All India Civil Services Coaching Centre

(Under the aegis of Government of Tamil Nadu)

Environment

Answer Key Explanation

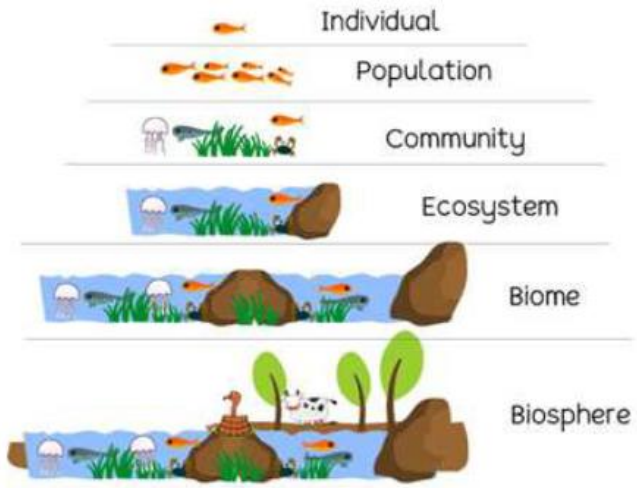
Maximum Questions: 100 **Maximum Marks: 200**

1. Ans. (a)

- The options are set in a way to eliminate the correct answer easily. If you know Amla to be a deciduous tree and Ebony as an evergreen tree, the only answer possible is A.
- Tropical Rainforests of India, are found in the Andaman and Nicobar Islands, the Western Ghats, which fringe the Arabian Sea, the coastline of peninsular India, and the greater Assam region in the north-east.
- Small remnants of rainforest are found in Odisha state.
- The Western Ghats monsoon forests occur both on the western (coastal) margins of the ghats and on the eastern side where there is less rainfall.
- Important trees found in these forests are mahogany, Indian laurel, ebony and rosewood.
- Amla and Semul are deciduous trees.
- Source: AR: Page 59: 6th NCERT: Geography

2. Ans.(a)

- An ecosystem is a system formed by the interaction of all living organisms (biotic) with each other and with the physical and chemical factors (abiotic) of the environment in which they live, all linked by the transfer of energy and material.
- Biome is a larger region than an ecosystem and comprises many such ecosystems.
- We will be covering more questions on the hierarchies of ecology.



Source: Page 5: Geography NCERT 7th: Our Environment

3. Ans.(c)

- The Earth has a natural greenhouse effect due to trace amounts of water vapour (H_2O), carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) in the atmosphere.
- These gases let the solar radiation reach the Earth's surface, but they absorb infrared radiation emitted by the Earth and thereby lead to the heating of the surface of the planet.
- One needs to distinguish between the natural greenhouse effect and the enhanced greenhouse effect.
- The natural greenhouse effect is caused by the natural amounts of greenhouse gases, and is vital to life. In the absence of the natural greenhouse effect the surface of the Earth would be approximately 33 °C cooler.

- The enhanced greenhouse effect refers to the additional radiative forcing resulting from increased concentrations of greenhouse gases induced by human activities.
- The main greenhouse gases whose concentrations are rising are carbon dioxide, methane, nitrous oxide, hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs) and ozone in the lower atmosphere.
- The Global Atmosphere Watch (GAW) observes, analyses and publishes greenhouse gas data collected by fifty countries around the globe from the High Arctic to the South Pole.
- Source: AR: Page 20: Geography NCERT 7th: Our Environment

4. Ans. (d)

- Statement 1: Forest moderate temperature, cool the surroundings by transpiration and capture the carbon dioxide that traps heat.
- Deforestation and low forest cover contributes to urban heat islands.
- Statement 2: The concrete and metals in buildings and the asaphalt of roads get heated up during the day. This heat is released during the night.
- Also, the crowded high rise buildings of the cities trap the warm air and thus raise the temperature of the cities.
- Statement 3: Vehicle exhaust emits CO2, NOX and other GHGs that capture heat.
- Statement 4: Density of population and industrial economic activity automatically increase the heat generated per unit area.
- We will cover these topics in more detail in higher level NCERTs and standard books.
- Source: AR: Page 24: Geography NCERT 7th: Our Environment

5. Ans. (c)

Antarctica Treaty System

- Antarctica is defined as all land and ice shelf south of 60°S, but not the surrounding waters.
- It is regulated by the Antarctica Treaty System (ATS) ratified by 12 countries in Washington in 1959.
- [12 countries are Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, South Africa, the Union of Soviet Socialist Republics, the UK and the US.]
- The Antarctic Treaty System is the whole complex of arrangements made for the purpose of regulating relations among states in the Antarctic.

The treaty aims for

1. Peaceful exploration of the continent for science and prohibits military activity other than as support for research;
2. Free exchange of information and personnel with the UN and other international agencies; prohibits new territorial claims;
3. Disallows nuclear explosions or disposal of radioactive wastes; and
4. Gives treaty-state observers free access to all stations, premises and equipment.

- **Working -** The Treaty is augmented by recommendations adopted at Consultative Meetings, by
- The Protocol on Environmental Protection to the Antarctic Treaty (Madrid, 1991), Convention on the Conservation of Antarctic Seals (London 1972), Convention on the Conservation of Antarctic Marine Living Resources (Canberra 1980).
- **Members -** Before this treaty was ratified, the UK, Norway, New Zealand, Chile, Argentina, Australia, and France had made territorial claims in Antarctica.
- Australia's claim is the largest; almost half of the entire continent.

- ATS has been signed by 53 countries, including India (1983).
- By not signing the treaty, the United States, Russia, South Africa, Peru, and Brazil reserve the right to make territorial claims.
- Source:https://www.downtoearth.org.in/blog/climate-change/polar-ebb-stockholm-50we-need-urgent-agreement-toprotectantarctica-the-arctic-83061

6. Ans. (b)

- Statement 1 and 2: Red Sanders or Sandalwood (Pterocarpus santalinus) is an Indian endemic tree species, with a restricted geographical range in the Eastern Ghats.
- It is endemic to a distinct tract of forests in Andhra Pradesh.
- This light-demanding species grows in the rocky, degraded and fallow lands with Red Soil and hot and dry climate.
- Specialty - Red Sanders is known for their rich hue and therapeutic properties.
- They are high in demand across Asia, particularly in China and Japan, for use in cosmetics and medicinal products as well as for making furniture, woodcraft and musical instruments.
- Statement 2: Red Sanders was classified as 'near threatened' in 2018 and has now joined the 'endangered' list once again in 2021.
- The IUCN's Red List summary states that while the species retained its geographical area despite harvesting since the 16th century, its population saw a sharp decline of 50-80%.
- Statements 3 and 4: Red Sanders is protected under CITES convention (ban on international trade) and the second schedule of the Wild Life (Protection) Act, 1972.
- The 1972 act of the Parliament of India was enacted for the protection of plants and animal species.
- Before 1972, India had only five designated national parks. Among other reforms, the Act established schedules of protected plant and animal species; hunting or harvesting these species was largely outlawed.
- The Act provides for the protection of wild animals, birds and plants; and for matters connected therewith or ancillary or incidental thereto. It extends to the whole of India.
- It has six schedules which give varying degrees of protection. Schedule I and part II of Schedule II provide absolute protection - offences under these are prescribed the highest penalties.
- Species listed in Schedule III and Schedule IV are also protected, but the penalties are much lower.
- Animals under Schedule V, e.g. common crows, fruit bats, rats and mice, are legally considered vermin and may be hunted freely.
- The specified endemic plants in Schedule VI are prohibited from cultivation and planting.
- The hunting to the Enforcement authorities have the power to compound offences under this Schedule (i.e. they impose fines on the offenders).
- Source: https://www.downtoearth.org.in/news/wildlife-biodiversity/red-sanders-falls-back-in-iucn-s-endangered-category-81053

7. Ans.(c)

- Statement 1, 2 and 3: The Net Zero Emissions by 2050 Scenario (NZE).
- This is a normative IEA scenario that shows a narrow but achievable pathway for the global energy sector to achieve net zero CO2 emissions by 2050, with advanced economies reaching net zero emissions in advance of others.
- This scenario also meets key energy-related United Nations Sustainable Development Goals (SDGs), in particular by achieving

universal energy access by 2030 and major improvements in air quality.

- This is consistent with limiting the global temperature rise to 1.5 °C without a temperature overshoot (with a 50% probability), in line with reductions assessed in the IPCC in its Special Report on Global Warming of 1.5 °C.
- Under the IEA net zero emissions scenario, and all Paris-aligned scenarios, all energy sources remain important through 2050, and oil and natural gas remain essential components of the energy mix.
- Statement 4: In recent years, the energy sector was responsible for around three-quarters of global greenhouse gas (GHG) emissions.
- Achieving net zero energy-related and industrial process CO2 emissions by 2050 in the NZE does not rely on the action in areas other than the energy sector, but limiting climate change does require such action.
- It therefore additionally examines the reductions in CO2 emissions from land use that would be commensurate with the transformation of the energy sector in the NZE, working in cooperation with the International Institute for Applied Systems Analysis (IIASA).
- Source:https://indianexpress.com/article/explained/what-are-carbon-bombs-why-environmentalists-want-them-defused-7957290/ https://www.iea.org/reports/world-energy-model/net-zero-emissions-by-2050scenario-nze

8. Ans. (b)

- The Renewable Energy Policy Network for the 21st Century (REN21) is the only global renewable energy community of actors from science, governments, NGOs and industry.
- It provides up-to-date and peer-reviewed facts, figures, and analysis of global developments in technology, policies, and markets.
- Its goal is to enable decision-makers to make the shift to renewable energy.
- REN21 creates an enabling environment to support renewables. It offers a platform for a variety of stakeholders to engage and collaborate.
- Therefore, option (b) is the correct answer. Relevance: The Renewable Energy Policy Network for the 21st Century (REN21) released the Renewables 2022 Global Status Report (GSR 2022).

9. Ans. (d)

- Biomass is renewable, widely available, carbon-neutral and has the potential to provide significant employment in rural areas.
- It is also capable of providing firm energy.
- About 32% of the total primary energy use in the country is still derived from biomass and more than 70% of the country's population depends upon it for its energy needs.
- For efficient utilization of biomass, bagasse-based cogeneration in sugar mills and biomass power generation have been taken up under the biomass power and cogeneration programme.
- The biomass power & cogeneration programme is implemented with the main objective of promoting technologies for the optimum use of the country's biomass resources for grid power generation.
- Biomass materials used for power generation include bagasse, rice husk, straw, cotton stalk, coconut shells, soya husk, de-oiled cakes, coffee waste, jute wastes, groundnut shells, sawdust, etc.
- Therefore, option (d) is the correct answer.
- Relevance: Ministry of New Renewable Energy amends the Policy for Biomass-based cogeneration projects in India.

10. Ans. (d)

- Environmental bioindicators are all those living organisms which, due to their ecological characteristics, have a high sensitivity to the different environmental changes that occur in nature, and react to them as if they were specific stimuli.
- These bioindicators are capable of reacting to the presence of pollutant accumulations much earlier than artificial or abiotic indicators do.

The following are examples of different bio-indicators:

- Microorganisms, mites, and worms. So, point 1 is correct.
- Fungi. So, point 2 is correct.
- Fern. So, point 3 is correct.
- Geckos or dragons are very good indicators of air quality.
- These are especially sensitive to industrial gases, such as sulfur dioxide. So, point 4 is correct.
- Lichens. So, point 5 is correct.
- Therefore, option (d) is the correct answer.

11. Ans. (c)

- Glyphosate herbicide is applied to the leaves of plants to kill both broadleaf plants and grasses.
- It prevents the plants from making certain proteins that are needed for plant growth. It stops a specific enzyme pathway- the shikimic acid pathway.
- The shikimic acid pathway is necessary for plants and some microorganisms.
- The rampant use of glyphosate in non designated areas has severe consequences.
- Its adverse health impacts range from cancer, reproductive and developmental toxicity to neurotoxicity and immunotoxicity. So, statement 1 is not correct.
- Atrazine is a man-made systemic herbicide called triazines. Specifically, atrazine is a chlorotriazine herbicide. It interferes with photosynthesis in some broadleaf plants and grasses.
- It is taken up by roots and leaves and moves upward in the plant to areas of new growth.
- The plant dries out and dies. Older leaves on plants may be affected more than new leaves.
- Root growth is not affected by atrazine. So, statement 2 is not correct.
- Dicamba is a selective herbicide in the chlorophenoxy family of chemicals.
- It acts like natural plant hormones known as auxins. These hormones help to control plant growth.
- When plants are treated with dicamba, they grow in abnormal and uncontrollable ways, and often, the plants die.
- Dicamba is used on many broadleaf weeds and woody plants. So, statement 3 is correct.
- Therefore, option (c) is the correct answer.
- Relevance: The Union Ministry of Agriculture and Farmers Welfare has restricted the use of glyphosate, a widely used herbicide, citing health hazards for humans and animals.

