

SECTION A (40 MARKS)
ANSWER ALL QUESTIONS

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 ONE alternative. If there are more than one circled, NO score will be awarded.** [25]

- i. The recurrence of various life processes such as respiration, germination, migration and reproduction at regular intervals in a year is termed as
- A diversity.
 - B edge effect.
 - C periodicity.
 - D ecological niche.

- ii. The information given below are initiating causes of ecological succession.
- I windstorm
 - II migration
 - III soil erosion
 - IV competition

Which one of the following combinations best describe initiating causes of ecological succession?

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

- iii. The Kingdom of Bhutan is the only country in the world that generates about 2.2 million tons of CO₂ each year, yet its forests absorb three times this amount, which eventually creates a carbon sink. Bhutan is said to be
- A carbon zero.
 - B carbon neutral.
 - C carbon positive.
 - D carbon negative.

- iv. “Certain tree species in the country have been found to cause allergic reactions in people. It can get in your nose and cause sneezing. In some, it causes itchiness and watery eyes.”

(BBS, March 28, 2018)

The above statement best describes

- A biological pollutant.
- B chemical pollutant.
- C genetic pollutant.
- D water pollutant.

- v. “Environment Assessment 2000, Biodiversity act of Bhutan 2003 and Convention on Biological Diversity (CBD) are a few national and international policies adopted by the National Biodiversity Centre (NBC) of Bhutan. All of the following are the benefits of these policies **EXCEPT**
- A provide food security
 - B promote livelihood of people
 - C contribute in income generation
 - D encourage resource consumption
- vi. The National Biodiversity Strategy and Action Plan (NBSAP) is Bhutan’s strategic document outlining the programmes and action plans for the conservation and sustainable use of biodiversity in the country. Which of the following thematic areas as per NBSAP is responsible for assessing socio-economic benefits from biodiversity?
- A National Resources Management
 - B Ecosystem and Ecosystem Services
 - C Knowledge, Technology and Education
 - D Species Conservation and Protected Areas Management
- vii. Study the figure given below.



(source: www.csuchico.edu)

- The type of land management practice depicted is
- A terracing.
 - B hedgerows.
 - C strip cropping.
 - D contour bunding.
- viii. Which of the following activity will have the minimum carbon footprint?
- A generating minimum waste
 - B a person cycling to work
 - C recycling plastic bottle
 - D reducing vehicles

- ix. The information mentioned below are the benefits of Green Building.
- I encourages consumption of energies
 - II reduces greenhouse gas emission
 - III encourages use of more raw materials
 - IV promotes eco-friendly practices
- Which one of the following best describe benefits of Green Building?
- A I and II
 - B II and III
 - C II and IV
 - D III and IV
- x. An ecologist is doing research on the ecological succession in one of the degraded ecosystems.
- Which of the following is the correct sequence she should follow during the study to get accurate data and result?
- A Invasion -> Stabilisation -> Competition & Coaction -> Nudation -> Reaction
 - B Nudation -> Stabilisation -> Competition & Coaction -> Invasion -> Reaction
 - C Invasion -> Nudation -> Competition & Coaction -> Reaction -> Stabilisation
 - D Nudation -> Invasion -> Competition & Coaction -> Reaction -> Stabilisation
- xi. The figure below shows degradation caused by mining.



How can such degradation be prevented?

- A building walls
- B reforestation
- C growing crops
- D counter ploughing

- xii. Which of the following statement is **NOT** true about community ecology?
- A Ecotone is characterized by the absence of ecological niche.
 - B Major community consist of a greater variety of organisms.
 - C Minor community consist of lesser variety of organisms.
 - D Ecotone consist of a wide range of organisms.
- xiii. “The people of Gomtu in Samtse are grappling with dust and air pollution every day. Emissions from the cement industries coupled with dusty roads have led to an increasing number of patients with dust-related eye, skin, and respiratory issues at the Gomtu hospital.”

