



ENVIRONMENTAL SCIENCE

Maximum Marks: 70

Time Allotted: Three Hours

Reading Time: Additional Fifteen Minutes

Instructions to Candidates

1. You are allowed an **additional fifteen minutes** for **only** reading the question paper.
2. You must **NOT** start writing during reading time.
3. This question paper has **6 printed pages**.
4. There are **twelve** questions in the paper. All questions are compulsory.
5. This paper is divided into **three sections: A, B and C**.
6. **Section A** has **fourteen subparts** which are very short answer questions. Each question carries 1 mark.
7. While attempting **Multiple Choice Questions** in Section A, you are required to **write only ONE option as the answer**.
8. **Section B** has **seven questions** which are short answer questions. Each question carries 4 marks.
9. **Section C** has **four questions** which are long answer questions. Each question carries 7 marks.
10. **Internal choices** have been provided in **three questions in Section B** and in **two questions in Section C**.
11. The intended marks for questions are given in brackets [].

Instruction to Supervising Examiner

Kindly read **aloud** the Instructions given above to all the candidates present in the examination hall.

Note: The Specimen Question Paper in the subject provides a realistic format of the Board Examination Question Paper and should be used as a practice tool. The questions for the Board Examination can be set from any part of the syllabus, though the format of the Board Examination Question Paper will remain the same as that of the Specimen Question Paper. The weightage allocated to various topics, as given in the syllabus, will be strictly adhered to.

SECTION A – 14 MARKS

Question 1

- (i) As part of her Environmental Science project, Anisha has to volunteer in an NGO led project to save a large river, from polluting activities. Which sequence of actions would be **MOST** effective to help save the river? [1]
(Evaluate)
- (a) Pray for rain-Relocate the villages-Fill the river with sand
 - (b) Ban on fishing-Export the toxic water-Build a wall around the river
 - (c) Increase the price of fish-Build a theme park nearby-Start a political agitation
 - (d) Identify the source-Use microbes to clean toxins-Suggest regulations for local factories
- (ii) A village in North India reported an outbreak of an unexplained illness with cholera like symptoms. Doctors linked the cause to the village's drinking water source, primarily hand pumps. The District Magistrate visited the village and decided to bring in experts to find the main reason behind the epidemic's source. [1]
Who among the following professionals would be **BEST** suited to track and identify the core cause? (Evaluate)
- (a) An economist to help generate and allocate relief funds
 - (b) A biologist to study the immediate health impact on villagers
 - (c) A sociologist to generate awareness about hygiene among the masses
 - (d) A geologist to investigate and trace the groundwater contamination source
- (iii) An environmentalist is comparing two ecosystems: A and B. Ecosystem A has a high diversity of lichen and butterflies, while Ecosystem B has a high density of trout fish but is without lichen. [1]
What can be inferred about Ecosystem B? (Analyse)
- (a) It has excellent air quality but poor water quality.
 - (b) It is a desert environment where water is abundant.
 - (c) It has high water quality but likely suffers from air pollution.
 - (d) It is more evolved than Ecosystem A because it supports larger animals.
- (iv) Green AI contributes to the fight against Climate Change by: (Understand) [1]
- (a) increasing fossil fuel extraction.
 - (b) powering crypto-mining servers.
 - (c) predicting weather patterns and rainfall.
 - (d) accelerating the production of single-use plastics.