12. Ans. (b)

- Volatile Organic Compounds (VOCs) are carbon-containing chemicals released by petrol and diesel vehicles.
- They impact air quality and human health. However, VOCs can have a natural origin too.
- Plants emit these chemicals to attract pollinators, defend themselves from pests and predators and adapt to environmental stress. So, statement 1 is not correct.
- VOCs can drive the formation of other dangerous pollutants.
- For instance, they react with sunlight and nitrogen dioxide to form ground-level ozone. So, statement 2 is correct.

The following are the major sources of VOCs

- Household products including paints, paint strippers, and other solvents, wood preservatives, stored fuels and automotive products, dry-cleaned clothing and pesticide. So, statement 3 is correct.
- Other products, including building materials and furnishings, office equipment such as copiers and printers, correction fluids and carbonless copy paper, graphics and craft materials including glues and adhesives, permanent markers and photographic solutions.
- Therefore, option (b) is the correct answer.
- Relevance: Recent studies indicate that Volatile Organic Compounds (VOCs) levels in India are rising faster.

13. Ans. (c)

- Climate tipping points occur when a change in a part of the climate system becomes self-perpetuating beyond a warming threshold, leading to substantial Earth system impacts.
- A tipping point is a critical threshold that, when crossed, leads to large and often irreversible changes in the climate system.
- If tipping points are crossed, they are likely to have severe impacts on human society.
- Tipping behavior is found across the climate system, in ecosystems, ice sheets, and the circulation of the ocean and atmosphere.
- Therefore, option (c) is the correct answer.
- Relevance: A study reported that exceeding 1.5 degrees Celsius of global warming could trigger several and lead to irreversible climate impacts.

14. Ans.(a)

- Terraforming is the process of modifying a planet, moon or other body to a more habitable atmosphere, temperature, or ecology.
- If (nanotechnology and advanced chemical processes) research continue, it may become feasible to terraform planets in centuries rather than millennia.
- On the other hand, it may become reasonable to modify humans so that they don't require an oxygen/nitrogen atmosphere in a 1G gravity field to live comfortably.
- That would then reduce the need to terraform worlds, or at least the degree to which other worlds' environments would need to be altered.
- Therefore, option (a) is the correct answer.

15. Ans. (b)

- Bioluminescence is the light being emitted by living things by means of chemical reactions in their bodies.
- It is a type of chemiluminescence, which is simply the term for a chemical reaction where light is produced.
- Bioluminescence is a "cold light." Cold light means less than 20% of the light generates thermal radiation or heat. So, statement 1 is correct.
- The chemical reaction that results in bioluminescence requires two unique chemicals:
- luciferin and either luciferase or photoprotein.
- Luciferin is the compound that actually produces light. In a chemical reaction, luciferin is called the substrate.
- The bioluminescent colour (yellow in fireflies, greenish in lanternfish) is a result of the arrangement of luciferin molecules. So, statement 2 is correct.
- Most bioluminescent organisms are found in the ocean.
- These bioluminescent marine species include fish, bacteria, and jellies.
- Some bioluminescent organisms, including fireflies and fungi, are found on land.
- There are almost no bioluminescent organisms native to freshwater habitats. So, statement 3 is not correct.

- Therefore, option (b) is the correct answer.

16. Ans. (a)

- The 'Blue Flag' certification is an eco-label awarded by the Denmark-based non- profit Foundation for Environmental Education (FEE) to beaches, marinas, and tourism boats.
- The iconic Blue Flag is one of the world's most recognized voluntary awards for beaches, marinas, and sustainable boating tourism operators.
- To qualify for the Blue Flag, a series of stringent environmental, educational, safety, and accessibility criteria must be met and maintained.
- Launched in France in 1985, the Blue Flag programme has been implemented in Europe since 1987 and in regions outside of Europe since 2001.
- The 12 beaches in India which have the globally acclaimed eco-label 'Blue Flag' are Shivrajpur (Gujarat), Ghoghla (Diu), Kasarkod and Padubidri (Karnataka), Kappad (Kerala), Rushikonda (Andhra Pradesh), Radhanagar (Andaman and Nicobar), Golden (Odisha), Kovalam (Tamil Nadu) Eden Puducherry), Thundi Beach and Kadmat Beach in Lakshadweep.
- Therefore, option (a) is the correct answer.
- Relevance: Thundi Beach and Kadmat Beach in Lakshadweep bagged the 'Blue Flag' certification, taking India's tally to 12.

17. Ans. (c)

- Air Quality Index is a tool for effective communication of air quality status to people in terms, which are easy to understand.
- It transforms complex air quality data of various pollutants into a single number (index value), nomenclature and colour.
- There are six AQI categories, namely Good, Satisfactory, Moderate, Poor, Very Poor, and Severe.
- Each of these categories is decided based on ambient concentration values of air pollutants and their likely health impacts (known as health breakpoints).
- AQ sub-index and health breakpoints are evolved for eight pollutants for which short-term (up to 24 hours) National Ambient Air Quality Standards are prescribed.

The following are those eight pollutants:

- Particulate matter 10
- Particulate matter 2.5
- Nitrogen dioxide
- Sulphur dioxide
- Carbon monoxide
- Ammonia
- Lead
- Ozone
- Benzene and Carbon dioxide are not measured under the NAQI.
- Therefore, option (c) is the correct answer.
- Relevance: Recently Delhi recorded a very poor air quality index which led to curbs under stage III of the Graded Response Action Plan (GRAP).

18. Ans. (c)

- The Cartagena Protocol on Biosafety to the Convention on Biological Diversity aims to contribute to ensuring an adequate level of protection in the field of the safe transfer, handling, and use of living-modified organisms (LMOs) resulting from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health, and specifically focusing on transboundary movements, transit, handling of LMOs.
- LMOs that are pharmaceuticals for humans are excluded from the scope of the Protocol if they are covered by other international agreements or arrangements.

- Cartagena is the name of the city in Colombia where the Biosafety Protocol was originally scheduled to be concluded in February 1999.
- However, due to certain outstanding issues, the Protocol was finalized and adopted a year later on 29 January 2000 in Montreal, Canada.
- Therefore, option (c) is the correct answer.

19. Ans. (d)

- Allelopathy is a sub-discipline of chemical ecology that is concerned with the effects of chemicals produced by plants or microorganisms on the growth, development, and distribution of other plants and microorganisms in natural communities or agricultural systems.
- Under this biological phenomenon, certain plants release allelochemicals to destroy neighbouring plants in their bid for more space and sunlight.
- Therefore, option (d) is the correct answer.

20. Ans. (a)

- The Ecological Footprint continues to be the only metric that comprehensively compares human demand on nature against nature's capacity to regenerate.
- It measures the ecological assets that a given population or product requires to produce the natural resources it consumes and to absorb its waste, especially carbon emissions.
- It includes plant-based food and fibre products, livestock and fish products, timber and other forest products, space for urban infrastructure.
- The Ecological Footprint especially tracks the use of productive surface areas like the typical cropland, grazing land, fishing grounds, built-up land, forest area, and carbon demand on land which represents the nation's biocapacity.
- These areas, especially if left unharvested, can also serve to absorb the waste we generate, especially our carbon emissions from burning fossil fuels.
- Therefore, option (a) is the correct answer.

21. Ans.(b)

- The following measure will help in reducing global warming by reducing the concentration of carbon dioxide and other greenhouse gases in the atmosphere:
- Placing artificial reflectors -giant mirrors or very small reflecting particles – in outer space that can reflect back some part of solar radiation incident on earth's surface.
- By blocking a part of the sun's rays, temperatures on the earth can be brought down. So, point 1 is correct.
- Injection of sulphate aerosols, very fine solid particles, into the stratosphere is one of the measures of reducing global warming.
- Sulphate aerosol particles are very good reflectors of sunlight, and climatic models have shown that even if 1% of current incident solar radiation is reflected back into space, a very significant amount of temperature rise on earth can be offset. So, point 2 is not correct.
- Cirrus clouds let the solar radiation pass through and reach the surface, but trap the higher wavelength infrared (IR) radiation emitted from the earth, thereby contributing to the heating.
- If these clouds are reduced by some engineering interventions, it would allow the IR radiation from the earth, too, to pass through to space, thus allowing some of the heat to dissipate and hence cool the planet. So, point 3 is correct.
- Real trees, breathe in carbon dioxide and breathe out oxygen.
- The artificial tree developed will remove carbon dioxide from the air faster and at far higher levels than natural photosynthesis can accomplish.

- Artificial trees will simply absorb carbon from the air into their leaves, which are coated with sodium carbonate. When sodium carbonate comes into contact with carbon dioxide, it shall form a harmless bicarbonate – baking soda.
- The CO2 can then be released by a gentle flow of water, either to be used industrially or sequestered underground. So, point 4 is correct.
- Therefore, option (b) is the correct answer.

22. Ans. (c)

- Colony Collapse Disorder (CCD) is the phenomenon that occurs when the majority of worker bees in a colony disappear and leave behind a queen, plenty of food and a few nurse bees to care for the remaining immature bees and the queen.
- In the USA, during the winter of 2006-2007, some beekeepers began to report unusually high losses of 30-90 percent of their hives.
- Bee hives cannot sustain themselves without worker bees and would eventually die.
- This combination of events resulting in the loss of a bee colony has been called Colony Collapse Disorder.
- There have been many theories about the cause of CCD, but the researchers who are leading the effort to find out why are now focused on these factors which cause Potential immune-suppressing stress on the bees:
- Increased losses due to the invasive varroa mite (a pest of honey bees).
- New or emerging diseases such as the Israeli Acute Paralysis virus and the gut parasite Nosema.
- Pesticide poisoning through exposure to pesticides applied to crops or for in- hive insect or mite control.
- Stress bees experience due to management practices such as transportation to multiple locations across the country for providing pollination services.
- Changes to the habitat where bees forage.
- Inadequate forage/poor nutrition.
- Therefore, option (c) is the correct answer.

23. Ans. (c)

- The '30 × 30' target aims to protect and conserve 30% of the world's terrestrial, freshwater, coastal and marine ecosystems.
- The target is currently being negotiated by parties to the Convention on Biological Diversity (CBD) as part of the post-2020 'Global Biodiversity Framework'.
- The High Ambition Coalition (HAC) is an informal group of approximately 70 countries within the United Nations Framework Convention on Climate Change (UNFCCC) committed to advancing progressive proposals on climate ambition.
- It was launched in 2019 by Costa Rica, France, and Britain.
- Its main objective is to protect at least 30 percent of the world's land and ocean by 2030.
- Therefore, option (c) is the correct answer.

24. Ans. (d)

- The amount of radioactivity is measured by finding out how many radioactive atoms decay every second.
- These atoms may be giving off alpha particles, beta particles, and/or gamma rays.
- The amount of radioactivity is reported in Becquerel (Bq), which is the international unit, or the Curie (Ci).
- Geiger counters are commonly used to measure the amount of radioactivity,
- Ambient radiation levels are reported in Gray per hour (Gy/h) or Sievert per hour (Sv/h), which are the international units.
- Some countries also use Roentgen per hour (R/h) or rem per hour (rem/h).

- Instruments called pressurized ionization chambers are best suited for measuring ambient radiation levels.
- Therefore, option (d) is the correct answer.
- Relevance: There is a concern about nuclear radioactive pollution amidst the ongoing Russia- Ukraine conflict.

25. Ans. (c)

- Water.org is a global nonprofit organization working to bring water and sanitation to the world. It wants to make water and sanitation safe, accessible and cost effective.
- It helps people get access to safe water and sanitation through affordable financings, such as small loans.
- WaterCredit is a powerful solution and the first to implement microfinance tools in the water and sanitation sector.
- WaterCredit helps bring small loans to those who need access to affordable financing and expert resources to make household water and toilet solutions a reality.
- Therefore, option (c) is the correct answer.