(Source:bbs.bt, August 19, 2019)

Which of the following technological application is the best way to reduce air pollution?

- A gravitational settling chambers
 - B electrostatic precipitators
 - C incinerators
 - D biofilters
- xiv. Many of us are familiar with the effects of climate change. While there are many actions we can do daily, it is important to focus on the solutions with the biggest result.
- Most of the actions shown below will reduce emissions.
- I adopting a plant-based diet
 - II cleaning up ocean pollutants
 - III wasting less food
 - IV restoring tropical forest
- Which of the following combinations will have the biggest effect?
- A I, II and III
 - B I, II and IV
 - C II, III and IV
 - D I, III and IV
- xv. Plants may bloom before butterflies emerge to pollinate them; caterpillars may emerge before birds arrive to feed them to their young.
- These changes in phenophases indicate climate change as
- A phenophases are resilient to climate change.
 - B changes in phenophase manifested in nature.
 - C phenophases of plants and animals are resistant to climate change.
 - D phenophases of plants and animals are sensitive to climate change.

- xvi. “While there is no cure for the Coronavirus disease, it is the basic protocol that is still the most effective. Looking around, it is the same protocols that many are not following”.

(Source:kuenselonline, July 15,2022)

Which one of the following protocols does not support in containing Covid-19?

- A wearing face masks
 - B frequent hand washing
 - C wearing full sleeved shirts and pants
 - D completing vaccines recommended by medical experts
- xvii. Identify the long-term measure to mitigate human-wildlife conflict.
- A use of electric fencing
 - B use of different types of lethal snares
 - C relocation of wild animals to different habitats
 - D create more protective areas and buffer zones
- xviii. “To ensure the water is safe for drinking, without having any adverse risk to health, the laboratory service checks for presence of bacteria, acidity, sand or mud and whether the water has been chlorinated or not.”

(BBS, January 12, 2015)

In the above statement, presence of which bacteria is tested?

- A *Chromobacterium violaceum*
 - B *Aeromonas hydrophila*
 - C *Coliform bacteria*
 - D *Streptococcus mitis*
- xix. As an official from the Ministry of Agriculture and Forestry advocating on land use and its conservation, all of the following methods you would recommend to farmers **EXCEPT**
- A digging.
 - B terracing.
 - C hedgerows.
 - D contour bunding.
- xx. Which of the following does not belong to the four pillars of Gross National Happiness?
- A good governance
 - B community vitality
 - C environmental conservation
 - D preservation and promotion of culture

- xxi. Study the figure given below.

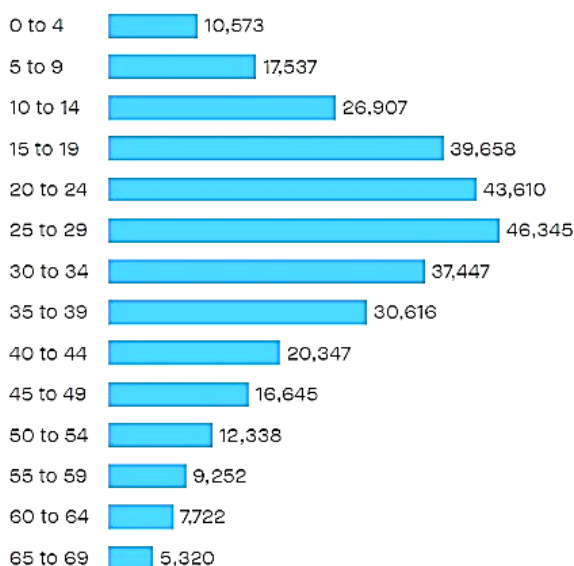


(Source: www.davidsbeenhere.com)

Population growth in urban areas has resulted in the rise in vehicular emissions and traffic congestion. As a Thromde officer, which of the following approaches would you adopt to build a smart, sustainable and resilient city?