- (v) In recent times, the standard of living has risen significantly due to modern advancements, but the overall quality of life has been negatively affected because it: [1]
(Understand)
- (a) ensures equal distribution of wealth and resources.
 - (b) creates a fast-paced culture that increases stress and reduces free time.
 - (c) reduces daily stress and lowers environmental pollution levels in the cities.
 - (d) increases the time available for family thereby strengthening community bonding.
- (vi) Harsimran, general manager of a shopping mall, has been given the responsibility to implement a waste management policy for the food court. Which of the following strategies should she adopt to ensure long-term mitigation of microplastic waste? [1]
(Apply)
- (a) Install a vending machine for recycling bottles
 - (c) Switch to an entirely reusable glass and metal cutlery
 - (b) Replace single use plastic straws with paper straws and cups
 - (d) Hire additional sanitation staff to dispose visible plastic trash
- (vii) A developing country is facing a double crisis in the form of a massive malaria outbreak and lack of clean drinking water for its villagers. [1]
Which of the following organisations would be able to solve this issue?
(Understand)
- (a) UNEP
 - (b) UNDP
 - (c) BRICS
 - (d) UNCTAD
- (viii) Which specific Indian act provides protection to diverse biological organisms? [1]
(Recall)
- (a) Wildlife Protection Act 1972
 - (b) Biological Diversity Act 2002
 - (c) Forest (Conservation) Act 1980
 - (d) Waste Management Rules in India 2022
- (ix) Given below are two statements marked Assertion and Reason. Read the two statements carefully and choose the correct option. [1]
(Understand)
- Assertion:** Agricultural societies led to the emergence of the concepts of private property and social classes.
- Reason:** The storage of surplus food allowed some individuals to accumulate wealth while others engaged in manual labour.
- (a) Both Assertion and Reason are true, and Reason is the correct explanation for Assertion.
 - (b) Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion.
 - (c) Assertion is true and Reason is false.
 - (d) Both Assertion and Reason are false.

- (x) Given below are two statements marked Assertion and Reason. Read the two statements carefully and choose the correct option. **(Understand)** [1]

Assertion: The United Nations Environment Programme (UNEP) plays a key role in setting the global environmental agenda.

Reason: It promotes international cooperation and assists the countries in developing and enforcing new environmental protection laws and policies.

- (a) Both Assertion and Reason are true, and Reason is the correct explanation for Assertion.
- (b) Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion.
- (c) Assertion is true and Reason is false.
- (d) Both Assertion and Reason are false.
- (xi) Study the relationship between the first pair below and complete the analogy. **(Understand)**
- (a) Solar energy: Sun rays: Geothermal energy: _____ [1]
- (b) Agricultural Mode: Fixed Settlements: Pastoral mode: _____ [1]
- (xii) Justify the following statements with a reason for each. **(Analyse)**
- (a) The Jarawa tribe is classified as a Particularly Vulnerable Tribal Group. [1]
- (b) Geothermal energy is not as popular as solar energy, even though it provides steady power supply. [1]

SECTION B – 28 MARKS

Question 2 [4]

- (i) Explain *two* effects and *two* measures to mitigate soil pollution. **(Recall)**

OR

- (ii) Explain *two* sources and *two* effects of radioactive pollution. **(Recall)**

Question 3 [4]

Roma visited her grandmother who lived in a village on the foothills of the Himalayas. She observed that no other plants grew near walnut trees planted in her grandmother's courtyard. Later, Roma also noticed egrets hopping and pecking at insects behind the grazing wild buffaloes. Her grandmother remarked that all living organisms interact with one another and their surroundings in diverse ways.

The next week she travelled to Odisha with her grandmother where she saw a leafless, yellow, wire-like plant wrapped around a large tree with some of its parts piercing through the tree. Her grandmother told her that this plant disconnects with the soil entirely once it spreads on the tree.

Discuss the *three* distinct types of interrelationships that Roma witnessed among the different species. **(Understand)**

Question 4

Leena read about the Sentinelese tribe living in the Andaman and Nicobar Islands and are considered one of the world's last remaining 'Stone Age' tribes.

- (i) List *two* general features of the tribe that Leena read about. (Understand) [2]
- (ii) Contrast the Pastoral community with the Industrial community based on their social organisation and relationship with nature. (Analyse) [2]

Question 5

Kaushal, a twenty-five-year old man, was healthy and excited when he joined the aluminium foil manufacturing factory as a full-time employee. However, six months after joining, he developed severe cough, wheezing and shortness of breath. He visited his family doctor who diagnosed Chronic Obstructive Pulmonary Disease upon thorough examination.

- (i) Examine the factors responsible for Kaushal's condition. (Analyse) [2]
- (ii) State the basic principles of Ayurveda as a form of medicine that can ease breathing and help Kaushal build immunity. (Understand) [2]

Question 6

- (i) Discuss the interdisciplinary approach of environmental science in addressing present day issues. (Recall) [4]

OR

- (ii) Discuss the relevance of studying environmental science in contemporary times. (Recall) [4]

Question 7

- (i) How are biotic and abiotic processes linked together in the nitrogen cycle? (Understand) [4]

OR

- (ii) How are humans responsible for disruption of carbon cycle? Explain the effects of such disruptions. (Understand) [4]

Question 8

Over the years, beach tourism in Goa has created employment opportunities, increased income for local communities, and improved infrastructure such as hotels, means of transport, and markets. However, environmentalists have expressed serious concerns over uncontrolled tourism activities.