26. Ans. (b)

- The Trapping Zone is a new ecosystem, discovered some 500 meters beneath the surface, is being referred to as 'an oasis of oceanic life'.
- It has presence of several mega-faunal predators like sharks and other large marine fishes that feed on micro- nekton.
- According to scientists, these organisms are trapped at the 500 m mark, against the subsea landscape.
- Micro-nektons usually exhibit 'vertical migration' i.e. migration from the deep waters to the surface at night and vice versa at dawn.
- However, they are prevented from diving deeper by the subsea features like the cliffs, terraces, volcanic structures and fossilized carbonate reefs, forming the base of the atolls. Hence, the ecosystem presents a rich source of food for the larger predators like tuna, alfonsino, spiky oreo and sharks.
- This discovery is significant given the critical knowledge of sub-surface biodiversity would further support conservation efforts and encourage sustainable ocean management.
- It would also boost the country's fisheries and tourism sectors.
- Therefore, option (b) is the correct answer.
- Relevance: Recently, scientists reported the discovery of 'The Trapping Zone' in the island nation Maldives.

27. Ans. (c)

- The European Union (EU) has proposed a policy to tax products such as cement and steel, that are extremely carbon intensive, with effect from 2026.
- A consortium of countries that includes India has arrive at a conclusive agreement stating that carbon border taxes, that could result in market distortion and aggravate the trust deficit amongst parties, must be avoided.
- Carbon Border Adjust Mechanism (CBAM) is a climate measure that should prevent the risk of carbon leakage and support the EU's increased ambition on climate mitigation, while ensuring World Trade Organization (WTO) compatibility.
- Working of Carbon Border Adjust Mechanism (CBAM): The EU importers will have to buy carbon certificates corresponding to the carbon price that would have been paid in the EU, if the goods had been produced locally.
- The price of the certificates would be calculated according to the auction prices in the EU carbon credit market.
- The amount of certificates required would be defined yearly by the quantity of goods and the embedded emissions in those goods imported into the EU.
- Therefore, option (c) is the correct answer.

- Relevance: India, China, Brazil and South Africa have opposed the carbon border tax proposed by the European Union.

28. Ans. (c)

- Blue Transformation is a targeted effort by which agencies, countries and dependent communities, use existing and emerging knowledge, tools and practices to secure and sustainably maximize the contribution of aquatic (both marine and inland) food systems to food security, nutrition and affordable healthy diets for all.
- It is a visionary strategy designed to enhance the potential of food systems under water and feed the world's growing population sustainably.
- According to the Food and Agriculture Organization (FAO) 'Blue Transformation' is a strategy that how we can produce, manage, trade, and consume aquatic foods, to achieve the UN Sustainable Development Goals or SDGs.
- Therefore, option (c) is the correct answer.
- Relevance: The Food and Agriculture Organization of the United Nations has released a document called 'Blue Transformation - Roadmap 2022–2030'.

29. Ans. (a)

- A variety of physical and chemical changes can affect the global energy balance and force changes in the Earth's climate.
- Some of these changes are natural, while others are influenced by humans.
- These changes are measured by the amount of warming or cooling they produce, called "radiative forcing."
- Simply, Radiative Forcings is the net change in the energy balance of the Earth system due to various natural and anthropogenic factors of climate change.
- It is usually expressed in watts per square meter averaged over a particular period of time.
- Changes that have a warming effect are called "positive" forcing, while changes that have a cooling effect are called "negative" forcing.
- When positive and negative forces are out of balance, the result is a change in the Earth's average surface temperature. So, statement 1 is correct.
- In 2019, the Annual Greenhouse Gas Index was 1.45, which represents a 45-per cent increase in radiative forcing (a net warming influence) since 1990.
- Of the greenhouse gases, carbon dioxide accounts for by far the largest share of radiative forcing since 1990, and its contribution continues to grow at a steady rate.
- Carbon dioxide alone would account for a 36-per cent increase in radiative forcing since 1990. So, statement 2 is correct.
- Ozone present in the stratosphere (above the troposphere) absorbs the incoming shortwave radiation.
- Hence, it restricts the increase in temperature on the ground surface.
- As a result, this process produces a negative radiative forcing that is a cooling effect.
- But the ozone formed in the troposphere increases the temperature near the ground surface by absorbing the radiation.
- This results in positive radiative forcing. So, statement 3 is not correct.
- Therefore, option (a) is the correct answer.

30. Ans. (b)

- Ocean acidification refers to a reduction in the pH of the ocean over an extended period of time, caused primarily by the uptake of carbon dioxide (CO_2) from the atmosphere.
- The ocean absorbs about 30 percent of the CO_2 that is released in the atmosphere, and

as levels of atmospheric CO2 increase, so do the levels in the ocean.

- When CO2 is absorbed by seawater, a series of chemical reactions occur resulting in an increased concentration of hydrogen ions.
- This increase causes the seawater to become more acidic and causes carbonate ions to be relatively less abundant.
- So, statement 1 is not correct.
- Carbonate Compensation Depth (CCD) refers to the specific depth of the ocean at which calcium carbonate minerals dissolve in the water quicker than they can accumulate.
- Surface water, where most planktons live, is safe for shells made from calcium carbonate, whether that compound takes the form of calcite or aragonite.
- These minerals are almost insoluble there.
- But the deep water is colder and under high pressure, and both of these physical factors increase the water's power to dissolve calcium carbonate (CaCO3).
- The depth at which CaCO3 completely disappears, where its sedimentation is equalled by its dissolution, is the compensation depth.
- Due to ocean acidification, the CO2 in the oceans is high as a result the depth of CCD is shallower. So, statement 2 is correct.
- Organisms (calcifying organisms) combine calcium and carbonate to form hard shells and skeletons out of the mineral calcium carbonate.
- Ocean acidification reduces the amount of carbonate and slows the growth of calcium carbonate structures.
- This makes it more difficult for marine organisms, such as coral and some plankton, to form their shells and skeletons, and existing shells may begin to dissolve. So, statement 3 is correct.
- While some species will be harmed by ocean acidification, algae and seagrasses may benefit from higher CO2 conditions in the ocean, as they require CO2 for photosynthesis just like plants on land.
- There are some ongoing studies examining if growing seaweed can help slow ocean acidification.
- Therefore, option (b) is the correct answer.

31. Ans. (c)

- Hydroponics is a popular method of growing plants that uses only chemical nutrients and water, which means that this method grows plants without using soil.
- Aquaponics is a growing method that involves fishes and plants being grown in the same environment.
- Both in hydroponics and aquaponics, plants are grown in a soilless environment.
- Instead of plants getting their nutrients from sources in the soil, an aquatic solution provides the essential nutrients needed for plant growth directly to the roots, where efficient nutrient uptake can occur. So, statement 1 is not correct.
- Hydroponics requires adding fertilizers to the water to provide nutrients. However, in aquaponics, fish are grown simultaneously in the aquatic environment to provide a natural source of organic nutrients through their excreted waste. So, statement 2 is correct.
- Hydroponics growing systems can be used for plants with high nutrient needs because the nutrient solution can be adapted to meet plant needs; aquaponics systems typically work best to support plants that have lower nutrient needs such as lettuce, other leafy greens, and herbs. So, statement 3 is correct.
- Therefore, option (c) is the correct answer.

32. Ans. (b)

- Ecosystem services include the outputs, conditions, or processes of natural systems that directly or indirectly benefit humans or enhance social welfare. It can benefit people in many ways, either directly or as inputs

into the production of other goods and services.

- Ecosystems provide many of the basic services that make life possible for people.
- Plants clean air and filter water, bacteria decompose wastes, bees pollinate flowers, and tree roots hold soil in place to prevent erosion. So, point 1 is correct.
- Ecosystems such as wetlands filter effluents, decompose waste through the biological activity of microorganisms, and eliminate harmful pathogens. Fish, mollusks and other aquatic animals as well as fish habitats are vital parts of ecosystem functioning and processes that are essential for water quality.
- Trees contribute heavily to waste-water treatment through their root system and their role in nutrient cycling. So, point 2 is correct.
- Rainfall and mineral deposits are included in the category of environmental services.
- It includes material and energy generated in or by the ecosystem. So, point 3 is correct.
- Conditions or processes of ecosystems that cannot be linked to the welfare of identifiable beneficiary groups are not ecosystem services.
- For example, changes in fish abundance in areas not used by humans and that have no direct or indirect effect on human benefits are not ecosystem services. So, point 4 is not correct.
- The predators and parasites in ecosystems act to control populations of potential pest and disease vector.
- Fish populations serve as regulator of food webs and can influence community structure of other species and thereby also regulate pests and diseases. So, point 5 is correct.
- Therefore, option (b) is the correct answer.

33. Ans. (c)

- Xylem and phloem constitute the complex tissues in plants.
- Xylem functions as a conducting tissue for water and minerals from roots to the stem and leaves. It also provides mechanical strength to the plant parts.
- In contrast, phloem transports food materials, usually from leaves to other parts of the plant. So, statement 1 is correct.
- Phloem is responsible for transport of food (primarily) sucrose from the source to the sink.
- Since the source-sink relationship is variable, the direction of movement in the phloem can be upwards or downwards, i.e., bi-directional.
- This contrasts with that of the xylem where the movement is always unidirectional, i.e., upwards.
- Hence, unlike one-way flow of water in transpiration, food in phloem sap can be transported in any required direction so long as there is a source of sugar and a sink able to use, store or remove the sugar. So, statement 2 is not correct.
- Xylem is composed of four different kinds of elements, namely, tracheids, vessels, xylem fibres and xylem parenchyma.
- Xylem vessels are long hollow chains of tough long dead xylem cells.
- Tracheids are elongated or tube like cells with thick and lignified walls and tapering ends.
- These are dead and are without protoplasm.
- The vessel cells are also devoid of protoplasm.
- On the contrary, phloem consists of living cells arranged end to end.
- The cells that make up the phloem tissues need to be alive to facilitate the active transport of sucrose throughout the plant.
- So, statement 3 is correct.
- Therefore, option (c) is the correct answer.

34. Ans. (b)

- The Oriental white-backed vultures are listed as Critically Endangered on the IUCN Red List of Threatened Species.
- These are resident birds and not migratory, so they largely stay within a radius of 50-100 km of the breeding centre. So, point 1 is correct.
- The Gharial is listed as Critically Endangered by the IUCN Red List as a result of catastrophic population declines by up to 98% since the 1940s.
- The only viable population of gharial is found in the National Chambal Sanctuary.
- Small non-breeding populations exist in Son, Gandak, Hoogly and Ghagra rivers. So, point 2 is correct.
- The Pygmy hog is listed as Endangered in the IUCN Red List of Threatened Species.
- It is one of the very few mammals that build its own home, or nest, complete with a 'roof'. It is an indicator species. So, point 3 is not correct.
- There are six species of river sharks found in the world, out of which the Ganges shark (Glyphis gangeticus) is endemic to India.
- It inhabits the River Hooghly in West Bengal, as well as the rivers Ganges, Brahmaputra, Mahanadi in the states of Bihar, Assam and Orissa.
- It is listed as a Critically Endangered species in the IUCN Red list. So, point 4 is correct.
- The Amur leopard is native to the southeastern Russia and northern China.
- It is listed as Critically Endangered on the IUCN Red List. So, point 5 is correct.
- Therefore, option (b) is the correct answer.
- Relevance: Recently, 148 gharials have been released in the Gandak thereby turning the river having the second-largest gharial population after the Chambal river in the country.

35. Ans. (d)

- Environmental gradients, defined as gradual changes in biotic or abiotic environmental factors, are essential determinants of the structure and functioning of ecological systems and their components. So, statement 1 is correct.
- Traits whose values vary predictably in response to such gradients are called 'response traits'; these differ according to the gradient considered.
- Understanding the ecological significance of this response requires an explicit identification of the variables underlying the gradient considered. So, statement 2 is correct.
- Along environmental gradients, changes in trait values result from a combination of intraspecific variation and species' intrinsic differences.
- Beyond species, studies have also shown that the responses of dominant species to environmental factors are more consistent than those of less abundant species. So, statement 3 is correct.
- Therefore, option (d) is the correct answer.

