed by Section 38W of the Wildlife (Protection) Act, 1972 whose provisions are as follows
  - **Section 38 W (1): "No alteration in the boundaries of a tiger reserve shall be made except on a recommendation of the Tiger Conservation Authority and the approval of the National Board for Wild Life". Hence, statement 2 is not correct.**
  - 38 W (2): "No State Government shall de-notify a tiger reserve, except in public interest with the approval of the Tiger Conservation Authority and the National Board for Wild Life".
- **Wildlife Institute of India (WII) in close collaboration with global experts and the National Tiger Conservation Authority (NTCA) developed a framework for an independent evaluation procedure to evaluate the Tiger Reserves of the country.**

Q 91.B

- **Amensalim** is an **antagonistic interspecific interaction** where one species suffers and the other species remains unaffected. This is commonly the effect when one species produces a chemical compound (as part of its normal metabolic reactions) that is harmful to the other species. It is also called **antibiosis**. The affected species is called **amensal** and the affecting species is called **inhibitor**.
- **Allelopathy**, in which some plants produce **chemical compounds that inhibit the growth of nearby would-be competitors, is one type of amensalistic interaction.** For example Black Walnut tree (Juglans nigra), secretes juglone from its roots, it is a chemical that harms or kills some of the surrounding plants species. The other plants are prohibited from growing under or near the trees while the walnut trees do not really get benefit in any way. **Hence option (b) is the correct answer.**
- **The "inhibitory" chemicals** are released into the environment and affect the development and growth of nearby plants. These substances influence the growth and development of agricultural and biological systems. Allelopathic chemicals can be present in the **leaves, flowers, roots, fruits, or stems** and may be released from these parts of the plant. Allelochemicals are introduced by the plants into the environment via root exudation, foliar leaching, volatilization, residue decomposition. They can also be found in the surrounding soil. Target species are affected by these toxins in many different ways. The toxic chemicals may **reduce the plant growth by inhibiting the shoot/root growth, by blocking the nutrient uptake,** or by disturbing the naturally occurring symbiotic relationship thereby destroying the plant's usable source of a nutrient. Allelochemicals may be involved in plant-plant, plant herbivore or plant insect communication via chemicals.

Q 92.C

- **Echolocation** is a technique to determine the location of objects using reflected sound.
- Animals that use echolocation emit high-frequency sound pulses, often beyond the range of human hearing.
- **Bats, which have poor eyesight, use this ability to hunt and navigate in the dark while dolphins use it to locate objects and communicate underwater. Whales and some birds, such as the tawny oilbirds, swiftlets and the tenrec (from Madagascar), also use echolocation.**
    - Another possible candidate is the hedgehog, and incredibly some blind people have also developed the ability to echolocate.
- For dolphins and whales, this technique enables them to see in muddy waters or dark ocean depths, and may even have evolved so that they can chase squid and other deep-diving species.
- Echolocation allows bats to fly at night as well as in dark caves. This is a skill they probably developed so they could locate night-flying insects that birds can't find.
- **Hence option (c) is the correct answer.**

Q 93.A

- Wetlands are areas of marsh or peat land with water that is static or flowing, fresh, brackish, or saline, including areas of marine water the depth of which at low tide does not exceed 6 m.
- Wetlands are transition zones (Eco tone) between terrestrial and aquatic ecosystems.
- E.g. Mangroves, lake littorals (marginal areas between the highest and lowest water level of the lakes), floodplains (areas lying adjacent to the river channels beyond the natural levees and periodically flooded during high discharge in the river), and other marshy or swampy areas.
- These habitats experience periodic flooding from adjacent deep-water habitats and therefore support plants and animals specifically adapted to such shallow flooding or waterlogging.
- Ramsar Convention
    - The Convention came into force in 1975 and is one of the oldest inter-governmental accords for preserving the ecological character of wetlands.
    - The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world".
    - At the center of the Convention on Wetlands, philosophy is the "wise use" of wetlands. When they accede to the Convention, Contracting Parties commit to work towards the wise use of all the wetlands and water resources in their territory, through national plans, policies and legislation, management actions, and public education.
    - The Convention defines wise use of wetlands as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development".
- India has over 27000 wetlands of which over 23000 are inland wetlands while around 4000 are coastal wetlands. [Number of inland wetlands > Number of coastal wetlands]. **Wetlands occupy 18.4% of the country's area of which 70% are under paddy cultivation. Hence, statement 1 is correct.**
- The state of **Tamil Nadu (14) has the most Ramsar sites in India, followed by the state of Uttar Pradesh with 10 sites. Hence, statement 2 is not correct.**