- (i) Evaluate the economic benefits of tourism in Goa against its long-term environmental challenges for the tourists and the local community. (Evaluate) [2]
- (ii) Suggest a stepwise Action Research Plan based on your response to subpart (i). (Create) [2]

SECTION C – 28 MARKS

Question 9

- (i) (a) What is NGT? Mention *two* of its main objectives? **(Recall)** [3]
- (b) Discuss the role of NGT as a natural saviour in the case of illegal coal mining in Meghalaya. **(Understand)** [4]
- OR**
- (ii) (a) Which incident led to the passing of The Environmental Protection Act 1986? State *two* of its objectives. **(Recall)** [3]
- (b) State *four* rules passed under this Act. **(Recall)** [4]

Question 10

[7]

- (i) How do incidents of diseases act as critical indicators of environmental breakdown within a society? **(Analyse)**
- OR**
- (ii) Examine the role of biotechnology in the fields of medicine, industry and agriculture. **(Analyse)**

Question 11

Imagine you are an architect and have been approached by a client who wants to design a modern office building in a densely populated city where electricity consumption is high and green cover is limited. The client is committed to sustainable development and wants the building to reflect environmentally responsible design principles to reduce the building's environmental impact while ensuring a comfortable and productive workspace.

- (i) Outline *four* green architecture features that you would incorporate into the design. **(Understand)** [4]
- (ii) Explain how these features would promote sustainability and energy efficiency. **(Understand)** [3]

Question 12

Read the scenario given below and answer the questions that follow.

Different species of bumblebees are found in the same mountain meadows, but their feeding pattern differs based on the structure of their mouth parts (tongue) and the depth of the flower's corolla.

Small tongued bumblebees feed on shallow flowers while medium tongued bees feed on medium length of flowers. Long tongued bumblebees feed on deep, tubular flowers.

- (i) Identify and explain the ecological concept indicated above. Contrast it with Gause's principle of competitive exclusion. **(Understand)** [4]
- (ii) What would happen if all three species fed on the same kind of flower? Justify your answer. **(Analyse)** [3]



ENVIRONMENTAL SCIENCE

ANSWER KEY

SECTION A – 14 MARKS

Question 1

- (i) (d) Identify the source-Use microbes to clean toxins-Suggest regulations for local factories [1]
- (ii) (d) A geologist to investigate and trace the groundwater contamination source [1]
- (iii) (c) It has high water quality but likely suffers from air pollution. [1]
- (iv) (c) predicting weather patterns and rainfall. [1]
- (v) (b) creates a fast-paced culture that increases stress and reduces free time. [1]
- (vi) (b) Switch to an entirely reusable glass and metal cutlery [1]
- (vii) (a) UNEP [1]
- (viii) (b) Biological Diversity Act 2002 [1]
- (ix) (a) Both Assertion and Reason are true, and Reason is the correct explanation for Assertion. [1]
- (x) (a) Both Assertion and are true, and Reason is the correct explanation for Assertion. [1]
- (xi) (a) Earth's core heat [1]
(b) Nomadic [1]
- (xii) (a) The Jarawa tribe is classified as a Particularly Vulnerable Tribal Group because of its critically low population, and reliance on pre-agricultural modes driven by hunter-gatherer modes of existence. They also have limited interaction with the outside world and are prone to diseases. [1]
(b) Geothermal energy is not as popular as solar energy, even though it provides steady power supply because it requires drilling into Earth's surface which is very expensive and requires specialised heavy equipment. It also poses a major engineering challenge as underground water contains corrosive material that can damage the pipes and turbines. [1]

SECTION B – 28 MARKS

(Answers provided in Sections B and C are suggestive and not exhaustive. Any other relevant answers will be accepted.)