36. Ans. (d)

- Biotic potential is the maximum reproductive capacity of an organism under optimum environmental conditions.
- It is often expressed as a proportional or percentage increase per year.
- It can also be defined as the number of offspring of an individual organism that would survive to reproductive age under ideal conditions.
- It is a measure of an individual's reproductive potential, although this is seldom fully realized under natural conditions.
- Full expression of the biotic potential of an organism is restricted by environmental resistance, any factor that inhibits the increase in the population.

- These factors include unfavourable climatic conditions; lack of space, light, or a suitable substrate; deficiencies of necessary chemical compounds or minerals; and the inhibiting effects of predators, parasites, disease organisms, or unfavourable genetic changes.
- So, points 1, 2, 3 and 4 are correct.
- Therefore, option (d) is the correct answer.

37. Ans. (a)

- Mangroves are ecotone species that are mainly found near the coast of rivers, oceans etc.
- In India, they are found along the coast areas of Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha and West Bengal.
- They are also found along the Lakshadweep Islands and Andaman & Nicobar Islands.
- Pichavaram in Tamil Nadu, Vembanad in Kerala and Bhitarkanika in Odisha are located in coastal regions.
- These are few of the largest mangrove forest sites in India. So, point 1, point 2 and point 4 are correct.
- Rayalseema is a rain shadow region in Andhra Pradesh. It doesn't contain mangrove forests. So, point 3 is not correct.
- Therefore, option (a) is the correct answer.
- Relevance: Recently, there was a threat to Bhitarkanika mangroves due to the diversion of freshwater from the Brahmani river basin.

38. Ans. (c)

- As per the India State of Forest Report, Forest cover is defined as: "All lands, more than one hectare in area, with a tree canopy density of more than 10 percent irrespective of ownership and legal status.
- Such lands may not necessarily be recorded forest area.
- It also includes orchards, bamboo and Palm."
- Area-wise, Madhya Pradesh has the largest forest cover in the country followed by Arunachal Pradesh, Chhattisgarh, Odisha and Maharashtra.
- In terms of forest cover as percentage of total geographical area, the top five States are Mizoram (84.53%), Arunachal Pradesh (79.33%), Meghalaya (76.00%), Manipur (74.34%) and Nagaland (73.90%).
- Therefore, option (c) is the correct answer.

39. Ans. (d)

- Karakoram Range is a mountain system extending some 500 km from the easternmost extension of Afghanistan in a south-easterly direction along the watershed between Central and South Asia.
- Karakoram anomaly is the mystery of why few pockets of glaciers in the Karakoram Range are resisting glacial melt due to global warming, defying the trend of glaciers losing mass across the globe, with the Himalayas being no exception.
- It remains an intriguing scientific question to the researchers.
- Some researchers have attributed this phenomenon to the recent revival of western disturbances (WDs).
- Therefore, option (d) is the correct answer.
- Relevance: A recent study has postulated a new theory to explain the Karakoram anomaly and attributed it to recent revival of western disturbances.

40. Ans. (d)

- Primary production is defined as the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis.
- The rate of biomass production is called productivity. So, statement 1 is not correct.
- Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis.
- Primary producers can either be photoautotrophs, organisms that synthesize organic compounds using the sun as a

source of energy, or chemoautotrophs, organisms that synthesize organic compounds from inorganic molecules found in the environment.

- Both photosynthesis and chemosynthesis contribute to the oceans' primary productivity, but photosynthesis is the dominant process with respect to the amount of carbon fixed and energy stored in organic compounds. So, statement 2 is not correct.
- The annual net primary productivity of the whole biosphere is approximately 170 billion tons (dry weight) of organic matter. Of this, despite occupying about 70 per cent of the surface, the productivity of the oceans is only 55 billion tons.
- Rest, is on land. So, statement 3 is correct.
- Therefore, option (d) is the correct answer.

41. Ans. (c)

- The process by which communities of plant and animal species in an area are replaced or changed into another over a period of time is known as ecological succession.
- **Primary succession:** It takes place over bare or unoccupied areas where no community has existed previously. The plants that invade first bare land, where soil is initially absent are called pioneer species. A pioneer species generally show high growth rate but short life span. So, statement 1 is not correct.
- **Secondary succession:** It is the development of a community which forms after the existing natural vegetation that constitutes a community is removed, disturbed or destroyed by a natural event.
- Primary succession is much more difficult to observe than secondary succession because there are relatively very few places on earth that do not already have communities of organisms.
- Each transitional (temporary) community that is formed and replaced during succession is called a stage in succession or a seral community. So, statement 2 is correct.
- The terminal (final) stage of succession forms the community which is called as climax community. The "climax community" is a stable endpoint of succession, or at least an assemblage in which succession has slowed to the point at which other processes are more important.
- The climax community remains stable as long as the environment remains unchanged.
- With time the xerophytic habitat gets converted into a mesophytic one. So, statement 3 is correct.
- Therefore, option (c) is the correct answer.

42. Ans. (c)

- Wetlands of International Importance tag is associated with Ramsar Convention.
- The mission behind the convention is the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution toward achieving sustainable development throughout the world.
- There are nine criteria laid down by the Ramsar Convention on Wetlands to classify any wetland as a Wetland of International Importance.
- As per Criterion 9, a wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species. So, statement 1 is correct.
- As per Criterion 5, a wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds. So, statement 2 is not correct.
- As per Criterion 3, a wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular

biogeographic region. So, statement 3 is correct.

- Therefore, option (c) is the correct answer.

43. Ans. (b)

- A red tide is an event that occurs on the coastline when algae grows out of control.
- The name "red tide" comes from the fact that overgrown algae can cause the water to change colour.
- Red tides can be hazardous to human health and sea life. Red tides are sometimes also called harmful algal blooms.
- Red tide is a misnomer because the blooms are not always red and their movement is largely unrelated to tides.
- Also, many species of algae that cause red discoloration are not harmful.
- Red tides have been around since long before humans.
- However, certain human activities are making them more frequent.
- Chemicals from farming, factories, sewage treatment plants and other sources can become dissolved in water on the land.
- This water, called runoff, eventually flows into the ocean and can cause algae to grow faster, leading to red tides.
- Therefore, option (b) is the correct answer.

44. Ans. (a)

- An estuary is a transitional zone between rivers and sea representing an ecotone possessing unique ecological features and biotic communities.
- Estuaries are the most productive ecosystems of the world.
- An estuary is semi-enclosed part of the coastal ocean containing brackish water that has free connection with the sea on one side and on the other side, it is connected with a river mouth and receives fresh water. So, statement 1 is correct.
- The most dominant feature of the estuarine environment is the fluctuation in salinity.
- Though a salinity gradient exists sometimes in an estuary, the pattern of gradient varies seasonally with the topography, with the tides and with the amount of fresh water.
- The temperature of the estuary keeps on fluctuating, it heats up and cools down more rapidly under prevailing atmospheric conditions.
- Another reason for this variation is freshwater input.
- Temperature also varies vertically. The surface waters have the greatest temperature range and the deeper waters have the smallest. So, statement 2 is correct.
- Variation i.e. the salinity, the texture of substrate, temperature, organic matter content and available oxygen is controlled by wave action and currents.
- The wave action in the estuaries is small. As a result, there is a deposition of fine sediments and the development of rooted plants. So, statement 3 is not correct.
- Therefore, option (a) is the correct answer.

45. Ans. (b)

- Aestivation or estivation is a survival strategy used by many vertebrates and invertebrates to endure arid environmental conditions.
- It is experienced by animals in response to heat stress.
- Stimulus for estivation is usually a combination of high temperatures and water shortage.
- Key features of aestivation include strong metabolic rate suppression, strategies to retain body water, conservation of energy and body fuel reserves, altered nitrogen metabolism, and mechanisms to preserve and stabilize organs, cells and macromolecules over many weeks or months of dormancy. So, statement 1 is correct.

- Hibernation is an extended form of torpor, a state where metabolism is depressed to less than five percent of normal.
- Most of the physiological functions are extremely slowed down or completely halted during hibernation.
- While hibernation is most often seen as a seasonal behaviour, it's not exclusive to cold-weather critters.
- There are tropical hibernators that may do so to stay cool in the heat.
- Temperature isn't always a factor. Some species hibernate in response to food shortages.
- For example, echidnas in Australia will hibernate after fires, waiting until food resources rebound to resume normal activities. So, statement 2 is not correct.
- Torpor is a temporary drop in body temperature and metabolic rate often accompanied by failure to eat or micturate/defecate.
- It is an adaptation of endothermic vertebrates that enables them to survive the energetic demands of cold ambient temperature.
- To decrease the energy expenditure of producing body heat while resources are also limited, some vertebrates can significantly decrease their body temperature and metabolic rate.
- This behaviour is under environmental control via the endocrine system. So, statement 3 is correct.
- Therefore, option (b) is the correct answer.

46. Ans. (b)

- Tundra biome:
- For most of the year, the tundra biome is a cold, frozen landscape.
- This biome has a short growing season, followed by harsh conditions that the plants region need special adaptations to survive.
- Tundra form in two distinct cold and dry regions.
- Arctic tundra is found on high- latitude landmasses, above the Arctic Circle—in Alaska, Canada, Russia, Greenland, Iceland, and Scandinavia, for example—or on far southern regions, like Antarctica.
- Alpine tundra is located at very high elevations atop mountains, where overnight temperatures fall below freezing. So, statement 1 is not correct.
- Tundra regions typically get less than 25 centimetres (10 inches) of precipitation annually, which means these areas are also considered deserts.
- They have long, cold winters with high winds and average temperatures below freezing for six to ten months of the year. So, statement 2 is correct.
- The soil in the Arctic is largely permafrost or soil that remains frozen year-round, leaving only a thin surface layer of thawed soil in summer for plant roots to grow in.
- Tundra soil is also scarce in many of the nutrients that plants need to grow.
- These conditions lead to one of the tundra biome's most distinct features: They are largely treeless.
- Vegetation in the tundra has adapted to the cold and the short growing season.
- Mosses, sedges, and lichens are common, while few trees grow in the tundra.
- The trees that do manage to grow stay close to the ground so they are insulated by snow during the cold winters. So, statement 3 is correct.
- Therefore, option (b) is the correct answer.
- Relevance: According to a report, the green cover of the tundra biome of the Arctic region also increased in 2021.

47. Ans. (b)

- Ecotone is a zone of junction between two or more diverse ecosystems.

Characteristics of ecotone:

- It may be very narrow or quite wide.
- It has conditions intermediate to the adjacent ecosystems. Hence ecotone is a zone of tension.
- A well-developed ecotone contains some organisms which are entirely different from that of the adjoining communities. So, statement 1 is not correct.
- Sometimes the number of species and the population density of some of the species is much greater in this zone than either community. This is called the edge effect.
- The organisms which occur primarily or most abundantly in this zone are known as Edge Species. So, statement 2 is correct.
- Mangrove forests represent an ecotone between marine and terrestrial ecosystem.
- Some more examples of ecotone are – grassland, estuary and river bank. So, statement 3 is correct.
- Therefore, option (b) is the correct answer.

48. Ans. (a)

- Angiosperms are also called flowering plants.
- The seeds develop inside an ovary which is modified to become a fruit. So, statement 2 is not correct.
- Gymnosperms bear naked seeds and are usually perennial, evergreen and woody. For example - Sequoia, Pines, and Deodar. So, statement 1 is not correct.
- The leaves in gymnosperms are well adapted to withstand extremes of temperature, humidity and wind.
- In conifers, the needle-like leaves reduce the surface area.
- Their thick cuticle and sunken stomata also help to reduce water loss. So, statement 3 is correct.
- Therefore, option (a) is the answer.

49. Ans. (d)

- The term "cryosphere" traces its origins to the Greek word 'kryos' for frost or ice cold.
- The cryosphere is the part of the Earth's climate system that includes solid precipitation, snow, sea ice, lake and river ice, icebergs, glaciers and ice caps, ice sheets, ice shelves, permafrost, and seasonally frozen ground. So, points 1, 2, 3 and 4 are correct.
- This sphere helps maintain Earth's climate by reflecting incoming solar radiation back into space.
- As the world warms due to increasing greenhouse gases being added to the atmosphere by humans, the snow and ice are melting.
- At sea, this exposes more of the dark ocean below the ice, and on land, the dark vegetation below.
- These dark surfaces then absorb the solar radiation causing more melting. This creates a positive feedback loop, which exacerbates the impacts of climate change.
- Therefore, option (d) is the correct answer.

