



ENVIRONMENTAL SCIENCE

Maximum Marks: 70

Time Allotted: Three Hours

Reading Time: Additional Fifteen minutes

Instructions to Candidates

- You are allowed **additional 15 minutes** for **only** reading the question paper.
- You must **NOT** start writing during the reading time.
- This question paper has **6** printed pages.
- It is divided into **three sections** and has **12 questions** in all.
- All questions are compulsory. Answer **all** questions.
- **Section A** has **fourteen subparts** which are very short answer questions. Each question carries 1 mark.
- While attempting **Multiple Choice Questions** in Section A, you are required to **write only ONE option as the answer**.
- **Section B** has **seven questions** which are short answer questions. Each question carries 4 marks.
- **Section C** has **four questions** which are long answer questions. Each question carries 7 marks.
- **Internal choices** have been provided in **two questions in Section B** and in **one question in Section C**.
- 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.

SECTION A - 14 MARKS

Question 1

- (i) Potential resources are those resources that already exist in nature but are not used for the benefits of human beings. [1]

Which one of the following represents Potential Resources?

(Application)

- (a) Hydroelectric power generated by Bhakra Nangal Dam.
- (b) Crude oil discovered in Rampur district of Uttar Pradesh.
- (c) Existence of water in three forms on earth.
- (d) Timber derived from Corbett National Park and transported to various cities.
- (ii) Given below are two statements marked Assertion and Reason. Read the two statements carefully and choose the correct option. [1]

Assertion: Malthus held that human population would have to resort to subsistence living.

Reason: He believed that the population grew arithmetically and resources grew geometrically.

Which one of the following is correct?

(Analysis)

- (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) Assertion is false and Reason is true.
- (iii) *Eris* are popular rainwater harvesting systems of Tamil Nadu in India. Which one of the following categories do these systems fall under? [1]

(Understanding)

- (a) Micro irrigation
- (b) Macro irrigation
- (c) Modern irrigation
- (d) Ultra-modern irrigation

- (iv) High volume sampler is a manual technique for collecting samples of *particulate matter* (PM). Ananya used this technique to measure the PM level at four different locations. [1]
Which one of the following areas is **likely** to record the maximum level of particulate matter? **(Application)**
- (a) A shopping mall in Delhi
 - (b) A remote village
 - (c) The peak of a mountain
 - (d) A cement industrial area
- (v) Study the relationship between the first and second words given below and fill in the fourth word on that basis. **(Analysis)** [2]
- (a) Ex-situ : In-situ :: Cryopreservation : _____
 - (b) Pull factors : Immigration :: Push factors : _____
- (vi) Name the radical environmental advocacy group founded by Dave Foreman, Mike Rosella and Howie Wolke. **(Recall)** [1]
- (vii) The practice of exporting hazardous wastes from developed countries to developing countries amounts to environmental injustice. **(Recall)** [1]
Name the International Treaty formulated to curb this practice. **(Recall)**
- (viii) Write the expanded forms of the following. **(Recall)** [2]
- (a) HYV
 - (b) TRIPS
- (ix) Write a term for the description given below.
- (a) A factual data of deaths in a population during a specific period. **(Recall)** [1]
 - (b) The permit that allows the holder to emit one tonne of carbon dioxide. **(Recall)** [1]
 - (c) The maximum number of individuals that can be supported by an ecosystem without causing any damage to the environment. **(Understanding)** [1]
 - (d) Government's decision to restrict the international trade to protect and promote domestic business. **(Understanding)** [1]

SECTION B – 28 MARKS

Question 2

[4]

- (i) Discuss the purpose of Environmental Economics. **(Understanding)**

OR

- (ii) What is *natural resource accounting*? Explain *any two* of its advantages. **(Understanding)**

Question 3

[4]

The thermometers used commonly in households are high risk sources of mercury which is a toxic soil pollutant. It can pose a serious health hazard if not disposed carefully. It should not be discarded carelessly but returned to the shopkeeper who should then return it to the manufacturer for its safe disposal or resource retrieval.

Under which environmental scheme is the shopkeeper responsible for the safe disposal? Explain. **(Understanding)**

Question 4

[4]

State *any four* functions of the Central Pollution Control Board. **(Recall)**

Question 5

A monkey and a butterfly inhabit the same area in a forest. Each follows a different life pattern for its survival.