Question 2

[4]

(i) Effects of Soil Pollution:

- Contaminated soil leads to serious health problems in human beings. Many soil pollutants are carcinogenic which highly increases the chance of cancer.
- Soil pollution disrupts the food chain. Smaller life forms ingest the harmful chemicals in the soil, which then passes up the food chain to larger animals, leading to increased mortality rates and even extinction.
- Soil pollution decreases soil fertility which reduces the crop output.
- Loss of nutrients makes the soil barren.
- It contaminates the groundwater leading to toxicity in drinking water.

Mitigation Measures:

- The use of disposable products should be reduced.
- Item should be recycled and reused to limit the amount of waste that ends up in landfills contributing to soil pollution.
- The use of appropriate quantity of chemical fertilisers can also prevent the soil from being polluted.
- Affirmative steps by the government and civilians in reducing deforestation and increasing tree plantation can also mitigate the pollution.
- Enforcement of strict laws on disposals of hazardous waste can also lessen the damaging impact.

(Candidates have to briefly explain any two sources and effects to reduce soil pollution.)

OR

(ii) Sources of Radioactive Pollution:

- High energy radiation from outer space and sun are a source.
- Nuclear power plants, nuclear waste disposal and nuclear weapon testing are the major human made sources of radioactive pollution.
- Naturally occurring radioactive elements in the earth's crust also cause pollution.
- Improper disposal of radioactive isotopes used in cancer treatment and various medical devices also cause pollution.
- Uranium mining also leads to radioactive pollution.

Effects of Radioactive Pollution:

- Radioactive exposures lead to genetic mutations and changes in DNA compositions.
- The presence of Radioactive pollution increases the risk of cancer.
- Radioactive compounds present in the soil adversely affect soil compositions making it toxic and reducing its fertility.
- It causes chronic illness like cancer.

(Candidates have to briefly explain any two sources and effects of radioactive pollution.)

Question 3

[4]

- The walnut trees as observed by Roma exhibit *Amensalism*. It is the ecological interaction between two species in which the impact of one species on the other is negative, that is, one species is destroyed but the other remains unaffected. Here, the toxic chemical secreted in the soil by walnut trees stops any other plants or any nearby vegetation to grow. The walnut trees remain unaffected.
- Roma saw egrets pecking at insects behind the grazing wild buffaloes which signifies the interrelationship known as *Commensalism*. It is a type of interaction where one species benefits from another without causing any harm. In this instance, the egret does not significantly affect the buffalo (host) but is benefitted immensely. While grazing, the buffaloes uproot the grasses exposing the insects which are then pecked at by the birds. Egrets get their food and buffaloes remain unaffected.
- The leafless, yellow, wire-like plant wrapped around a large tree is an example of *Parasitism*, which is a biological relationship where an organism (yellow, wire-like plant) known as parasite, lives at the expense of the other (the large tree). In this kind of relationship one organism is harmed while the other is benefitted. *Cuscuta* lacks chlorophyll, so it cannot synthesise food. It penetrates the stem of the tree through haustoria drawing nourishment from it.

(Candidates are required to briefly discuss the three types of interrelationships indicated in the scenario. They must logically relate the discussion to the scenario provided.)

Question 4

- (i) General features of Sentinelese Tribe:

[2]

- The Sentinelese are an indigenous tribe. They are majorly hunter-gatherers.
- They are an isolated community that fiercely reject all external contact and strongly defend their territory.
- They rely mostly on fishing, gathering forest goods and hunting local wildlife.

(Candidates have to write any two features of the Sentinelese tribe.)

- (ii)

- **Social Organisation:** The pastoralists have no specific form of social organisation. They are tightly knit tribes with household as the basic unit of organisation. The industrialists, on the other hand, have a social structure with clear preference for urbanisation. The prevalence of nuclear family is common as kinship ties are weak and social life is almost nil. The pastoralists have an authoritarian society, and social polygamy is permitted among the wealthy. The society of the industrialists, on the contrary, is dictated by class, caste, occupation and power. Its members are competitive and aggressive.
- **Relationship with nature:** There is an interdependence between human societies and nature in a pastoralist setup. The members live in cohesion and harmony with the environment while industrialists objectify nature and view it as a tool to fulfil their needs. The pastoralists view nature as sacred and believe it to possess spiritual power which promotes sustainability and maintains ecological balance. There is no attempt to control nature. The industrialists dominate and master the forces of nature to fulfil human needs and desires which leads to depletion of resources.

