

SECTION A (50 MARKS)
ANSWER ALL QUESTIONS

Question 1

a) For each question, there are four alternatives: A, B, C and D. Choose the correct alternative and circle it. Do not circle more than the ONE alternative. If there is more than one choice circled, NO score will be awarded. [25]

i. Despite some significant environmental achievements, Bhutan's natural resources are under pressure. As a concerned citizen, which strategy would you choose to safeguard the natural resources of the country?

A Implementation of laws
B Minimizing human activities
C Carrying out advocacy programmes
D Practicing afforestation and reforestation

ii. Tashi owns 30 acres of land. Out of 30 acres, 10 acres of land is used for paddy cultivation, 5 acres as pasture and 10 acres as orange orchard, while 5 acres is barren land. The total bio-productive land is

A 10 acres.
B 15 acres.
C 25 acres.
D 30 acres.

iii. The ocean creatures called anemone fishes live between the tentacles of sea anemones to protect themselves from the predators.
The type of commensalism described in the above example is

A phoresy.
B metabiosis.
C inquilinism.
D chemical commensalism.

iv. Which of the following is NOT a part of geophysical disaster?

A volcano
B tsunami
C earthquake
D storm surge

v. Biotic potential is the ability of organisms to grow in a population without limit. The organisms will have maximum biotic potential when

A population grows beyond carrying capacity.
B the climatic conditions are unfavourable.
C resources available are unlimited.
D resources available are limited.

vi. What determines the carrying capacity of an ecosystem?

- A Growth rate
- B Territorial size
- C Natural selection
- D Limiting resources

vii. Normally in the phosphorous cycle, the amount of phosphorous eroded from the soil is more than the amount added. This continuous loss is due to

- A leaching, erosion and surface runoff.
- B decomposition, erosion and leaching.
- C geological uplift, leaching and erosion.
- D leaching, decomposition and surface runoff.

viii. The following are the issues related to an ecosystem:

- I Disturbance of food chain
- II Degradation of ecosystem
- III Pollution of resources
- IV Extinction of species

Identify the combination of issues that show the consequences of overharvesting of resources.

- A I, II and III
- B I, II and IV
- C I, III and IV
- D II, III and IV

ix. *Rhododendron bhutanense* and *Rhododendron kesangiae* are the species of rhododendron which are found in Bhutan only. This type of species is called as

- A exotic species.
- B native species.
- C endemic species.
- D endangered species.

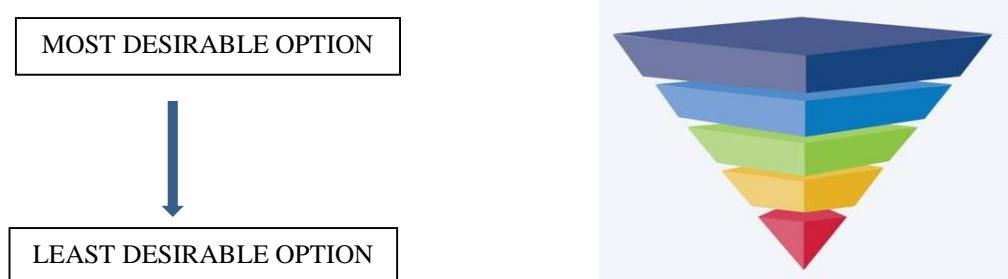
x. Which of the following is an intrinsic factor that influences the stability of an ecosystem?

- A hunting
- B spread of diseases
- C floods and landslide
- D increase in population

xi. Climate change has caused the rise in sea levels due to the melting of ice sheets and glaciers. This can cause

- A destruction of human settlements.
- B spread of water borne diseases.
- C increase in marine animals.
- D extinction of species.

xii. Which one of the following sequence would best fit the waste management hierarchy given below?



- A Refuse → Reuse → Reduce → Recycle → Disposal
- B Refuse → Reduce → Reuse → Recycle → Disposal
- C Refuse → Reduce → Recycle → Reuse → Disposal
- D Refuse → Recycle → Reuse → Reduce → Disposal

xiii. Biodiversity conservation ethics are deeply rooted in the Bhutanese culture and tradition.

One such cultural practice is ‘*sokdam*’ which refers to refraining for a certain period from

- A using mountain passes by humans.
- B grazing of animals in the forest.
- C human activities in the forests.
- D killing of animals.

xiv. The ultimate aim of the disaster management is to

- A restore the services and facilities as before.
- B provide financial support after the disaster.
- C collect valuable data for future management.
- D resettle people in the closest unaffected areas.

xv. Which one of the following energy sources has the least impact on the environment and people?

- A hydro energy
- B solar energy
- C wind energy
- D fossil fuels

xvi. Which one of the following statement best describes the aim of sustainable development?