50. Ans. (b)

- Fishes, reptiles and amphibians are cold blooded creatures or Poikilothermic.
- It means that they cannot regulate their own body temperature. So, statement 1 is not correct.
- Both reptiles and fishes have scales while amphibians don't have them.
- Amphibians have moist skin. So, statement 2 is correct.
- Unlike amphibians, reptiles lay eggs with tough coverings and they don't need to lay their eggs in water. Amphibian eggs are jelly-like. So, statement 3 is correct.
- Therefore, option (b) is the correct answer.

51. Ans. (a)

- Ephemeral plant is any short-lived plant, usually one that has one or more

generations per year, growing only during favourable periods (as when adequate moisture is available) and passing the unfavourable periods in the form of seeds.

- The seed coats of some species contain a growth inhibitor that can be washed off only by a copious quantity of water, thus preventing germination after only a brief shower.
- The most common types of ephemeral species are desert annuals, plants whose seeds remain dormant for months or years but which quickly germinate, grow, and flower when rain does fall.
- Therefore, option (a) is the correct answer.

52. Ans. (d)

- According to the Darwin's theory of evolution, the fitness of species is based on the number of offspring that survive and are then capable of reproduction.
- Based on this, the species can be classified into two extreme categories in evolutionary terms - r-selected species and k-selected species.
- K-selected (K refers to the carrying capacity) produce low number of offsprings that each have a higher probability of survival to maturity.
- This means that the babies are entering a competitive world, in a population at or near its carrying capacity.
- In contrast, r-selected (r is for reproduction) species puts only a small investment of resources into each offspring, but produces many such low effort babies. So, statement 1 is not correct.
- K-selected species possess relatively stable populations fluctuating near the carrying capacity of the environment. These species are characterized by having only a few offspring but investing high amounts of parental care.
- On the other hand, r-selected species often inhabit unstable environments and are completely density independent.
- These species often have short life expectancies and invest very low amounts of parental care. So, statement 2 is not correct.
- Elephants, humans and bison are all k - selected species while R-selected species can include mosquitos, mice and bacteria.
- So, statement 3 is correct.
- Therefore, option (d) is the correct answer.

53. Ans. (b)

- In Ex situ Conservation, threatened animals and plants are taken outside from their natural habitat and placed in a special setting where they can be protected and given special care.
- Zoological parks, botanical gardens, gene banks, aquariums and cryopreservation techniques like seed vaults are some of the examples of ex situ conservation sites.
- So, Chang La seed vault, Ladakh, Nandankanan Zoological Park, Odisha, Lalbagh Botanical Garden, Bengaluru and National Gene Bank, Delhi are examples of Ex-situ conservation sites. So, point 1, point 2, point 3 and point 5 are correct.
- In In-situ Conservation, threatened animals and plants are kept in their natural habitat.
- Tiger Reserves and sacred groves are In-situ conservation sites. So, point 4 and point 6 are not correct.
- Therefore, option (b) is the correct answer.

54. Ans. (d)

- Bioaccumulation is defined as the net accumulation of a contaminant in or on an organism from all sources including water, air, and diet.
- Bioaccumulation describes the accumulation and enrichment of contaminants in organisms, relative to that in the environment.

- Bioaccumulation takes place in a single organism over the span of its life, resulting in a higher concentration in older individuals. So, statement 1 is correct.
- Biomagnification is the process by which a compound (such as a pollutant or pesticide) increases its concentration in the tissues of organisms as it travels up the food chain.
- Biomagnification takes place as chemicals transfer from lower trophic levels to higher trophic levels within a food web, resulting in a higher concentration in apex predators. So, statement 2 is correct.
- Because of their persistence and high lipid solubility, Persistent Organic Pollutants (POPs) tend to bioaccumulate in fatty tissues.
- They also are semi-volatile and therefore can vaporize or absorb into atmospheric particles.
- This permits the global transport of these chemicals in air and water. So, statement 3 is correct.
- Therefore, option (d) is the correct answer.
- Relevance: Heavy Metal Poisoning, biomagnification and bioaccumulation is the reason behind the recent mass death of fishes in water bodies in India.

55. Ans. (d)

- Mangrove forests, or mangals, grow at tropical and subtropical latitudes near the equator where the sea surface temperatures never fall below 16°C.
- Mangals line about two-thirds of the coastlines in tropical areas of the world.
- Some mangroves remove salt from brackish estuarine waters through ultra-filtration in their roots. Other species have special glands on their leaves that actively secrete salt, a process that leaves visible salt crystals on the upper surface of the leaves. So, point 1 is correct.
- Mangrove seeds begin growing while still attached to the parent plant. These seedlings, called propagules, even grow roots.
- After a period of growth, these seedlings drop to the water below and float upright until they reach water that is shallow enough for their roots to take hold in the mud. So, point 2 is correct.
- Many species of mangrove trees have aerial roots called pneumatophores that take up oxygen from the air for the roots. So, point 3 is correct.
- All mangrove species have laterally spreading roots with attached vertical anchor roots.
- These roots are very shallow. So, point 4 is correct.
- Therefore, option (d) is the correct answer.

56. Ans, (b)

- Tarballs are dark-coloured, sticky balls of oil that form when crude oil floats on the ocean surface.
- Tarballs are formed by weathering of crude oil in marine environments.
- They are transported from the open sea to the shores by sea currents and waves.
- Most of the times, the presence of several tarballs indicate an oil spill.
- Tarball pollution is a major concern to global marine ecosystem.
- Microbes such as bacteria and fungi are known to be associated with tarballs.
- They presumably play an important role in tarball degradation and some are potential human and animal pathogens.
- Source: https://indianexpress.com/article/explained/explained-what-are-tarballs5871982/

57. Ans. (b)

- Statement Analysis:

Statement 1 Correct	• Non-biodegradable Solid wastes are generated by thermal power plants which

	produce fly ash; integrated iron and steel plants which produce blast furnace slag and steel melting slag. • Industries manufacturing aluminium, zinc and copper produce mud and tailings. • Fertilizer industries produce gypsum. • Nowadays, fly ash and slag from the steel industry are utilised by the cement industry.
Statement 2 Correct	They can also be used in construction of roads and bridges and other engineering applications.
Statement 3 Incorrect	The wastes are toxic and disposal of non-degradable industrial solid wastes, if not done by a proper and suitable method, may cause serious threat to the environment.

58. Ans. (b)

- Detritivores (e.g., earthworm) are organisms that break down detritus into smaller particles.
- This process is called fragmentation.
- Detritus is the organic matter made up of dead plant and animal material.
- Detritivores are often invertebrate insects such as mites, beetles, butterflies and flies; mollusks such as slugs and snails; or soil-dwelling earthworms, millipedes and woodlice.
- Examples of detritivores in marine environments are crustaceans such as crabs and lobsters, echinoderms such as sea stars or sea cucumbers.
- Many of these marine detritivores occupy a similar niche to terrestrial soil-dwellers, living on or within the seabed known as the benthos.
- These organisms are often called “bottom-feeders”.
- Seahorse and Jellyfish are carnivores and are not decomposers.

59. Ans. (d)

- Nutrients are supplied to plants by air, water and soil. There are several nutrients which are essential for plants.
- Air supplies carbon and oxygen, hydrogen comes from water, and soil supplies the other thirteen nutrients to plants.
- Amongst these, some are required in large quantities and are therefore called macro-nutrients.
- The other nutrients are used by plants in small quantities and are therefore called micro-nutrients.

60. Ans. (d)

Desertification		
	Causes	**Effects**
1.	Deforestation	Decrease in crop yield
2.	Farming	Poverty
3.	Excessive fertilizers and pesticides use	Hunger and starvation
4.	Animal grazing	Mass migration
5.	Global warming	Habitat destruction
6.	Overpopulation	Biodiversity losses
7.	Change in land use	Floods
8.	Mining	Soil erosion
9.	Waste generation	Water pollution
10.	Soil pollution	Global warming etc..
11.	Acid rain	
12.	Natural causes	

61. Ans. (d)

- Biodegradable are the things that decompose in natural cycles or are degraded by organisms which are available in soil.
- It is environmentally friendly and thus has advantages in making soil more fertile.
- Biodegradable wastes include humans Waste, animals Waste, paper, peel of fruits, leaves, natural rubber, cotton clothes, dead

plants and animals, manure, sewage sludge etc., Non-biodegradable waste on the other hand are the material which does not decompose or does not degrade by organisms in natural cycle decomposition.

- This waste stays in environment for longer period and is the main reason of pollution.
- It includes plastics, glasses, E-wastes, metals, synthetic fibres etc.

62. Ans. (d)

- **Statement Analysis:**

Statement 1 Correct	• Reforestation help conserve water and raise groundwater levels in that specific region. • The Forests also recycle moisture in the atmosphere through the process of transpiration to increase rainfall.
Statement 2 Correct	• Rainwater Harvesting is used to increase the availability of water by collecting rainwater and store it for later use. • The basic idea behind rainwater harvesting is "Catch water where it falls". • Many methods can be used such as Rooftop rainwater harvesting, Ground water recharging etc.
Statement 3 Correct	• Drip Irrigation is a technique of watering plants by making use of narrow tubings which deliver water directly at the base of the plant. • This will help farmers to conserve and use water economically.
Statement 4 Correct	• Water Recycling is the process of collecting, wastewater, particularly from municipalities,industry and agriculture. • The recycled water can be used for irrigation or industrial purposes, as well as domestic purposes if properly treated.

63. Ans. (d)

- Deforestation is the conversion of forested areas to non-forested ones.
- The consequences of deforestation are many.
- One of the major effects is enhanced carbon dioxide concentration in the atmosphere because trees that could hold a lot of carbon in their biomass are lost with deforestation.
- Deforestation also causes loss of biodiversity due to habitat destruction, disturbs hydrologic cycle, causes soil erosion, and may lead to desertification in extreme cases.

64. Ans. (d)

- Statement 1 is Correct: Deforestation is the conversion of forested areas to non-forested ones .
- The consequences of deforestation are many.
- One of the major effects is enhanced carbon dioxide concentration in the atmosphere because trees that could hold a lot of carbon in their biomass are lost with deforestation.
- Deforestation also causes loss of biodiversity due to habitat destruction, disturbs hydrologic cycle, causes soil erosion, and may lead to desertification in extreme cases.
- Statement 2 is Correct: Over-exploitation:

- Humans have always depended on nature for food and shelter, but when 'need' turns to 'greed', it leads to over-exploitation of natural resources.
- Many species extinctions in the last 500 years (Steller's sea cow, passenger pigeon etc..) were due to overexploitation by humans.
- Statement 3 is Correct: Alien species invasions: When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive, and cause decline or extinction of indigenous species.
- We may be familiar with the environmental damage caused and threat posed to our native species by invasive weed species like carrot grass (Parthenium), Lantana and water hyacinth (Eicchornia).
- Statement 4 is Correct: Co-extinctions: When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct.
- For example when a host fish species becomes extinct, its unique assemblage of parasites also meets the same fate.
- Hence correct option is 'd': all ther statements are correct.

65. Ans. (b)

- Statement 1 is Correct: Certain organisms are capable of fixing atmospheric nitrogen
  into ammonium ions.
- These include free living nitrifying bacteria (e.g. aerobic Azotobacter and anaerobic Clostridium) and symbiotic nitrifying bacteria living in association with leguminous plants and symbiotic bacteria living in non-leguminous root nodule plants (e.g. Rhizobium) as well as blue green algae (e.g. Anabaena, Spirulina).
- Statement 2 is Incorrect: Ammonium ions can be directly taken up as a source of nitrogen by some plants, or are oxidized to nitrites or nitrates by two groups of specialized bacteria: Nitrosomonas bacteria promote transformation of ammonia into nitrite.
- Statement 3 is Incorrect: Nitrite is then further transformed into nitrate by the Nitrobacter bacteria.
- Statement 4 is Correct: in the soil as well as ocean there are special denitrifying bacteria (e.g Pseudomonas), which convert the nitrates/ nitrites to elemental nitrogen
- Hence the correct option 'b'. Only statement 1 and 4 is correct.