[2]

(Candidates have to discuss the distinction between the Pastoralists and the Industrialists on the parameters specified in the question.)

Question 5

- (i) Kaushal was exposed to certain air pollutants and toxic gases in air during his work hours in the factory. The prolonged exposure to and inhalation of these toxic gases and aluminium particles led to chronic lung disease in Kaushal. Also, absence of proper ventilation aggravated his condition. [2]
- (ii) Ayurveda is a traditional, holistic and simple form of healing approach. It aims to discover the real causes of one's health conditions by diagnosing and treating the core of the problem. It can help analyse the primary cause of Kaushal's ailment, be it the improper diet, lifestyle, hereditary, negative thinking or emotional and energetic imbalance. This diagnosis can not only detect the actual cause but also provide remedies that would treat his problem from the core. [2]

Question 6

[4]

- (i)
- Environmental science merges all disciplines to understand and solve modern problems. It engages with biology and studies living things, animal habitats, biodiversity, and how disruptions affect ecosystems.
 - It also enables scientists to measure chemical pollutants in the air, water, and soil, and understand toxic reactions.
 - It studies geological processes like plate tectonics, soil formation, rock weathering, and natural disasters to understand their impact on the ecosystem.
 - It helps us understand energy flow and the mechanics of renewable energy systems like wind or solar power.
 - It also evaluates the economic benefits of policies versus their ecological impact and promotes sustainable green businesses.
 - It shapes environmental policies, laws, and public awareness to ensure citizens cooperate and environmental justice is served.

(Candidates are expected to refer to disciplines and discuss how Environmental Science combines them to address ecological issues.)

OR

- (ii)
- Environmental science is a multidisciplinary domain that actively engages with daily human actions.
 - It mirrors the consequences of human actions on environment. It enlightens us about the importance of protection and conservation of environment. Recent times have witnessed an increase in environment issues, that have grown in number as well as complexity threatening the survival of various species on earth.
 - Environment issues like global warming, ozone depletion, acid rain and marine pollution are not merely national issues but global and hence need to be tackled with international efforts and cooperation.
 - It propagates the idea of sustainable development ensuring that present economic growth does not rob future generations of vital natural resources like clean water, fertile soil, and forests.
 - It provides scientific facts to help design effective environmental regulations, and international treaties.

(Candidates are expected to discuss the reasons that make Environmental Science a relevant area of study.)

Question 7

[4]

- (i) Nitrogen moves through the abiotic and biotic parts of ecosystem in a process called the Nitrogen Cycle. Nitrogen cycles between the atmosphere and living things.

Stages of the Nitrogen Cycle:

- During lightening, free nitrogen reacts with oxygen in the air and forms oxides of nitrogen. It dissolves in water and enters the soil as nitrates. This is abiotic process.
- Legume as well as non-legume plants absorb nitrates from the soil. Animals eat these plants and get nitrogen in the form of proteins from plants which is a biotic process.
- Free living nitrifying bacteria as well as leguminous plants aid in this process and convert ammonium in the soil into nitrates. The process is called *nitrification*.
- All waste matter and the decomposed dead and decaying animals release nitrogen into atmosphere. Denitrifying bacteria assists in this process.

OR

- (ii)
- Burning of fossil fuels increases huge amount of carbon dioxide in the air. This process rapidly releases massive amounts of carbon dioxide, which is a greenhouse gas, directly into the atmosphere.
 - Deforestation leads to depletion of forests that act as major carbon sinks by absorbing the huge amount of carbon di oxide released during photosynthesis. Clearing of forests for agriculture, industrialisation and urbanisation removes these vital sinks.
 - The excess of greenhouse gases causes global warming which has negative effects on food production and leads to loss of biodiversity, extinction of species, rise in average global temperature, rise in sea level, heavy rainfall, melting of glaciers and flooding of coastal areas.
 - Modern agriculture practices such as the use of pesticides, chemicals, technical equipment like tractors reduce the soil's capacity to store carbon and lead to the release of greenhouse gases.