- A building four lane road connectivity
- B building multistoried skyscraper
- C building waste treatment and management plants
- D building high-capacity electro metro system

- xxii. Study the graph on rural to urban migration by age group in Bhutan as of 2017.



(Source: *Population and Housing Census of Bhutan, 2017*)

Which of the following has heavily impacted the rural community of Bhutan?

- A loss of local culture
- B acute shortage of labor force
- C lack of community development
- D sharp decline in domestic violence

- xxiii. According to the world's air pollution: real-time air quality index, air quality index of Kolkata, India is 151.

The air quality is

- A healthy.
- B unhealthy.
- C hazardous.
- D very unhealthy.

- xxiv. Read the information presented in the table below.

Sectors	Percentage of emitted CO ₂
I. Energy (electricity, heat and transport)	73.2%
II. Direct Industrial Processes	5.2%
III. Waste	3.2%
IV. Agriculture, Forestry and Land Use	18.4%

(Source: <https://ourworldindata.org/emissions-by-sector>)

Which one of the sectors in the table requires intervention to control the emission of CO₂?

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

- xxv. Sustainable development projects are developments that meet the needs of the present without compromising the ability of future generations to meet their own needs.

Which of the following action best relates to sustainable development goals?

- A green revolution and no poverty
- B Paris agreement and climate action
- C conservation of tiger and life below water
- D competency based education and reduce inequality

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

[5]

i.	Educating people on disasters is an example of _____ phase of the disaster management cycle.
ii.	The policies framed to ensure safe transfer of imported packaged food, live plants, animals and Genetically Modified Organisms in the country is called _____.
iii.	The responsible travel to natural areas that conserve the environment, sustains the well-being of the local people, and involves interpretation and education. This is called _____.

iv.	Pollination of wild related flora by genetically engineered crop causes _____.
v.	The organisms produced by altering DNA materials using genetic engineering methods is called as _____.
vi.	The timing of phenophases in plants and animals subjected to evolution is _____.
vii.	The process which involves observing and keeping record of changes in timing of phases of events in living things for a long duration is _____.
viii.	<i>Rhododendron kesangiae</i> and <i>Ursus maritimus</i> thrives in Bhutan and Arctic regions respectively. Such type of species is called _____.
ix.	The Convention on Biological Diversity adopts conservation of biodiversity and the fair, equitable benefits sharing from the use of _____ resources.
x.	Light emitting plasma, light emitting diode and motion sensor are some of the examples of _____.

c) **Write TRUE or FALSE for the following statements in the space provided.** [5]

i.	Developmental activities and urbanization do not account for land degradation in our country.	
ii.	A victim who resists the stress and adapts to the new challenges is called resilient.	
iii.	The National Environment Protection Act of 2007 (NEPA) sets the overarching legal framework for environmental protection and management in Bhutan.	
iv.	Presence of <i>Benthic macroinvertebrates</i> indicates contaminated water source.	
v.	His Majesty the 4 th Druk Gyalpo received 31 st award of Blue Planet of 2022.	
vi.	Hunting Hazard in the school is part of the disaster management to identify the probable disaster scenario.	
vii.	Hydrogen is safe to be used in cars as a fuel.	
viii.	There are 18 Sustainable Development Goals committed to protect planet, end poverty and ensure peace and prosperity for all.	
ix.	Average person in rural areas use more water for domestic purposes than the urban resident.	

x.	Exemption of tax on import of electric vehicles in Bhutan promotes green technology.		
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- d) **Match each item under column A with the most appropriate item in column B. Write the correct alphabet in the space provided under the ‘answer’ column.** [5]