66. Ans. (b)

- Statement 1 is Incorrect: The trophic level represents a functional level, not a species as such.
- A given species may occupy more than one trophic level in the same ecosystem at the same time; for example, a sparrow is a primary consumer when it eats seeds, fruits, peas, and a secondary consumer when it eats insects and worms.
- Statement 2 is correct: In most ecosystems, all the pyramids, of number, of energy and biomass are upright, i.e., producers are more in number and biomass than the herbivores, and herbivores are more in number and biomass than the carnivores.
- Also, energy at a lower trophic level is always more than at a higher level.
- However, there are exceptions. For instance, pyramid of biomass in sea is generally inverted because the biomass of fishes far exceeds that of phytoplankton.
- Statement 3 is correct: Pyramid of energy is always upright, can never be inverted, because when energy flows from a particular trophic level to the next trophic

level, some energy is always lost as heat at each step.

- Each bar in the energy pyramid indicates the amount of energy present at each trophic level in a given time or annually per unit area.
- Hence, the correct option is 'b'.

67. Ans. (d)

- All the arrangements are correct :
- All animals depend on plants (directly or indirectly) for their food needs.
- They are hence called consumers and also heterotrophs.
- If they feed on the producers, the plants, they are called primary consumers, and if the animals eat other animals which in turn eat the plants (or their produce) they are called secondary consumers .
- Likewise, there are tertiary consumers too.
- The primary consumers will be herbivores.
- Some common herbivores are insects, birds and mammals in terrestrial ecosystem and molluscs in aquatic ecosystem.
- The consumers that feed on these herbivores are carnivores, or more correctly primary carnivores (though secondary consumers).
- Those animals that depend on the primary carnivores for food are labelled secondary carnivores.

68. Ans.(b)

- Statement 1 is Incorrect: Insectivorous plants are a specialized group of plants that grow in wet, acidic soils.
- Statement 2 is Correct: One of the most critical plant nutrients is nitrogen which is usually taken up by plants as nitrates.
- Nitrogen is a nutrient that is easily leached out of soils.
- For this reason, the plants that live in these soils have evolved into carnivorous plants that capture and digest insects as a means of obtaining nitrates.
- These plants are usually associated with leached, nutrient-poor soils , or wet and acidic areas that are ill-drained.
- Hence, the correct option is 'b'.

69. Ans.(b)

- Allen's Rule says that m ammals from colder climates generally have shorter ears and limbs to minimise heat loss.
- In the polar seas aquatic mammals like seals have a thick layer of fat (blubber) below their skin that acts as an insulator and reduces loss of body heat.
- Bergmann's rule says that animals or organisms residing at a higher altitude should be larger and have a thicker coat than those that are living at lower altitudes and found close to the equator.

70. Ans. (a)

- Statement 1 is correct: Homeostasis refers to maintenance of a constant internal environment by the organisms.
- This contributes to optimal performance of organisms.
- Statement 2 is Incorrect: n a homeostatic system, negative feedback mechanism is responsible for maintaining stability in an ecosystem.
- Only some organisms (regulators) are changing external environment. Others either partially regulate their internal environment or simply conform.
- Hence, the correct option is 'a'.

71. Ans. (d)

- All statements are correct.
- Statement 1 is Correct: Temperature: The average temperature on land varies seasonally, decreases progressively from the equator towards the poles and from plains to the mountain tops.
- The temperature affects the kinetics of enzymes and through it the metabolic

activity and other physiological functions of the organism.

- Statement 2 is Correct: Water: Water is another the most important factor influencing the life of organisms.
- In fact, life on earth originated in water and is unsustainable without water.
- Statement 3 is Correct: Soil: determines to a large extent the vegetation in any area.
- This in turn dictates the type of animals that can be supported.
- Similarly, in the aquatic environment, the sediment-characteristics often determine the type of benthic animals that can thrive there.
- Statement 4 is Correct: Light: Since plants produce food through photosynthesis, a process which is only possible when sunlight is available as a source of energy, we can quickly understand the importance of light for living organisms, particularly autotrophs.

72. Ans. (b)

- Statement 1 is Correct: Food chain is a series of organisms taking part in feeding at various biotic levels.
- Each step or level of the food chain forms a trophic level.
- The autotrophs or the producers are at the first trophic level.
- They fix up the solar energy and make it available for heterotrophs or the consumers.
- The herbivores or the primary consumers come at the second, small carnivores or the secondary consumers at the third and larger carnivores or the tertiary consumers form the fourth trophic level.
- Statement 2 is Incorrect: There is a loss of energy as we go from one trophic level to the next, this limits the number of trophic levels in a food-chain.
- Thus, food chains generally consist of only three or four levels.
- The loss of energy at each step is so great that very little usable energy remains after four trophic levels.
- Statement 3 is Correct: The flow of energy in food chain in unidirectional because the sun is the only source of energy for all ecosystems on earth.
- Then the energy is captured by the autotrophs does not revert back to the sun.
- Therefore, in the food chain, the energy moves progressively through various trophic levels.
- Hence, the correct option is ‘b”.

73. Ans. (c)

- Option (c) is correct: Dissolved oxygen is one of the factors that limit the productivity of the Aquatic Ecosystem.

Factors limiting the productivity of aquatic habitats

Sunlight:

- Sunlight penetration rapidly diminishes as it passes down the column of water.
- The depth to which light penetrates a lake determines the extent of plant distribution.

Dissolved Oxygen:

- In aquatic ecosystems, oxygen is dissolved in water, where its concentration varies constantly depending on factors that influence the input and output of oxygen in water.
- In freshwater, the average concentration of dissolved oxygen is 0.0010 percent (also expressed as 10 parts per million or 10 ppm) by weight, which is 150 times lower than the concentration of oxygen in an equivalent volume of air.
- Oxygen enters the aquatic ecosystem through the air-water interface and by the photosynthetic activities of aquatic plants.
- Therefore, the quantity of dissolved oxygen present in an ecosystem depends on the

rate at which the aforesaid two processes occur.

- Dissolved oxygen escapes the water body through the air-water interface and through respiration of organisms (fish, decomposers, zooplanktons, etc).
- The amount of dissolved oxygen retained in water is also infl uenced by temperature. Oxygen is less soluble in warm water.
- Warm water also enhances decomposer activity.
- Therefore, increasing the temperature of a water body increases the rate at which oxygen is depleted from water.
- When the dissolved oxygen level falls below 3-5 ppm, many aquatic organisms are likely to die.

Transparency:

- Transparency affects the extent of light penetration. Suspended particulate matters such as clay, silt, phytoplankton, etc make the water turbid.
- Consequently, it limits the extent of light penetration and the photosynthetic activity in a signifi cant way

Temperature:

- The water temperature changes less rapidly than the temperature of air because water has a considerably higher specific heat than air, i.e. larger amounts of heat energy must be added to or taken away from water to raise or lower its temperature.
- Since water temperatures are less subject to change, the aquatic organisms have narrow temperature tolerance limit.
- As a result, even small changes in water temperature are a great threat to the survival of aquatic organisms when compared to the changes in air temperatures in the terrestrial organisms.

74. Ans. (a)

- Statement 2 is incorrect: The interaction where one species is benefi tted and the other is neither benefi tted nor harmed is called commensalism.

Population interactions

- Interspecifi c interactions arise from the interaction of populations of two different species. They could be beneficial, detrimental or neutral (neither harm nor benefi t) to one of the species or both.
- Both the species benefi t in mutualism and both lose in competition in their interactions with each other.
- In both parasitism and Predation, only one species benefi ts (parasite and predator, respectively) and the interaction is detrimental to the other species (host and prey, respectively).
- The interaction where one species is benefitted and the other is neither benefitted nor harmed is called commensalism.
- In amensalism, one species is harmed whereas the other is unaffected.
- Predation, parasitism, and commensalisms share a common characteristic– the interacting species live closely together.
-

Population Interactions		
Species A	**Species B**	**Name of Interaction**
+	+	Mutualism
-	-	Competition
+	-	Predation
+	-	Parasitism
+	0	Commensalism
-	0	Amensalism

75. Ans. (c)

- Both statements are correct Reasons for Greater Biodiversity in Tropics Ecologists and evolutionary biologists have proposed

various hypotheses for the greater biological diversity of tropics; some important ones are Speciation is generally a function of time, unlike temperate regions subjected to frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification.

- Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable.
- Such constant environments promote niche specialisation and lead to a greater species diversity.
- There is more solar energy available in the tropics, which contributes to higher productivity; this, in turn, might contribute indirectly to greater diversity.

76. Ans. (d)

- All statements are correct.
- Responses to Abiotic Factors Regulate Some organisms are able to maintain homeostasis by physiological (sometimes behavioral also) means which ensures constant body temperature, constant osmotic concentration, etc.
- All birds and mammals and a very few lower vertebrate and invertebrate species are indeed capable of such regulation (thermoregulation and osmoregulation).
- Plants, on the other hand, do not havesuch mechanisms to maintain internal temperatures.

Conform

- An overwhelming majority of animals and nearly all plants cannot maintain a constant internal environment.
- Their body temperature changes with the ambient temperature.
- In aquatic animals, the osmotic concentration of the body fl uids changes with that of the ambient water osmotic concentration.
- These animals and plants are simply conformers.

Migrate

- The organism can move away temporarily from the stressful habitat to a more hospitable area and return when a stressful period is over.
- Every winter the famous Keoladeo National Park (Bharatpur) in Rajasthan hosts thousands of migratory birds coming from Siberia and other extremely cold northern regions.

Suspend

- In bacteria, fungi and lower plants, various kinds of thick-walled spores are formed which help them to survive unfavorable conditions – these germinate on availability of suitable environment.
- In higher plants, seeds and some other vegetative reproductive structures serve as means to tide over periods of stress besides helping in dispersal – they germinate to form new plants under favorable moisture and temperature conditions.
- They do so by reducing their metabolic activity and going into a date of 'dormancy'.
- In animals, the organism, if unable to migrate, might avoid the stress by escaping in time.
- The familiar case of bears going into hibernation during winter is an example of an escape in time.
- Some snails and fish go into aestivation to avoid summer-related problems-heat and desiccation.
- Under unfavorable conditions, many zooplankton species in lakes and ponds are known to enter diapause, a stage of suspended development.

77. Ans. (d)

- Statement 3 is incorrect : Organic farming uses natural fertilizers and avoids chemical fertilisers.

Organic Farming

- Integrated organic farming is a cyclical, zero-waste procedure, where waste products from one process are cycled in as nutrients for other processes.
- This allows the maximum utilization of resources and increases the effi ciency of production.
- It relies upon crop rotations, crop residues, animal manures, off-farm organic waste, and biological systems of nutrient mobilization and plant protection.

The key characteristics of organic farming are:

- Relies primarily on local, renewable resources and avoids the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives, etc)
- Makes efficient use of solar energy and the production potential of biological systems.
- Maintains the fertility of the soil Crop waste is used to create compost, which can be used as a natural fertilizer or can be used to generate natural gas for satisfying the energy needs of the farm.
- Maximizes recycling of plant nutrients and organic matter.
- Does not use organisms or substances foreign to nature (e.g. GMOs, chemical fertilizers or pesticides).
- Maintains diversity in the production system as well as the agricultural landscape.
- Weed, disease and pest control relying primarily on crop rotations, natural predators, diversity, organic manuring, resistant varieties.
- Nitrogen self-suffi ciency through the use of legumes and biological nitrogen fixation.

78. Ans. (b)

- Statements 1 and 3 are incorrect: There is a small desert situated in the state of Tamil Nadu.
- It consists of red sand dunes and is confined to Thoothukudi district.
- The red dunes are called theri in Tamil.
- They consist of sediments dating back to the Quaternary Period and are made of marine deposits.
- Statement 2 is correct: They have very low water and nutrient retention capacity.
- The dunes are susceptible to aerodynamic lift.
- This is the push that lets something move up. It is the force that is the opposite of weight.
- The petrographical study (petrography is the study of composition and properties of rocks) and X-ray diffraction analysis (a method used to determine a material's crystallographic structure) of the red sand dunes reveal the presence of heavy and light minerals.
- These include Ilmenite, Magnetite, Rutile, Garnet, Zircon, Diopside, Tourmaline, Hematite, Goethite, Kyanite, Quartz, Feldspar, Biotite.
- The iron-rich heavy minerals like ilmenite, magnetite, garnet, hypersthene and rutile present in the soil had undergone leaching by surface water and were then oxidized because of the favourable semi-arid climatic conditions.
- It was due to these processes that the dunes near Tiruchendur, a coastal town of Thoothukudi district are red-coloured.
- The dunes are spread over Kuthiraimozhi theri (2,387.12 hectares) and Sathankulam (899.08 ha) reserve forest of Tiruchendur taluk, which is located on the shoreline

overlooking the Bay of Bengal in the south-eastern part of Tamil Nadu.