Question 8

- (i) The severe long-term impact of increased tourist activities in Goa outweighs its economic benefits. Tourism contributes a massive share to Goa's state Gross Domestic Product (GDP) and brings in foreign exchange. It also creates jobs in hotels, restaurants, transport, and tour operations for local residents. However, tourist invasion has created long term environmental challenges and impacted the local community. The construction of luxury hotels and swimming pools drain local groundwater tables, leaving residents with shortages. The influx of tourists has led to massive amounts of plastic and solid waste that local landfills cannot handle safely. Unregulated construction has damaged sand dunes, eroded beaches, and destroyed marine life habitats. Therefore, compared to the economic benefits which are seasonal gains, long term environmental challenges are serious and threaten existence of humans and other species.

[2]

(Candidates are required to compare the benefits as well as the challenges posed by increased tourism in Goa and give their opinion.)

- (ii) Step 1: Data Collection: Carrying out scientific tourism carrying capacity assessments to determine the areas that can sustainably accommodate tourists. [2]

Step 2: Policy Formation:

- Establish recommended daily visitor limits for particularly sensitive sites.
- Setup scientific waste disposal plans.
- Enforce stringent rules to protect biodiversity and marine life.

Step 3: Implementation of the policy in a localised area as a pilot project.

Step 4: Compare environmental conditions before and after the interventions with data based evidence.

Step 5: Evaluate the effectiveness of the plan. If satisfactory results are obtained, implement the plan to a wider geographic tourist zone.

(Candidates are required to design an Action Plan in brief outlining the concrete steps that can be taken to mitigate the impact of surge of tourism in Goa. Any other relevant plan apart from the one mentioned above will be accepted.)

SECTION C – 28 MARKS

Question 9

- (i) (a) NGT: The National Green Tribunal is a specialised statutory body established in 2010 to handle the environmental disputes efficiently. [3]

The broader aim of NGT is environmental preservation and sustainability.

The objectives of NGT are:

- Delivering prompt and timely justice in environmental cases
- Making holistic decisions based on both legal and technical knowledge
- Enforcement of the environmental laws and regulations with strictness
- Empowerment of citizens by giving them a platform whereby the grievances of the people and environmental issues can be addressed
- Providing relief and compensation of environmental degradation damages to individuals

(Candidates have to write any two of the above objectives.)

- (b) NGT acted as a vital natural saviour by imposing a complete ban on unscientific rat-hole coal mining in Meghalaya in 2014 to stop severe ecological destruction and mounting workers fatalities. The mines were typically unregulated, lacking safety measures such as proper ventilation, structural support, or safety gear for the workers. They were also linked to ecological issues, such as the acidification of rivers, land degradation, deforestation, and water pollution. [4]

It ordered a complete and immediate interim ban on mining and transport of unauthorised coal across the state. It highlighted toxic acidic water pollution of local rivers and penalised the state authorities. It also facilitated ecological restoration by monitoring environmental damage and imposing hefty fines on the state. It intervened through suo motu cognisance and judicial enquiries.

OR

(ii) (a) The Act was introduced after Bhopal Gas Tragedy. [3]

The Environmental Protection Act 1986 aims to:

- provide a common legal framework to control pollution in India and to synchronise the national policies with the international environmental obligations.
- implement coordinated central action for the protection and improvement of the quality of the environment in air, water and land.
- provide guidelines for controlling pollutants and hazardous substances including their use, storage and disposal.
- keep the Indian law abreast of the global standards.
- create penalties severe enough to deter environmental violations.

(Candidates have to write any two objectives in complete sentences.)

(b) Rules passed under The Environmental Protection Act 1986: [4]

- Environment Protection Rules, 1986
- Hazardous Waste Rules, 1989 (Now 2016)
- Biomedical Waste Rules, 1998
- Municipal Solid Waste Rules, 2000
- Noise Pollution Rules, 2000
- Ozone Depleting Substances Rules, 2000
- Battery Waste Rules, 2001
- Plastic Waste Rules, 2011
- Electronic waste Rules, 2011

(Candidates have to write any four of the above rules passed under this Act.)

Question 10

[7]

(i) Incidents of diseases are a critical indicator of environmental breakdown because changes in the environment directly influence human health.

Environmental diseases can be directly attributed to unhealthy, adverse environmental factors. Such factors include exposure to toxic chemicals, radiation, air pollution, water contamination and inadequate sanitation. If the conditions of air, water and soil deteriorate, the occurrence of diseases increases.