Answer	Column A	Column B	
	i. Phenomenon caused by over utilization of ground water	a. biogas	
	ii. The method helps in making farming effective and sustainable in slopes. It is determined by the use of Digital Elevation Model	b. aspect map	
	iii. Technology application use to study global land use and land cover changes	c. land subsidence	
	iv. Insulating walls, floors and ceilings	d. conservation of marine ecosystem	
	v. The cheap, available and efficient alternative source of energy that every household in Bhutan can afford	e. stagflation	
	vi. Use fewer natural resources, reduce pollution and waste, recycle and reuse materials, and moderate emissions in their processes	f. polarization radar	
	vii. Verifies compliance with the environmental laws and regulations	g. peace, justice and strong institution	
	viii. Promoting respect for human rights, strengthening capacity of government authorities both at local and national level by making inclusive and sustainable livelihood	h. partnership for goals	
	ix. One indicator of 14 th Sustainable Development Goal: <i>Life Below Water</i> which is a least concern to Bhutan	i. environmental audit	
	x. Current global crisis that is challenging for Bhutan in achieving Sustainable Development Goals	j. remote sensing	
		k. weatherization	
		l. vermicomposting	

SECTION B (60 MARKS)
ANSWER ANY SIX QUESTIONS

Question 2

ai) What is air quality index? [1]

ii. Mention any **ONE** purpose of air quality index. [1]

b) Observe the figure given below.



(source: www.pandotrip.com)

i. Predict the type of ecological succession that might occur on the basis of the nature of habitat. [1]

- ii. State at least **TWO** significances of such ecological succession. [1]

- iii. Mention any **TWO** causes of ecological succession mentioned in Q.i. [1]

- c) Differentiate major community from minor community. Mention **TWO** points each. [2]

	Major community	Minor community	

- d) Carbon footprint of rural dwellers is higher than the urban dwellers. Do you agree? Support your answer with **THREE** reasons. [3]

Question 3

a) Define genetic pollution. [1]

b) What do you understand by Sustainable Development Goals? Mention any **TWO** examples. [2]

- c) What do you understand by a resilient community? Mention **ONE** condition that makes a community resilient. **[2]**

- d) The information in the table provides properties of three different types of soil.

Soil properties	A	B	C
Mineral content	High	High	Moderate
Drainage	High	Low	Moderate
Water holding capacity	Low	High	Moderate
Air spaces	High	Low	Moderate
Potential organic matter	High but less retention capacity	Low	High
Primary productivity	Low	Low	Highest

[1]

- i. Which soil type is the best for growing crops and vegetables? Why?

- ii. Which soil type has high water holding capacity? Give a reason. **[1]**

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iii. Which soil type is the most vulnerable to degradation? Support with a reason. [1]

- e) The most expensive fungi ‘Yartsa Goenbub’ rewarded good prices for the collectors in 2022. “It has been the best auction so far for cordyceps collector, said Kinzang from Lunana in Gasa. The 54-year-old is elated with the returns from the sale of cordyceps this year. This year, he earned Nu.0.8 million from his sale of the most prized fungi (*Cordyceps sinensis*)”.

(Source: kuenselonline, August 16, 2022)

To maintain the sustainability of fungi, you as a Dzongkhag Environmental Officer, formulate any two innovative strategies to conserve the fungi in the locality. [2]

Question 4

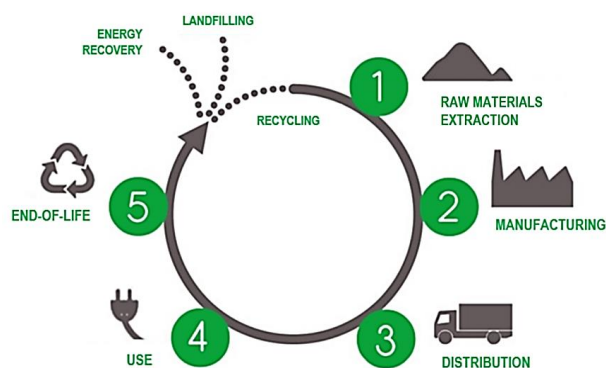
a) Write any **TWO** impacts of climate change in Bhutan. [2]

- b) Phenology study provides information and fundamental knowledge about patterns and processes in nature. Ap Wangchuk has been observing and recording the flowering of plum and walnut trees in his orchard for the past decade. From the collected data, he found irregular flowering pattern in his walnut trees.