Q 94.B

- Recently the plant **'Gentiana Kurroo'** was in news as the efforts of experts in the research wing of the Uttarakhand Forest Department have brought back the 'critically endangered' plant from the brink of extinction. **Endemic to the Western Himalayas, Gentiana Kurroo, commonly known as Himalayan Gentian or Trayman, is a unique and revered medicinal herb. Hence statement 1 is not correct.**
- The highly valued plant holds a rich history in **traditional medicine** and has promising prospects in modern healthcare - it is known to help **treat liver ailments digestive disorders, diabetes, bronchial asthma, and urinary infection.** The remarkable feature of this plant is its distinctive vibrant, trumpet-shaped blue flowers (the presence of blue-colored flowers in angiosperms is relatively uncommon). **Hence statement 3 is correct.**
- These flowers typically bloom from **mid-September to October** and feature a characteristic white or yellow spot at their base. The **root of the Himalayan Gentian** is known for its therapeutic properties - particularly in treating liver ailments. As a result, it has always been subjected to overexploitation, taking it to the verge of extinction.

- **Classified as 'critically endangered' by the International Union for Conservation of Nature (IUCN),** the Himalayan Gentian is one of the 16 plant species in the Uttarakhand Biodiversity Boardlist of 'threatened species' in the state. **Hence statement 2 is correct.**

Q 95.A

- What does the Biodiversity Act - 2002 primarily address?
  - The Biodiversity Act - 2002 primarily addresses issues of conservation, sustainable use of biological resources in the country, issues related to access to genetic resources and associated knowledge and fair and equitable sharing of benefits arising from utilization of biological resources to the country and its people.
- What are the implementation structures of the Biodiversity Act - 2002?
  - The Act and the Rules are implemented in India through a decentralized system.
  - A three-tiered structure has been established under the Act at the national, state and local levels.
  - At the local level, the Biodiversity Management Committees (BMCs) are to be established by institutions of local self-government for implementation of specific provisions of the Act and Rules.
  - At the state level, the State Biodiversity Boards (SBBs) are established to deal with all matters relating to the implementation of the Act and the Rules.
  - At the national level, the National Biodiversity Authority (NBA) is established to deal with all matters relating to the implementation of the Act and the Rules.
  - Each of these structures is required to be connected for decision-making processes on various issues, including issues of access and benefit sharing (ABS).
- **There is no overlap in the functions of NBA and SBBs on issues of ABS. Their domains and functions are very distinct from each other.**
- All matters relating to requests by foreign individuals, companies or institutions and all matters relating to the transfer of results of research to any foreigner, approvals for intellectual property protection where biological resources and associated knowledge are involved will be dealt with by NBA. All matters relating to access by Indians for commercial purposes will be under the purview of the concerned State Biodiversity Boards. However, the benefit-sharing guidelines are to be issued by the NBA.
- **The Indian researchers neither require prior approval nor need to give prior intimation to SBB for obtaining biological resources for conducting research in India. Hence, statement 1 is correct.**
- **The legislation provides for the following exemptions:**
  - **Exemption to local people and communities of the area for free access to biological resources within India.**
  - Exemptions to growers and cultivators of biodiversity and to Vaids and Hakims to use biological resources.
  - Exemption through notification of normally traded commodities from the purview of the Act only when used as a commodity.
  - Exemption for collaborative research through government-sponsored or government-approved institutions is subject to overall policy guidelines and approval of the Central Government and conforms to the central government guidelines.
- What is a PBR?
  - **People's Biodiversity Register (PBR) is a legal document that contains details of biological resources occurring within a BMC and contains associated knowledge as well.** The PBR acts as a source of inventory of biological resources and knowledge and for benefit-sharing purposes under the ABS component.
- Who prepares a PBR?
  - **Under Rule 22 (6) of Biological Diversity Rules, 2004, the BMC needs to develop PBR. Hence, statement 2 is not correct.**

Q 96.C

- **Habitat** is the physical environment in which an organism lives. Each organism has particular requirements for its survival and lives where the environment provides for those needs.
- The features of the habitat can be represented by its **structural components namely:**
  - **Space:** Space refers to the physical area or geographical location where an organism or a population of organisms resides within an ecosystem. It is a fundamental structural component of a habitat because it defines the actual physical environment in which organisms live. Space includes the specific geographic location, the landscape features, and the spatial relationships within the habitat.