- (i) Identify the survival strategies followed by the two species mentioned above. **(Recall)** [1]
- (ii) In the event of a natural calamity, the monkey flees the forest and moves to a stable environment while the butterfly stays in the forest and struggles to survive. Account for the differences in their reactions to the natural calamity. **(Analysis)** [3]

Question 6

[4]

- (i) Why did Cuba switch to organic farming? **(Understanding)**

OR

- (ii) Water crisis can lead to social unrest and misery. Explain the statement with reference to Cochabamba. **(Understanding)**

Question 7

[4]

Explain *any four* ecological impacts of Transnational Companies.

(Understanding)

Question 8

[4]

Farah bought a flat in a new housing society shown below. The builder told her that the housing society integrated the best practices of rural and urban living.



(Source: <https://www.georgiaencyclopedia.org>)

- (i) Identify the emerging style of living shown above. **(Understanding)** [1]
- (ii) Why is this style of living preferred to an ultra-modern way of living? **(Analysis)** [3]

SECTION C – 28 MARKS

Question 9

Read the following passage and answer the questions given below.

Despite being a major food producer with extensive food security schemes and the largest public distribution system in the world, India still grapples with significant levels of food insecurity, hunger, and child malnutrition.

The Global Hunger Index (GHI), 2022, ranked India 107 among 121 countries.

(Source(edited): *Measuring hunger across States – December 7, 2023 - The Hindu Website*)

- (i) How is the problem referred to in the passage linked to the Green Revolution? **(Analysis)** [2]
- (ii) In the light of the above passage, discuss *three* major problems encountered in attaining food security. **(Understanding)** [3]
- (iii) Discuss *two* main features of the Food Security Law. **(Understanding)** [2]

Question 10

- (i) How did Gandhi's advocacy of Khadi address the political, environmental and socio economic needs of Indian villages? **(Analysis)** [4]
- (ii) Differentiate between *tied aid* and *untied aid*. Support your answer by giving one example for each. **(Understanding)** [3]

OR

- (i) Given below are a few lines from a poem by Wendell Berry. [4]
- “Sowing the seed,
My hand is one with the Earth.
Having cared for the plants,
My mind is one with the air.
Eating the fruit,
My body is one with the earth.”
- How do the lines given above bring forth Wendell Berry’s idea of conservation? (Analysis)
- (ii) State *any two* advantages and *any one* disadvantage of Free Trade. [3]
- (Understanding)

Question 11

- (i) Mr. Saini owns an orchard. He is delighted to know that his new neighbour is a beekeeper. [2]
- In the light of externalities, specify the reason for Mr. Saini’s delight. Mention the term for the type of externality in the example mentioned above. (Analysis)
- (ii) The tiger has been placed in its coffin. [5]
- Nothing short of a miracle can save tigers in the wild in this country.
(Source: <https://frontline.thehindu.com>)
- In the light of the above statement, examine the effectiveness of Project Tiger launched by the Government in 1972. (Analysis)

Question 12

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

The next time you take printouts unnecessarily or you throw a paper in to the bin, think for a minute as to how many trees have been felled to manufacture it and how much wastewater generated in the process for something you use so often every day.

Can you take out some time from your everyday routine and devote it to starting a simple recycling program at your school or your neighbourhood? Not only you would save our planet from the torture of felling greenery, but you would also reduce generation and dumping of waste into the environment.

- (i) Besides waste generation, paper manufacturing industry also degrades the quality of air and water. Discuss *any two* points to establish the role of State Pollution Control Board in mitigating the problem. [2]
- (Understanding)
- (ii) Which *three* indicators of water quality should be checked? What is their significance if you want to recycle wastewater generated in the case above? [3]
- (Analysis)
- (iii) DEWATS (Decentralised Waste Water Treatment System) is a simple and cost effective method of recycling water. Explain the statement. [2]
- (Evaluate)



ENVIRONMENTAL SCIENCE

ANSWER KEY

SECTION A - 14 MARKS

Question 1

In answering Multiple Choice Questions, candidates have to write either the correct option number or the explanation against it. Please note that only ONE correct answer should be written.