- A Preservation of culture and tradition at any cost
- B Ensuring that every individual is happy in the country
- C Preventing the use of natural resources for the developmental activities
- D Meeting the needs of the present without compromising for the future generations

xvii. All the following statements describe the importance of phenology **EXCEPT**

- A provides information and fundamental knowledge about processes in nature.
- B studies the number of different species in an ecosystem.
- C detects climate change and its impacts.
- D carries out agricultural planning.

xviii. Study the picture given below.



The direct impact of this phenomenon would be

- A collapsed building, floods and tsunami.
- B famine and increase in poverty.
- C release of ash and hot gases.
- D spread of diseases.

xix. Which of the following is the prime health risk associated due to the depletion of the ozone layer?

- A eye cancer
- B skin cancer
- C bone cancer
- D blood cancer

xx. The lifestyle of people is generally expressed through

- A habits, attitudes and language.
- B culture, income and health conditions.
- C consumption pattern, habits and attitudes.
- D consumption pattern, culture and family size.

xxi. Deforestation leads to climate change because it reduces the

- A plants that absorb carbon dioxide.
- B habitats of organisms.
- C amount of rainfall.
- D transpiration.

xxii. Despite various initiatives undertaken by the government towards sustainable development, Bhutan is facing some challenges because of

- A change in the lifestyle of people.
- B lack of proper education system.
- C proper access to clean technologies.
- D high dependence on external market and aid.

xxiii. The cost of electricity is less in the villages as compared to the towns. This is called “cap and trade” system. The objective of such a system is to

- A distribute the energy equally in rural and urban areas.
- B discourage people to use electricity in urban areas.
- C regulate and conserve energy consumption.
- D generate more income for the country.

xxiv. Ecotourism is considered as a sustainable developmental strategy because it

- A respects the local culture and traditions.
- B improves the livelihoods of the people in the community.
- C leads to exchange of positive experiences between host and guest.
- D contributes to biodiversity conservation and income generation as well.

xxv. The following are some of the measures to reduce the overuse of pasture land.

- I Practise rotational grazing
- II Grow high yielding grasses
- III Practise seasonal livestock rearing
- IV Keep limited high yielding livestock

As an environmentalist, which combination of advice would you give to the farmers?

- A I, II and III
- B I, II and IV
- C II, III and IV
- D I, II, III and IV

b) Fill in the blanks with appropriate word(s).

[5]

i. The process in carbon cycle that helps to remove carbon dioxide from the atmosphere is _____.

ii.	The long term measure taken to reduce the risk and impact of disaster is called _____.	
iii.	The different interaction between the species and their environment has a major influence on the _____ of the ecosystem.	
iv.	The amount of electricity generated by wind energy will depend on _____ of wind.	
v.	The carrying capacity of earth is _____.	

c) **Match the phrase of column A correctly against the word or phrase in column B. Rewrite the numbers of matching pair in the space provided.** [5]

Column A	Column B
i. total number of species in an ecosystem.	1. resilience
ii. ability of an ecosystem to regenerate after disturbance.	2. species richness
iii. how close in number the species are in an ecosystem..	3. disaster relief
iv. providing food, water and emergency health care.	4. species evenness
v. species that have a tendency to spread causing damage to other species.	5. invasive species
	6. resistance
	7. disaster rehabilitation

Column A	Column B	
i.		
ii.		
iii.		
iv.		
v.		

b) State TRUE or FALSE for the statements given below. Rewrite the false statements in the correct form. [5]

- i. Flowering of apple in spring increases the carrying capacity of the orchard.
- ii. People in Thimphu will have smaller ecological footprint than the people in Gasa.
- iii. If the pressure on a given resource in an ecosystem increases, the resource degrades both in quality and quantity.
- iv. As the average global temperature rises, average precipitation decreases due to less evaporation.
- v. The advantage of landfills is that it will reduce the volume of waste.

c) **Answer the following questions.**

i. How is economical factor responsible for shaping the lifestyle of people? Justify with **TWO** points. [2]

ii. Sacred forests and lakes contribute to conservation of biodiversity. Give **TWO** [2] justifications.

iii. Write **TWO** advantages of electricity generated from hydropower energy over [2] solar energy.

iv. Why do you think Bhutan should take tourism as one of the strategy to achieve the [2] goals of sustainable development? Give **TWO** reasons.

v. Read the excerpt given below.

Land degradation due to natural as well as anthropogenic factors is becoming a serious concern in the country, and to address this, a workshop was conducted on assessing the economic benefits of sustainable land management (SLM) with an aim to identify potential policies that are beneficial for long-term growth. Minister for Agriculture and Forests, Yeshey Dorji, said, “Land degradation is increasingly becoming an issue of serious concern, both locally and globally.”