The primary environmental causes of diseases are:

- Increased pollutants from industries, vehicles, and burning fuels contribute to respiratory diseases such as asthma, bronchitis and lung cancer.
- Contaminated water spreads enteric diseases such as cholera, diarrhoea, typhoid and hepatitis.
- Destruction of natural habitats can bring humans into closer contact with disease carrying animals. Felling of trees increases the risk of zoonotic diseases.
- Environmental conditions such as stagnant water, rainfall and increased temperatures can favour mosquito breeding and malaria or dengue transmission.

- The use of pesticides, heavy metals and industrial chemicals in food, water or soil can cause chronic illnesses, including neurological, reproductive and certain cancers.

OR

- (ii) Biotechnology is a broad discipline in which biological processes, organisms, cells or cellular components are exploited to develop new technologies.

Role of biotechnology in the field of medicine:

- Development of tailor-made medicines maximise therapeutic effects and decrease damage to nearby healthy cells.
- Detection of biomarkers in patient samples enables in accurate diagnostics.
- Biotechnology is revolutionising regenerative tissue engineering.
- Gene and cell therapy is guided by biotechnological principles.

Role of biotechnology in industry:

- Biotechnology helps manufacture biofuels to produce ethanol, biodiesel, and biogas.
- Biotechnology aids in microbial treatment of wastewater and solid waste.
- It has revolutionised the field of pharmaceutical and food processing.

Role of biotechnology in agriculture:

- It has enhanced agriculture with development of genetically modified crops and pest resistant plants.
- Biotechnology helps develop high-yielding crop varieties.
- It has also created crops that can survive drought, salinity, and extreme temperatures.
- Crops can be enriched with essential nutrients through biotechnology.

Apart from the cutting-edge reforms that the intervention of biotechnology has made in these fields, it has also led to certain serious ethical concerns on genetic manipulation of human embryos and altering the human germline. Multinational companies often patent biological resources and traditional knowledge from developing nations without proper authorisation or fair compensation. Also, releasing genetically modified organisms into medical or environmental settings can trigger unforeseen side effects.

Question 11

- (i) Suitable Green Architecture Features:

[4]

- Rainwater harvesting system can be introduced to conserve water.
- Ventilation system can be designed for efficient heating and cooling.
- Design of the building can be such that it maximises the natural light propagation.
- Locally sourced or recycled material can be used in designing the office.
- Non-synthetic, non-toxic materials can be used in the design.
- Energy efficient lighting appliances can be fixed.
- Water saving plumbing fixtures can be incorporated in the design.
- Alternate power sources such as solar energy or wind power can be installed on the roof.

(Candidates have to write any four suitable features that they would include in their design.)

- (ii)
 - Solar panels would reduce fossil fuel reliance. Its use would also promote energy efficiency.
 - Conservation of water would aid in recycling and reduce ground water depletion.
 - The use of reworked wood, reused steel or sustainable materials like bamboo would reduce the carbon footprint of the construction.
 - The open design would support the occupant's health and promote a strong sustainable livelihood. [3]

(Candidates have to highlight how the green features selected for the architectural design of the office space would promote environmental sustainability.)

Question 12

- (i) Resource Partitioning is the ecological concept indicated in the scenario. It happens when species with same ecological niches divide resources to minimise competition. [4]

Resource Partitioning allows the species to coexist in the same habitat by using different resources or using the same resources to avoid competition. In Nature, species dependent on the same resource may compete fiercely for it. To avoid this competition, the two species may partition the resource based on their behavioural or morphological factors.

Morphological Differentiation happens when two competing species evolve differently so that they can use the resource in different ways. Like the different lengths of proboscis (mouth parts) of the two competing bumblebees will decide on which flowers it will feed on. By evolving different proboscis length, several species of bumblebees can exist in the same habitat.

On the other hand, Competitive Exclusion Principle, often referred to as Gause's Law, states that two species with identical niches cannot coexist indefinitely. Both will compete for the same scarce resource, and one will inevitably outcompete the other, leading to extinction or the displacement of the weaker competitor.

- (ii) If all three species fed on the same kind of flower, interspecific competition will increase manifold which may eventually lead to the survival of the fittest and strongest. As a result, other two bumblebees may be displaced and excluded from the habitat. They can become locally extinct. There will be no resource-partitioning and no co-existence. [3]