- (i) (b) Crude oil discovered in Rampur district of Uttar Pradesh. [1]
- (ii) (c) Assertion is true and Reason is false. [1]
- (iii) (a) Micro irrigation [1]
- (iv) (d) A cement industrial area [1]
- (v) [2]
- (a) National Park
- (b) Emigration
- (vi) Earth first [1]
- (vii) Basel convention [1]
- (viii) [2]
- (a) High Yielding Variety
- (b) Trade Related Aspects of Intellectual Property Rights
- (ix) [1]
- (a) Mortality [1]
- (b) New Urbanism [1]
- (c) Carrying capacity [1]
- (d) Protectionism [1]

SECTION B – 28 MARKS

Question 2

[4]

- (i) Purpose of Environmental economics
- It aims to quantify the intangible resources and assign an economic value to these resources.
 - It strives to ensure the judicious use of natural resources.
 - By quantifying the natural resources, it aims at infusing the realisation that natural resources do not come for free.

OR

- (ii) Natural resource accounting is an accounting system that deals with stocks and stock changes of natural assets comprising of biota, sub soil assets water, soil with their natural ecosystem.

Advantages

- It incorporates environmental values into conventional accounting thereby, helping us assess the sustainability of economic growth.
- It provides an information system linking the economic activities to the changes in the natural resource base and shows how these activities utilize natural resources and affect the environment.

Question 3

[4]

Extended producer responsibility

It is a practice and a policy approach in which producers take responsibility for management of the disposal of products they produce once those products are designated and no longer useful by consumers.

It ensures that the environment remains clean. It reduces the waste from the environment and encourages producers to manufacture fewer toxic goods/ more durable goods.

Question 4

[4]

Functions of the Central Pollution Control Board

- To advise the central government on any matter concerning the control of air pollution.
- To plan and execute nationwide programmes for controlling pollution.
- To provide technical assistance and guidance to the state boards for research work to control pollution.
- To organise training of persons to be engaged in prevention and abatement of pollution.
- To organise mass media campaigns regarding control of pollution / To organize a comprehensive programme through mass media for prevention and control of air pollution.
- To lay down standards of air quality etc.
- To lay down standards for maintaining the air quality.
- To collect and disseminate information in respect of matters relating to air pollution.

(Candidates are required to write any four functions in complete sentences and not phrases.)

Question 5

- (i) Monkey 'k' strategy, Butterfly 'r' strategy [1]
- (ii) The monkey belongs to 'k' category and has a long span of life. It produces few offsprings. Hence, it lives in a stable environment to ensure the survival of its species. It is density dependent and needs to leave the forest in the event of a calamity. [3]

The butterfly adopts 'r' strategy to survive. It produces many offsprings and is not density dependent. It has a short span of life but few offsprings survive to produce the next generation. Therefore, the butterfly does not leave the forest.

(Candidates have to analyse the reactions of the two species and give valid reasons to support their answers.)

Question 6

[4]

(i) Reasons for organic farming in Cuba

- Cuban economy relied heavily on support from Soviet Union and were receiving all resources from them. During cold war, Cuba received subsidised oil, chemical fertilisers, pesticides and other farm products in exchange of sugar. Hence, they remained insensitive to the need for organic farming.
- This aid was stopped by the Soviet Union and Cuba faced a situation of crisis.
- It struggling to cope up with shortage of fuel, raw material and manufactured products.
- Therefore, Cuba had no option but to switch over to sustainable methods which were cheaper.

(Candidates have to explain any two reasons in brief.)

OR

(ii) Cochabamba

- The privatisation of the government led to a hefty hike (40%) in water tariff.
- The World Bank had suggested the idea of privatisation to repair and maintain the waterworks which had reduced the supply of water by the Government.
- A protest was led by the middle class farmers, teachers, students, unemployed miners and even the local police. In retaliation to police firing, the protesters became unruly and unparalyzed the country by nationwide roadblocks.
- The outcome was that the controversial amendment was scrapped and the agreement was revoked. As a result Cochabamba's water supply continues to function at 40% capacity while the economically weaker sections have to make do with contaminated water supply from water tankers.

(Candidates have to explain the statement by referring to the water crisis in Cochabamba.)

Question 7

[4]

Impact on environment

TNCs are involved in environmentally damaging activities.

- They are responsible for more than 50% of the greenhouse gases leading to global warming.
- TNCs are related to mining and use of non-renewable resources.
- Most of world's chlorine and toxic chemicals like PCB, DDT, and Dioxin is produced by TNCs.
- Production and use of CFCs leading to depletion of ozone layer.

- TNCs are main transmitters of environmentally unsound productive systems, hazardous materials and products to the third world, through advertisements TNCs promote a culture of unsustainable consumption.

(Candidates are required to explain any four ecological impacts of TNCs.)