79. Ans. (d)

- Option (d) is correct
- Plants need nitrogen to make them. Without nitrogen, a plant cannot make the proteins, amino acids and even its very DNA.
- This is why when there is a nitrogen deficiency in the soil, plants are stunted.
- They simply cannot make their own cells. If there is nitrogen all around us, as it makes up 78 percent of the air we breathe.
- In order for plants to use the nitrogen in the air, it must be converted in some way to nitrogen in the soil.
- This can happen through nitrogen fi xation, or nitrogen can be "recycled" by composting plants and manure.
- There are two routes to go when fi xing a nitrogen deficiency in the soil, either organic or non-organic.

Organic

- To correct a nitrogen defi ciency using organic methods requires time, but will result in a more even distribution of the added nitrogen over time.

Some organic methods of adding nitrogen to the soil include:

- Adding composted manure to the soil Planting a green manure crop, such as borage Planting Nitrogen fixing plants like peas or beans.
- Adding coffee grounds to the soil.

Non-organic

- Nitrogen as a plant fertilizer is common when purchasing chemical fertilizers.
- When looking to specifically add nitrogen to your garden, choose a fertilizer that has a high first number in the NPK ratio.
- The NPK ratio will look something like 10-10-10 and the first number tells you the amount of nitrogen.
- Using a nitrogen fertilizer to fix a nitrogen deficiency in the soil will give a big, fast boost of nitrogen to the soil, but will fade quickly.

80. Ans.(d)

- Option (d) is correct
- It refers to the exertion of a major controlling influence of one or more species upon all other species by virtue of their number, size, productivity or related activities.

To be considered as an ecologically dominant species:

- The organism can compete more successfully than other organisms for essentials of life such as nutrition in the same habitat or the physical environment in which it live,
- It has greater adaptability to environmental variables,
- It can exert a greater influence and compete on the habitat in which it lives,
- The population or the size of the individual species constitutes a dominant proportion when compared with other species, and
- The organism is mobile, aggressive and intelligent, particularly in the case of human beings.
- Example: Caribou are a dominant species on the tundra

81. Ans. (c)

- Statement 1 is correct: The number of species surviving in the world today is the outcome of two processes viz. speciation and extinction.
- Speciation is the process by which new species are formed and evolution is the

mechanism by which speciation is brought about.

- A species comprises of many populations.
- Often different populations of a species remain isolated due to some geographic barrier such as mountain, ocean, river, etc.
- Geographic isolation occurs when a physical barrier develops between two populations of a species.
- Statement 2 is correct: The most common way a population undergoes speciation is by geographic isolation.

82. Ans. (b)

- Option (b) is correct
- The Bonn Challenge is a global goal to bring 150 million hectares of degraded and deforested landscapes into restoration by 2020 and 350 million hectares by 2030.
- Launched by the Government of Germany and IUCN in 2011, the challenge has already surpassed the 150-million-hectare milestone for pledges in 2017.
- India joined the Bonn Challenge in 2015 with a pledge to restore 21 million hectares of degraded and deforested land.
- This was raised to a target of 26 million hectares by 2030 during the United Nations Convention on Combating Desertification (UNCCD) Conference, held in Delhi in September 2019.

Bonn Convention

- Its objective is to protect the migratory species of wild animals and their habitats, and it works under the aegis of UNEP.
- It is also known as the Convention on Conservation of Migratory Species of Wild Animals (CMS).
- India has been a party to the Bonn Convention since 1983.

Desertification

- It means the destruction of the biological potential of land, which may ultimately lead to desert-like conditions.

Causes of desertification:

- Excessive population
- Overgrazing by the cattle
- Increased agriculture
- Development activities
- Deforestation, etc.

- In India, desertification is the major issue faced by Rajasthan, Gujarat, and adjoining parts of Punjab and Haryana.

Controlling desertification:

- Programmes at global level to contain or prevent desertifi cation include the UN Convention to Combat Desertification (UNCCD), Bonn Challenge, SDG 15, Global Environment Facility's initiative - the Great Green Wall, etc.
- India prepared its National Action Programme in 2001 to address the issue of desertifi cation.
- The major step to reduce desertifi cation is afforestation.

83. Ans. (c)

- Option (c) is correct

Genetic diversity

- Genetic diversity refers to any variation in the nucleotide, gene, chromosome or whole genome of the organism.
- According to Williams and Humphries, it is the currency of diversity.
- Approximately 1 billion of genes have been recognised from all the species on the earth.
- Genetic diversity is the key for the survival of any species with changing environmental factors.

- Two major sources of genetic diversity are mutation and sexual reproduction (meiotic cell division).
- Genetic diversity in a species ensures the success of only that particular species which may impact other species in the region either positively or negatively.
- For example, in ongoing global pandemic due to mutation there are several variants of SARS-CoV-2 are formed which is good for the survival and propagation or the virus but it is detrimental for the hosts (in this case human).
  Further mutation may turn it in to deadlier or help in diversify the host species.

84. Ans. (c)

- Option (c) is correct

Alien Invasive species in India

- An alien plant also referred to as exotic, introduced, foreign, non-indigenous or non-native, is one that has been introduced by humans intentionally or otherwise through human agency or accidentally from one region to another.
- An alien plant that has escaped from its original ecosystem and is reproducing on its own in the regional flora is considered a naturalized species.
- Those naturalized aliens that become so successful as to spread in the fl ora and displace native biota or threatens valued environmental, agricultural or personal resources by the damage it causes are considered invasive.
- These species threaten native plants and animals or other aspects of biodiversity.
- They occur in all groups of plants and animals, as competitors, predators, pathogens and parasites, and they have invaded almost every type of native ecosystem.
- The effects on biodiversity are enormous and often irreversible.
- Some of the plant species are Goat weed (from America), Touch-Me-Not (from Brazil), Datura (from America), Madar (from Africa), Water Hyacinth (from America), Prosopis juliflora (from Mexico) 4 '0' clock plant (Peru), etc.
- Red Sanders (or Red Sandalwood) is an Indian species, found in South India.
- Blue vanda or autumn lady's tresses, is a native species of orchid found in Assam and neighboring Khasi hills with its range extending to China.

85. Ans. (a)

- Option (a) is correct

Biodiversity Cold spots

- Cold spots are defined as the areas with high biodiversity and Ecosystem Service values, but low threat values,
- i.e., low potential conflict. Such areas might cause less conservation conflicts due to low opportunity costs.
- Overall, the area covered by cold spots is smaller than that covered by hotspots.
- These are the world's last refuges where high numbers of threatened species still persist.
- They could be the result of protection or because of intact habitat that has not been cleared yet.

86. Ans. (a)

- Option (a) is correct

Floral Endemism in India

- Floral Endemism is the phenomenon of flower species being unique to a defined geographical area.
- Its measure defi nes the diversity of species at any location.
- In India, the sequence of fl oral endemism is (in decreasing order):
- Peninsular India including western and Eastern Ghats (about 2,600 species).

- Eastern Himalaya and north-eastern region (about 2,500 species).
- North-western Himalaya (about 800 species).
- Andaman & Nicobar Islands (about 250 species).

87. Ans. (c)

- Option (c) is correct

The Core Zone

- A core zone secures legal protection and management and research activities (such as sampling) that do not affect natural processes and wildlife are allowed.
- Destructive sampling for scientific investigations is prohibited.
- Strict nature reserves and wilderness portions of the area are designated as core areas of BR.
- The core zone is to be kept free from all human pressures external to the system.

88. Ans. (b)

- Option (b) is correct

Invasive Species

- An alien plant also referred to as exotic, introduced, foreign, non-indigenous or non-native, is one that has been introduced by humans intentionally or otherwise through human agency or accidentally from one region to another.
- An alien plant that has escaped from its original ecosystem and is reproducing on its own in the regional flora is considered a naturalized species.
- The global extent and rapid increase in invasive species is homogenising the world's flora and fauna and is recognized as a primary cause of global biodiversity loss.
- Bio-invasion may be considered as a form of biological pollution and significant component on global change and one of the major causes of species extinction.

Characteristic features of Invasive species:

- Invasive species possess characteristic features like "pioneer species" in varied landscapes, tolerant of a wide range of soil and weather conditions, generalist in distribution, produces copious amounts of seed that disperse easily, grows aggressive root systems, short generation time, high dispersal rates, long flowering and fruiting periods, broad native range, abundant in native range.
- Preliminary data from one interesting study shows that invasive species are likely to have relatively small amounts of DNA in their cell nuclei.
- Apparently, the cells in these plants are able to divide and multiply more quickly and consequently the entire plant can grow more rapidly than species with higher cellular DNA content.
- This gives them a leg up in disturbed sites.

89. Ans. (c)

- Option (c) is correct

Internal Carbon Price

- An internal carbon price is a value that companies voluntarily set for themselves, in order to internalise the economic cost of their greenhouse gas emissions.
- It can be used both as risk management tool and as part of a company's decarbonisation strategy.
- An internal carbon price can help companies enhance their global strategies to become more resilient to regulatory climate policies and more favourable to emission reductions.

Internal carbon pricing primarily takes two forms:

- A shadow price: which represents a carbon value (determined by the company) that is incorporated into investment decisions and

applied to the greenhouse gas emissions generated by projects;

- An internal carbon tax: a levy that companies voluntarily apply to their operations and that increases operating costs depending on the resulting greenhouse gas emissions; the company then uses the proceeds of this tax as it sees fit.
- Internal Carbon price is an internationally recognised business tool that enables companies to create resources which are invested in low carbon technologies, which help reduce future emissions and lower operating costs.

90. Ans. (d)

- All statements are correct

Arctic Amplification

- Over the past 30 years, the Arctic has warmed at roughly twice the rate as the entire globe, a phenomenon known as Arctic amplification.
- This means that global warming and climate change are impacting the Arctic more than the rest of the world.
- Global temperatures from 2000–2009 were on average about 0.6°C higher than they were from 1951–1980.
- The Arctic, however, was about 2°C warmer. Reasons for this are:
- Change in Albedo: Albedo is a measure of how much light that hits a surface is refl ected without being absorbed. When bright and reflective ice (with more albedo) melts, it gives way to a darker ocean (lowering albedo); this amplifi es the warming trend because the ocean surface absorbs more heat from the Sun than the surface of snow and ice.
- Changing Ocean currents: Ocean currents normally bring in warmer water from the Pacifi c, and colder water exits out of the Arctic into the Atlantic.
- But those currents may be changing because more melting ice is injecting the Arctic Ocean with freshwater.
- The missing ice also exposes the surface waters to more wind.
- This mixes up colder freshwater at the surface and warmer saltwater below, raising surface temperatures and further melting ice.
- Changing Weather: Ocean currents drive the powerful polar jet stream, which moves hot and cold air masses around the Northern Hemisphere.
- This is a product of the temperature differences between the Arctic and the tropics.
- But as the Arctic warms, the jet stream now undulates wildly north and south.
- This has been injecting the Arctic with warm air.
- Thunderstorms are also much more likely to occur in the tropics than the higher latitudes.
- The storms transport heat from the surface to higher levels of the atmosphere, where global wind patterns sweep it toward higher latitudes.
- The abundance of thunderstorms in tropics creates a near-constant flow of heat away from the tropics towards the Arctic.
- There is no Antarctic amplification.
- Antarctic warming has been similar to the global average, although some parts are warming much faster.
- This is because, Antarctica is surrounded by the vast Southern Ocean, which is soaking up much of the atmosphere's excess heat.

91. Ans. (c)

- Both statements are correct

Ecological Threat Report, 2021

- The Ecological Threat Report, 2021 was recently released by the Institute of Economics and Peace (IEP).

- This is the second edition of the Ecological Threat Report (ETR), which covers 178 independent states and territories.
- The ETR is unique in that it combines measures of resilience with the most comprehensive ecological data available to shed light on the countries least likely to cope with extreme ecological shocks, now and into the future.
- The ETR analyses a broad range of indicators associated with ecological risk including food and water availability, population growth and societal resilience, to better understand countries most at risk of experiencing signifi cant deteriorations in peace.
- The main finding from the ETR 2021 is that a cyclic relationship exists between ecological degradation and conflict.
- It is a vicious cycle, whereby degradation of resources leads to confl ict, leading to further resource degradation.