Source: https://July 9, 2018//thebhutanese.bt/combatting-land-degradation-in-the-country/

In the situation given above, if you are an agricultural officer, what programmes would you introduce to prevent land degradation? Mention any **TWO**. [2]

SECTION B (50 MARKS)
ANSWER ANY FIVE QUESTIONS

Question 2

a) The table given below shows the different organisms in a lake. Study the table and answer the questions that follow.

Species	Number (n)	$n(n-1)$
Brown trout	10	
Catfish	8	
Carp	4	
Steelheads	6	
Total (N)	28	

i. Complete the calculation of $n(n-1)$ in the third column.

[1]

ii. Calculate the value of Simpson's diversity index (D).

[1]

iii. What can you conclude about the diversity of the lake?

[1]

b) What is greenhouse effect? Write **TWO** causes of greenhouse effect.

[2]

c) How are the following a threat to biodiversity? Justify with **ONE** reason.

i. Habitat destruction and fragmentation

[1]

ii. Climate change

[1]

iii. Invasive species

[1]

d) After the first infestation of armyworm in 2013, villagers and agriculture extension agents (AEA) in Trongsa are again battling another outbreak, as it crawls from Nubi and Tangsibi in the north to Langthel and Drakteng in the south. The dzongkhag agriculture officer (DAO), Karma Tshewang, said that, except for Korphu gewog, the rest of the gewogs have all reported an outbreak of armyworm in paddy and maize fields.

Source: May 18, 2015/<http://www.kuenselonline.com/armyworm-infests-paddy-in-trongsa/>

In the biological disaster described in the above situation, explain any **TWO** measures to control the armyworm infestation.

[2]

Question 3

a) According to the Land Act of Bhutan 2007, farmers are not allowed to convert their '*Chuzhing*' to '*Kamzhing*'. What would happen if this restriction is not implemented? [2]

b) The pictures given below show the two different settings.



Write **THREE** differences in the lifestyle of the people based on the two settings.

c) A World Bank report on the state of solid waste around the world estimates that, the amount of Municipal Solid Waste (MSW) will rise from the current 1.3 billion tonnes per year to 2.2 billion tonnes per year by 2025, with much of the increase coming from rapidly growing cities in developing countries. Low income countries are also expected to generate 213 million tonnes of solid waste a day with the population rising to 676 million by 2025.

<https://www.omicsonline.org/open-access/solid-waste-disposal-and-community-health>

As an environmental science student, suggest any **TWO** measures that can be useful to reduce the solid waste generation.

[2]

d) What is energy conservation? Write **TWO** ways of conserving energy at home. [2]

e) Explain biotic potential taking the example of mosquitoes in summer. [1]

Question 4

a) “Advancement of technology increases the carrying capacity of the Earth”. Do you agree? Justify with **THREE** reasons. [3]

b) World Environmental Day is observed each year on 5th June with different themes to create awareness on protecting our environment. The theme for 2019 is 'Beating Plastic Pollution'. [2]

Design a poster to display the theme in your school.

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c) What are some of the factors that can lead to change in the carrying capacity of an ecosystem? Mention at least **TWO**. [2]

d) Explain exponential growth and logistic growth of population with the help of graphs. [2]

e) Define land use transformation. [1]

Question 5

a) Explain **THREE** purposes of energy conservation.

[3]

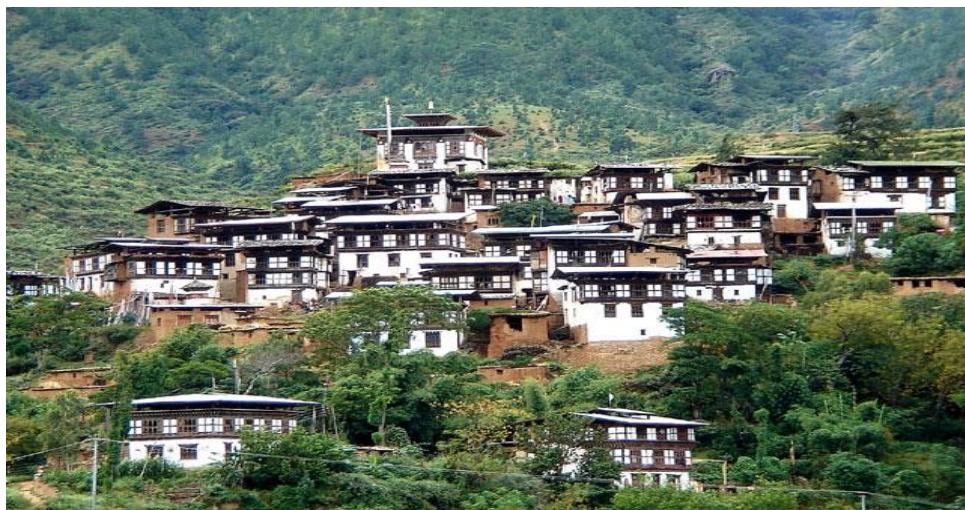
b) Climate change is a major global issue. Describe any **TWO** indicators which justifies that climate change has occurred.