Question 8

- (i) Neo Urbanism / New Urbanism [1]
- (ii) Features of new urbanism [3]
- It is an attempt to integrate the best features of both rural and urban living.
 - It creates a positive self- image for the community.
 - It solves the problem of housing, transportation and pollution.
 - It makes the cities livable.
 - It provides open space, safe streets, green buildings to increase affordable housing, universally acceptable public spaces, communities designed for pedestrian and transit, balanced development, appropriate technology and heritage conservation.

SECTION C – 28 MARKS

Question 9

- (i) The passage addresses the problem of acute shortage of food in India. It has traces in the Green revolution. Green revolution happened after Bengal famine. Though it benefitted the farmers immensely, in its provision of subsidies but it led to an increase in the cost of inputs as it stressed upon the use of HYV seeds. The petty farmers who could not afford new technology lost out and became landless labourers. Many fell victims to money lenders. This took a toll on the earnings of poor farmers and led to the problem of food security. Also, pulses were dropped in favour of wheat to boost import. Less people died of starvation but more suffered from malnutrition. In the long run, green revolution made the country self- sufficient in production, however it has its own set of problems. [2]
- (Candidates have to discuss in brief the linkages between green revolution and food security.)*
- (ii) Problems in attaining food security [3]
- Production problems – lack of support for farming, no loans, no credit, no market facilities for farmers no MSP storage- no good cold storage facilities/ access – no access to subsidised food for all underprivileged
- The production of food has stagnated but growth in population has not.
 - Low incomes/ poverty and disease.
 - Less arable land available for cultivation/ dependence on natural factors. The cost of food is increasing making it unaffordable for many After Green Revolution cases of malnutrition have increased.
 - Resource flow into agriculture has increased.
 - Climate change has been responsible for poor productivity.
 - Gross capital formation in agriculture has been declining.
 - Crop output may be reduced due to floods.

- Poor infrastructure for storage [improper warehouses] and poor transport facilities.
- Unavailability of timely credit for marginalized farmers.
- Presence of large middlemen reduces the profit margins
- Agricultural produce is not graded.

(Candidates have to discuss any three major problems. The problems discussed should be prominent and not general.)

(iii) Main features of the Food Security Law

[2]

- Public Distribution System covering 75% of population in rural areas and 50% in urban areas.
- States will determine eligibility criteria of food distribution.
- Free meals to be given to children ranging between 6 months to 14 years of age.
- Pregnant women and lactating mothers to get extra benefit.
- State and district level redress mechanism to be put in place.

(Any two main features have to be discussed in brief. The features should not be general in nature.)

Question 10

(i) Advocacy of Khadi

[4]

Political purpose

Gandhi's advocacy of Khadi promoted the idea of swaraj. It furthered the use of home-made fabrics thereby investing the small scale industries with power. This move decentralised the political powers vested in the colonial regime and encouraged the idea of *swadeshi* or home rule.

Environmental purpose

The promotion of Khadi led to the development of eco-friendly industries. It made a good use of the locally available raw material which in turn benefitted the environment. Since Khadi was produced in villages, the reliance on British industries decreased leading to environmental benefits.

Socio economic purpose

The advocacy of Khadi brought a social order as it led to an equal distribution of resources. It empowered women economically as they too participated in the manufacturing of Khadi. It created job opportunities for all since a massive part of populace was involved in manufacturing of Khadi. It also provided opportunities of growth to under privileged sections.

(Candidates are required to analyse the political, environmental and socio-economic effects of the advocacy of Khadi.)

(ii)

[3]

Basis	Tied Aid	Untied aid
Authority	Donor country decides how the aid should be utilized	Recipient country decides how the aid should be utilized
Impact	Minimises corruption on both sides	Can lead to corruption in the recipient country
Accountability	Both countries are accountable for proper utilization of aid	There is no accountability on either side.
Awareness of the needs	Awareness on the part of the donor country about the developmental needs of the recipient country	Donor country may not be aware of the developmental needs of the country receiving the aid.

(Candidates are required to cite any two differences between the two aids and also support the differences by giving one example for each. The differentiation must be done on a common basis.)

OR

(i) Wendell Berry is an environmental activist, farmer and a prolific writer of both fiction and non-fiction. Berry is known for his commitment to environmental protection and criticism of big business units that have occupied land. He took part in non-violent civil disobedience against construction of nuclear power plant in Indiana.