Key findings

- Ecological threat and migration:
- As per the report, around 1.26 billion people across 30 countries are suffering from both extreme ecological risk and low levels of resilience.
- These countries are least likely to be able to mitigate and adapt to new ecological threats, which is likely to cause mass displacement.
- The number of people displaced by conflict has been steadily rising with 23.1 million people from hotspot countries living outside their home country in 2020.
- Europe was hosting the largest number of displaced people from hotspot countries, at 6.6 million.
- As many as 13 faced extremely high and 34 others faced high ecological threats.
- The most vulnerable countries are clustered in the Middle East and North Africa, sub-Saharan Africa and South Asia.
- Ecological degradation and conflict work in a vicious circle, whereby one degradation of resources leads to conflict and vice versa.
- Climate change will have an amplifying effect, causing further ecological degradation and pushing some countries through violent tipping points.

Food Insecurity

- Since 2014, the number of people without access to adequate food globally has risen every year, increasing by 44%.
- Increases in food insecurity are associated with deteriorations in peace.
- By 2050, the global demand for food is expected to increase by 50%.
- As a region, south Asia is the worst-placed, with water and food risks driving the average ETR score in the region.
- In sub-Saharan Africa, the score is influenced by high levels of population growth, which will place increased pressure on existing food and water scarcity.
- The region has the highest proportion (66 per cent) of its population suffering from food insecurity, highlighting its severity of water and food risks.

Water stress

- The report reveals that by 2040 over 5.4 billion people will live in countries facing extreme water stress.
- Lebanon and Jordan are countries most at risk.
- Sub-Saharan Africa has the most countries with the lowest levels of social resilience combined with the highest population growth.
- 70% of its population suffer from inadequate access to safely managed water.

Other key findings of the report are:

- Eleven of 15 countries with the worst environmental threat scores are currently classifi ed as being in conflict.

- Another four are classifi ed as at high risk of substantial falls in peace, highlighting the relationship between resource degradation and conflict From 1990 to 2020, a total of 10,320 natural disasters occurred globally.
- Flooding has been the most common natural disasters, accounting for 42 per cent of the total disaster count.
- In 2020, 177 countries and territories recorded a warmer average temperature compared to their historical average temperatures.
- Eleven countries are projected to double their population between 2021 and 2050.
- They are all in sub- Saharan Africa.
- The three countries with the largest projected increases in population are Niger, Angola and Somalia, where the populations will increase by 161, 128 and 113 per cent, respectively.

92. Ans. (b)

- All statements are correct

Dead Zones

- Dead zones are hypoxic (low-oxygen) areas in the world's oceans and large lakes, caused by "excessive nutrient pollution from human activities coupled with other factors that deplete the oxygen required to support most marine life in bottom and near-bottom water.
- In the 1970s oceanographers began noting increased instances of dead zones.
- There are many physical, chemical, and biological factors that combine to create dead zones, but nutrient pollution is the primary cause of those zones created by humans.
- Excess nutrients that run off land or are piped as wastewater into rivers and coasts can stimulate an overgrowth of algae, which then sinks and decomposes in the water.
- The decomposition process consumes oxygen and depletes the supply available to healthy marine life.
- Less oxygen dissolved in the water is often referred to as a "dead zone" because most marine life either dies, or, if they are mobile such as fish, leave the area.
- Habitats that would normally be teeming with life become, essentially, biological deserts.
- These occur near inhabited coastlines, where aquatic life is most concentrated due to availability of food and nutritional requirements.
- Dead zones occur in many areas of the country, particularly along the East Coast, the Gulf of Mexico, and the Great Lakes, but there is no part of the country or the world that is immune.
- The second largest dead zone in the world is located in the U.S., in the northern Gulf of Mexico.

93. Ans. (c)

- Option (c) is correct

Harmful algal blooms

- Nutrient pollution from human activities makes the problem worse, leading to more severe blooms that occur more often.
- Under the right conditions, algae may grow out of control — and a few of these "blooms" produce toxins that can kill fi sh, mammals and birds, and may cause human illness or even death in extreme cases.
- Other algae are nontoxic, but eat up all of the oxygen in the water as they decay, clog the gills of fish and invertebrates, or smother corals and submerged aquatic vegetation.
- Still others discolour water, form huge, smelly piles on beaches or contaminate drinking water.
- Collectively, these events are called harmful algal blooms, or HABs.

Harmful algal blooms need:

- Sunlight
- Slow-moving water
- Nutrients (nitrogen and phosphorus)

94. Ans. (c)

- All statements are correct

Sewage Treatment Stages

- Primary treatment is done by pouring the wastewater into big tanks for the solid matter to settle at the surface of the tanks.
- The sludge, the solid waste that settles at the surface of the tanks, is removed by large scrapers and is pushed to the center of the cylindrical tanks and later pumped out of the tanks for further treatment.
- It is done to remove metals to prevent the grit from causing damage to the equipment.
- The remaining water is then pumped for secondary treatment.
- The secondary treatment stage involves adding seed sludge to the wastewater to ensure that it is broken down further.
- Air is first pumped into huge aeration tanks which mix the wastewater with the seed sludge which is basically a small amount of sludge, which fuels the growth of bacteria that uses oxygen and the growth of other small microorganisms that consume the remaining organic matter.
- This process leads to the production of large particles that settle down at the bottom of the huge tanks.
- The tertiary treatment stage has the ability to remove up to 99 percent of the impurities from the wastewater.
- This produces effl uent water that is close to drinking water quality. Unfortunately, this process tends to be a bit expensive as it requires special equipment, well trained and highly skilled equipment operators, chemicals and a steady energy supply.
- All these are not readily available.

95. Ans. (c)

- All statements are correct

Intergovernmental Panel on Climate Change (IPCC)

- The Intergovernmental Panel on Climate Change (IPCC) is the international body for assessing the science related to climate change.
- The IPCC was set up in 1988 by the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) to provide policymakers with regular assessments of the scientifi c basis of climate change, its impacts and future risks, and options for adaptation and mitigation.
- IPCC assessments provide a scientific basis for governments at all levels to develop climate-related policies, and they underlie negotiations at the UN Climate Conference – the United Nations Framework Convention on Climate Change (UNFCCC).
- The IPCC embodies a unique opportunity to provide rigorous and balanced scientific information to decision-makers because of its scientific and intergovernmental nature.
- The participation in the IPCC is open to all member countries of the WMO and United Nations.
- It currently has 195 members.
- Through its assessments, the IPCC identifi es the strength of scientifi c agreement in different areas and indicates where further research is needed.
- The IPCC does not conduct its own research.

96. Ans. (c)

- Statement 1 is incorrect: The India Biodiversity Awards is a joint initiative by the MoEFCC, NBA and the United Nations Development Programme.
- Statement 3 is incorrect: The winners of India Biodiversity Awards 2023 will be given cash of Rs.5 lakhs.

India Biodiversity Awards 2023

- The India Biodiversity Awards is a joint initiative by the Ministry of Environment, Forest and Climate Change, National Biodiversity Authority and the United Nations Development Programme.
- It is an innovative mechanism to identify and recognize the efforts of individuals, communities and institutions working towards biodiversity conservation, sustainable use of biological resources, access and benefi t sharing and biodiversity governance.
- The winners of India Biodiversity Awards 2023 will be given a Memento, a Certificate and a cash prize of Rs. 5 lakhs under each category.
- Two certificates of appreciation will be given in each category with a cash prize of Rs. 1 lakh each.

97. Ans. (a)

- Statement 1 is incorrect: The 1985 Vienna Convention for the Protection of the Ozone Layer was an international agreement in which United Nations members recognized the fundamental importance of preventing damage to the stratospheric ozone layer.
- It provided the framework for the Montreal Protocol to phase out ozone-depleting substances, including chlorofl uorocarbons (CFCs).
- Statement 2 is incorrect: The adoption of the Montreal Protocol on Substances that Deplete the Ozone Layer on September 16, 1987 marked a turning point in environmental history.
- It is a global agreement to protect the stratospheric ozone layer by phasing out the production and consumption of ozone-depleting substances (ODS).
- Statement 3 is correct: The Ozone Secretariat released “Reset Earth,” an innovative educational platform for adolescents about the role of the ozone layer and the Montreal Protocol.
- The platform includes an animated fi lm that imagines what would have happened if the ozone layer had not been saved.

98. Ans. (a)

- Statement 1 is correct : The Convention on Biological Diversity covers biodiversity at all levels: ecosystems, species and genetic resources.
- Statement 2 is correct : Cartagena Protocol under the convention governs the movements of living modifi ed organisms.
- Statement 3 is incorrect : Cartagena Protocol (not Nagoya Protocol) is related to the establishment of a Biosafety Clearing-House.

Convention on Biological Diversity

- The Convention on Biological Diversity covers biodiversity at all levels: ecosystems, species and 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 haveratified 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, and coordinate with other

international organizations and collect and spread information.

The Convention has two protocols:

- Nagoya Protocol on Access to Generic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization:
- Parties committed to taking into account the needs of, and cooperating with, developing country Parties and "in particular" LDCs, SIDS and Parties with economies in transition; and
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity (governs the movements of living modified organisms – LMOs – resulting from modern biotechnology from one country to another):
- In regard to the establishment of a Biosafety Clearing-House, Parties committed to " Assist Parties to implement the Protocol, taking into account the special needs of developing country Parties, in particular the least developed and small island developing States among them, and countries with economies in transition as well as countries that are centres of origin and centres of genetic diversity";
- in regard to capacity-building, financial resources and access to and transfer of technology and know- how, Parties commit to cooperating in the development and/or strengthening of human resources and institutional capacities in biosafety in developing country Parties, "in particular" the LDCs and SIDS among them, and in Parties with economies in transition.

99. Ans. (c)

- Both statements are correct

Race To Zero campaign

- Race To Zero is a global campaign to rally leadership and support from businesses, cities, regions, investors for a healthy, resilient, zero carbon recovery that prevents future threats, creates decent jobs, and unlocks inclusive, sustainable growth.
- It mobilizes a coalition of leading net zero initiatives, representing 1,049 cities, 67 regions, 5,235 businesses, 441 of the biggest investors, and 1,039 Higher Education Institutions.
- These 'real economy' actors join 120 countries in the largest ever alliance committed to achieving net zero carbon emissions by 2050 at the latest.
- Collectively these actors now cover nearly 25% global CO2 emissions and over 50% GDP.
- Led by the High-Level Climate Champions for Climate Action – Mahmoud Mohieldin and Nigel Topping – Race To Zero mobilizes actors outside of national governments to join the Climate Ambition Alliance, which was launched at the UNSG's Climate Action Summit 2019 by the President of Chile, Sebastián Piñera.
- The objective is to build momentum around the shift to a decarbonized economy ahead of COP26, where governments must strengthen their contributions to the Paris Agreement.
- This will send governments a resounding signal that business, cities, regions and investors are united in meeting the Paris goals and creating a more inclusive and resilient economy.

100. Ans. (d)

- All statement are correct
- Commission for Air Quality Management in NCR CAQM was setup under the Commission for Air Quality Management in the National Capital Region and Adjoining Areas Act, 2021.
- It will replace the Supreme Court mandated Environmental Pollution (Prevention and Control) Authority (EPCA).

- The Commission is the most powerful air pollution monitoring body set up by the Centre to date.
- The rulings by the commission on air pollution will override anything contained in any other law.
- The powers of the commission will also supersede that of any other body in matters of air pollution.
- Therefore, in cases where confl ict may arise between orders or directions issued by the other state governments, state pollution control boards or even the Central Pollution Control Board, the orders of the commission will prevail.
- It is also monitoring the measures taken by the states to prevent stubble burning.
- The Commission is headed by a full-time chairperson with experience of not less than 15 years in the fi eld of environmental protection and pollution control or having administrative experience of not less than 25 years.
- The members of the commission will also comprise of an offi cial from the Environment Ministry, five ex-officio members who are either chief secretaries or secretaries from Delhi, Punjab, Haryana, Rajasthan and Uttar Pradesh, one full-time member who is or has been a joint secretary, three full- time independent technical members who are experts in air pollution, one technical member each from the Central Pollution Control Board and Indian Space Research Organization, three members from non- governmental organization who deal in air pollution and one representative of the National Institution for Transforming India.
- The Commission is to have exclusive jurisdiction over the NCR, including areas in Haryana, Punjab, Uttar Pradesh and Rajasthan, in matters of air pollution, and will be working along with CPCB and ISRO, apart from the respective state governments.