- **Water:** Water is a structural component of a habitat because it is a physical feature that plays a critical role in the ecosystem. The availability and distribution of water in a habitat influence the types of organisms that can thrive there. **For aquatic ecosystems, water is not only a structural component but also the primary medium in which organisms exist.**
- **Shelter:** Shelter, or habitat structure, refers to the physical features within the habitat that provide protection, cover, or refuge for organisms. These features can include things like **trees, burrows, caves, grass, or any other elements that create physical protection** from environmental conditions or predators. **Shelter is crucial for various species for nesting, roosting, and avoiding extreme weather conditions.**
- **Food:** The availability of food is a crucial part of a habitat's suitable arrangement. For example, in the northern part of the U.S. state of Minnesota, black bears eat mostly plants, like clover, dandelions, and blueberries. If there were a drought, plants would become scarce. **Even though the habitat would still have space (large forest), shelter (caves, forest floor), water (streams and lakes), and some food, it wouldn't have enough to eat. It would no longer be a suitable arrangement.**
  - ✓ **Too much food can also disrupt a habitat.** Algae is a microscopic aquatic organism that makes its own food through the process of photosynthesis. Nutrients like phosphorous contribute to the spread of algae. When a freshwater habitat has a sharp increase in phosphorous, algae "blooms," or reproduces quickly. Algae also dies very quickly, and the decaying algae produces an algal bloom. The algal bloom can discolor the water, turning it green, red, or brown. Algal blooms can also absorb oxygen from the water, destroying the habitat of organisms like fish and plants. **Excess nutrients for algae can destroy the habitat's food chain. Hence Food is considered a Structural component of Habitat. Hence option (c) is the correct answer.**

Q 97.D

- **Recent context:** The latest edition **(30th) of the Asia-Pacific Economic Cooperation (APEC) Economic Leaders' Meeting was concluded in San Francisco with the Golden Gate Declaration,** in which the leaders underscored their commitment to "Creating a Resilient and Sustainable Future for All."
- The Asia-Pacific Economic Cooperation (APEC) is a regional economic forum established in **1989** to leverage the growing interdependence of the Asia-Pacific. **APEC's 21 members** aim to create greater prosperity for the people of the region by promoting balanced, inclusive, sustainable, innovative and secure growth and by accelerating regional economic integration.
- **The 21 members of the APEC** are Australia, Brunei, Canada, Chile, **China**, **Hong Kong**, Indonesia, Japan, **South Korea**, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Philippines, **Russia**, **Singapore**, Taiwan, Thailand, **United States,** Vietnam. **Hence option (d) is the correct answer.**
- APEC operates as a **cooperative, multilateral economic and trade forum.** Member economies participate on the basis of open dialogue and respect for views of all participants. In APEC, **all economies have an equal say** and decision-making is reached by consensus. There are **no binding commitments or treaty obligations.** Commitments are undertaken on a voluntary basis and capacity building projects help members implement APEC initiatives.
- The APEC Project Management Unit oversees APEC-funded projects in collaboration with working groups. Funding for projects is made possible by contributions from APEC members. The APEC Policy Support Unit provides policy research, analysis and evaluation to assist in the implementation of APEC's agenda. The APEC process is supported by a **permanent secretariat based in Singapore.**

Q 98.A

- **Homeostasis:**
  - Ecosystems are capable of maintaining their state of equilibrium. They can regulate their own species structure and functional processes. This capacity of the ecosystem's self-regulation is known as Homeostasis.
  - Homeostasis involves two kinds of feedback loops. They are,
    - ✓ **The positive feedback loop:** an increase in the population leads to more births, which increases the population even more. **Hence option (a) is the correct answer.**
    - ✓ **The negative feedback loop:** an increase in the population reduces the food supply. Less food means more deaths and fewer births. I**t is responsible for maintaining stability in an ecosystem.**