[2]

c) Mention **ONE** difference between in-situ and ex-situ approaches of biodiversity conservation in the table given below. [1]

In-situ conservation	Ex-situ conservation	

d) Study the picture given below.



What are some of the risks this village is vulnerable to at the time of disaster? [2]
Mention any **TWO**.

e) The type and amount of waste generated may differ between the communities. [2]
Identify **TWO** factors that may be the cause for this difference.

Question 6

a) Jamyang, an industrialist from Mongar, wishes to establish a Plastic Waste Recycling factory. You as the environmental officer is given the responsibility to carry out Environmental Impact Assessment (EIA) of his project.

What are the steps to be followed for issuing the Environmental Clearance (EC) to enable him to establish the factory? [3]

b) What is the aim of International Plant Protection Convention? Who is the focal agency for this convention in Bhutan? [2]

c) Give **TWO** examples where the natural resources degradation has impacted the carrying capacity of the ecosystem in Bhutan. [2]

d) According to a study carried out in 2013 by Ministry of Agriculture and Forest on the impact of collecting cordyceps, it was found that overharvesting of cordyceps has happened, and it has also impacted the habitats of wild life and other medicinal plants.

In this regard, mention at least **FOUR** factors that are responsible for overharvesting.

[2]

e) Write **TWO** application of solar energy in Bhutan.

[1]

Question 7

a) National Biodiversity Centre (NBC) at Serbithang in Thimphu is an organization under the Ministry of Agriculture and Forests. NBC was instituted in 1998 as an implementing agency, following the joining of Convention on Biological Diversity (CBD) by Bhutan in 1995.

With reference to the given information about NBC, write **TWO** important roles played by the agency in the conservation of biodiversity.

[2]

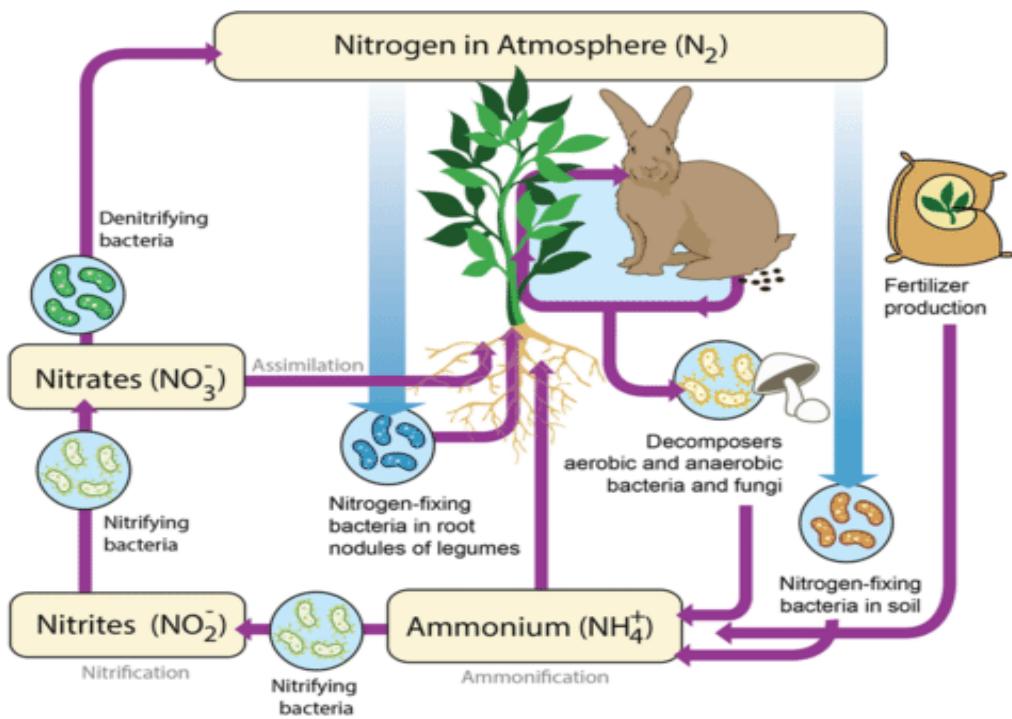
b) What are the procedures to be followed in Disaster Risk Reduction (DRR)? Give any **TWO**.

[2]

c) In what ways do humans interfere in the interactions of the organisms in an ecosystem? Explain any **TWO** ways. [2]

d) Forest plays a dual role in influencing the ecological footprint. Give TWO justifications. [2]

e) Study the diagram given below.



What would happen if there were no micro-organisms in the nitrogen cycle? State **TWO** consequences.

[2]