[4]

The lines given above echo his sentiment of saving the environment. They also foreshadow the unity of humans and nature. It also brings forth the mutual interdependence of human and environment. Berry insists upon caring for nature which in turn will lead to bounties of nature and benefit human society.

He believed that good life encompasses sustainable agriculture, appropriate technology, connection to place, healthy rural communities, good food, the miracle of life, fidelity, frugality and reverence.

(Candidates have to give a brief introduction of the environmental ideology of Wendell Berry's concerns and then link it to the extract.)

(ii) Free trade occurs when there are no artificial barriers put in place by governments to restrict the flow of goods and services between trading nations.

[3]

Advantages:

- Increased production
- Production efficiencies
- Benefits to consumer
- Employment
- Economic growth

Disadvantages:

- With removal of trade barriers, structural unemployment may occur
- Increased domestic economic instability from international trade cycles.
- Competition is high, new industries may find it difficult.
- Free trade may lead to pollution.

Question 11

- (i) Mr. Saini is delighted as the bees from his neighbour's orchard will pollinate the plants / crops / fruit trees in his orchard. It will indirectly increase the productivity and the overall output of his farms, thus giving him economic benefit. [2]

The type of externality referred to above is Positive externality.

- (ii) The project has been successful and effective in conservation of tigers. [5]
Reasons

- It has ensured the protection of the entire ecosystem.
- It has led to an increase in the number of prey and predator.
- The funds allocated have been used efficiently.
- The data collected under this project has been scientific.
- However, though a lot of money was pumped into the project mainly by WWF the results are not that satisfactory. Project tiger directorate is a guiding authority having no judicial powers, immense lack of coordination among the bodies dealing with the project.
- Funds are not adequate.
- A proper training is needed for the field staff.
- A stringent legal system that provides harsh punishment in a time bound scale needs to be established.

Nonetheless, the project has been successful to a great extent in conserving these endangered species.

(Candidates have to analyse the effectiveness of this project by referring to its pros and cons. Since the positive impacts of the project outweigh its limitations, it can be considered an effective move.)

Question 12

- (i) Role of State Pollution Control Board [2]
- To launch a program for control of air pollution e.g., NAMP.
 - To advise the state government on such matters.
 - To obtain knowledge and disseminate the information on corrective measures.
 - To generate awareness on matters related to control of air pollution.

- (ii) Indicators of water quality [3]
B.O.D, C.O.D, pH, D.O, Electrical conductivity, Turbidity, Temperature, Nitrates, Sulphates, and Faecal waste in water.

Significance

B.O.D- Biochemical oxygen demand or B.O.D is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific period of time. Higher BOD value suggests more polluted water.

- C.O.D- Chemical oxygen demand or C.O.D test is commonly used to indirectly measure the number of organic compounds of water. Most applications of COD determine the number of organic pollutants found in surface water e.g. lakes and rivers or wastewater. High COD means polluted water.

- pH- It indicates the acidity, alkalinity or H⁺ ion concentration.
It depends on the surrounding land, water inputs, or type of minerals in contact with water. It affects the solubility of organic matter, minerals and metals.
It affects both biological and chemical processes.
Change in pH level may increase the toxicity of water. The pH range from 5.5 to 8 is acceptable. More or less pH than the above suggest water is polluted.
- Dissolved pollutants- More the dissolved pollutants, poor is the quality of water.
- Physical Indicators- Indicators such as maggots' larvae and other plant or animal species also suggest poor quality of water.
- Turbidity- it is a measure of light transmission through water. The greater suspended particles greater is the turbidity, which indicates polluted water.
- Electrical Conductivity- the greater the concentration of ions in water higher will be the conductivity which means contaminated water. Salinity of water is the measure of its conductivity. It affects the aquatic biota; it also affects the quality of water used for irrigation and drinking purpose. It can also indicate any seepage or sewage leak in the ground water.
- Temperature- it is an important measure of the health of water. High temperature reduces the solubility of dissolved oxygen. BOD and COD rises. Spawning of fish, photosynthesis is affected. Extreme temperature may prove to be fatal. It may lead to mass death of fish also.

(Candidates have to write the significance of any three indicators in brief.)

(iii) DEWATS

- It does not require much space for operation.
- It can be decentralised and catered to a singly household.
- It does not require skilled labour.
- It is low in operation and incurs less maintenance cost.

(Candidates have to discuss only those features of DEWATS that substantiate the statement given in the question.)

[2]