- **Mechanism:**
  - **Increase in Population:** Suppose there is a species, let's call it Species A, that experiences a sudden increase in population due to favorable conditions like increased food availability, decreased predation, or optimal environmental factors.
  - **Resource Competition:** As the population of Species A increases, it places greater pressure on the available resources, such as food, shelter, or space. This heightened competition can lead to the overutilization of these resources.
  - **Negative Impact on Other Species:** The increased resource competition and overutilization negatively affect other species in the ecosystem, including Species B at a lower trophic level. Species B may experience a decrease in population due to resource scarcity or increased predation by Species A.
  - **Cascading Effects:** The decrease in Species B's population can have further ecological consequences. It might lead to an increase in the population of Species C, which preys on Species B. This, in turn, can influence the populations of other species in the ecosystem.
  - **This positive feedback loop can disrupt the balance within the ecosystem**, affecting multiple species and trophic levels. It's essential to understand these feedback systems as they play a crucial role in shaping the dynamics of ecosystems. Positive feedback systems are just one example of how changes in one part of an ecosystem can have far-reaching consequences throughout the entire system.

Q 99.A

- **Desert Ecosystem:**
  - Deserts are hot and low rain areas suffering from water shortage and high wind velocity. They show extremes of temperature. Globally deserts occupy about 1/7th of the earth's surface.
- **Flora and fauna:** Cacti, Acacia, Euphorbia and prickly pears are some of the common desert plants. Desert animals include shrews, foxes, wood rats, rabbits, camels and goats are common mammals in deserts. Otherprominentdesertanimalsare, reptiles, and burrowing rodent insects.
- **Adaptations:**
  - **Desert plants can withstand hot and dry conditions**. These plants conserve water by following methods:
    - ✓ They are mostly shrubs.
    - ✓ Leaves are absent or reduced in size.
    - ✓ Leaves and stems are succulent and water storing.
    - ✓ In some plants, even the stem contains chlorophyll for photosynthesis.
    - ✓ The root system is well-developed and spread over a large area.
  - **The animals are physiologically and behaviorally adapted to desert conditions.**
    - ✓ **They are fast runners.** This adaptation is essential for escaping predators or catching prey in the harsh desert environment.
    - ✓ **They are nocturnal** in habit to avoid the sun's heat during the daytime. Nocturnal behavior helps them conserve water and energy by foraging and being active during the cooler nighttime hours.
    - ✓ They conserve water by excreting concentrated urine.
    - ✓ **Animals and birds usually have long legs to keep the body away from the hot ground.**
    - ✓ Lizards are mostly insectivorous and can live without drinking water for several days.
    - ✓ Herbivorous animals get sufficient water from the seeds which they eat.
- **Hence option (a) is the correct answer**

Q 100.A

In nature, many species occupy the same habitat but they perform different functions. The functional characteristics of a species in its habitat are referred to as "niche" in that common habitat. **Habitat of a species is like its 'address' (**i.e. where it lives) **whereas niche can be thought of as its "profession"** (i.e. activities and responses specific to the species).

- The term niche means the sum of all the activities and relationships of a species by which it uses the resources in its habitat for its survival and reproduction.
  - A niche is unique for a species while many species share the habitat. **No two species in a habitat can have the same niche. This is because if two species occupy the same niche they will compete with one another until one is displaced. Hence both Statements are correct and statement II is the correct explanation of statement I.**

- **When two species occupy the same niche:**
  - In a well-established ecosystem, species occupying the same niche would compete for the same resources, leading to competitive exclusion or resource partitioning.
  - When two or more species occupy the same niche, they often compete for limited resources like food, shelter, or territory. This competition can be intense, leading to a competitive advantage for one species over the others.
  - In some cases, this competition can result in one species being more successful and eventually outcompeting or displacing the other species, a phenomenon known as **competitive exclusion.**
  - However, in nature, species may also **undergo adaptive changes or shift their niches slightly to coexist without direct displacement**. This is referred to as **resource partitioning**, where species evolve to use slightly different resources or habitats within the same broader niche, reducing competition.
  - **Two Species with the Same Niche:**
    - ✓ Consider two bird species, Species A and Species B, which both primarily feed on the same type of insects and occupy similar forest habitats. They are initially in competition for the same food resources. Over time, they may exhibit different behaviors or foraging strategies to minimize competition.
    - ✓ For example: Species A might forage for insects in the upper canopy of trees while Species B might focus on foraging in the lower understory. This resource partitioning allows both species to coexist in the same habitat and adjust their Niche reducing competition.