Develop questions and propose a hypothesis for the above mentioned phenological study.

[2]

- c) Study the given circular resource management system.



(Source: <https://eco3e.eu/base/eco-design-assets/>)

- i. Select any two stages from the figure (1-5) and briefly explain how these stages are related to green economy?

[2]

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- ii. One dimension of the green economy is the “Good health and well-being”. Why it is important to achieve this objective by our local communities? [2]

- d) Look at the picture below



(Chris Madden Cartoon)

Propose a suitable title phrase to give a meaningful message. [2]

Question 5

- a) Explain any **TWO** major impacts of urbanization on the natural environment. **[2]**

- b) Explain trickle with the help of a diagram. **[2]**

- ci) Mention any **TWO** energy-efficient technologies applicable in Bhutan. [2]

- ii. How does the use of green technology conserve our pristine environment? Give any **TWO** points. [1]

- d) Following are some of the National Key Area Results (NKARs) of 12th FY plan (2018-2023) of our country.

Economic diversification, Healthy ecosystem, Quality of education and skills, Food and nutrition security, Vibrant democracy and decentralization, Sustainable human settlements.

- Arrange the NKARs with respect to sustainable development goals (SDGs) in the table given below. [3]

SDGs	NKARs
Goal 1. No Poverty	
Goal 4. Quality Education	
Goal 8. Decent Work and Economic Growth	
Goal 11. Sustainable Cities and Communities	
Goal 13. Climate Action	
Goal 16. Peace, Justice and Strong Institutions	

Question 6

a) What is composting solid waste?

[1]

b) Explain how Genetically Modified foods affect the following:

i. Our health

[1]

ii. Environment

[1]

c) You own some land on a steep slope where the soil quality is significantly low and poses a challenge to grow crops. How can you make the land usable?

Suggest any **SIX** methods.

[3]

d) Desertification and Acidification are two processes that degrade the land. How do they differ? Mention any **FOUR** differences. **[4]**

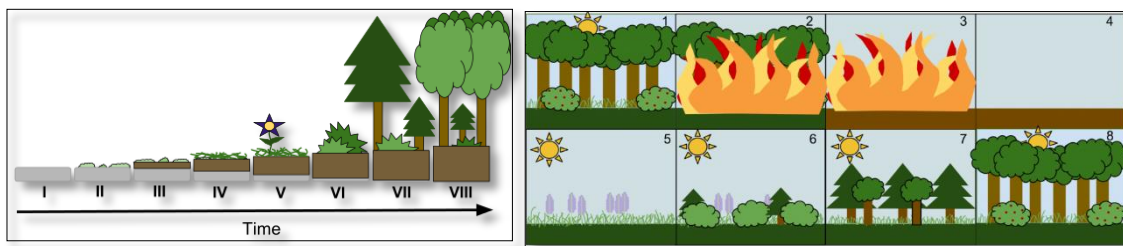
Desertification	Acidification

Question 7

a) Give any **TWO** examples of mutualistic phenophases of plants and animals.

[2]

b) Study the given figures.



(Source: www.thoughtco.com)

Differentiate between the two kinds of succession with an example each.

[2]

c) Explain why you agree or disagree with the following statements:

i. Conservation of local community forest promotes provisioning services. [1.5]

ii. Species richness contributes more to species diversities. [1.5]

d) Schools are densely populated places, with many small children, who are one of the most vulnerable groups in the society. It has been proven time and again that during disasters, schools and school children are the most affected.

Design a simple disaster evacuation map of any disasters related to Bhutan. Your map should include legend to explain any symbols used on the map. [2]

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e) Develop a slogan to communicate the significance of biodiversity conservation. **[1]**

Question 8

a) State any **FOUR** activities that are carried out during preparedness phase in your school. **[2]**

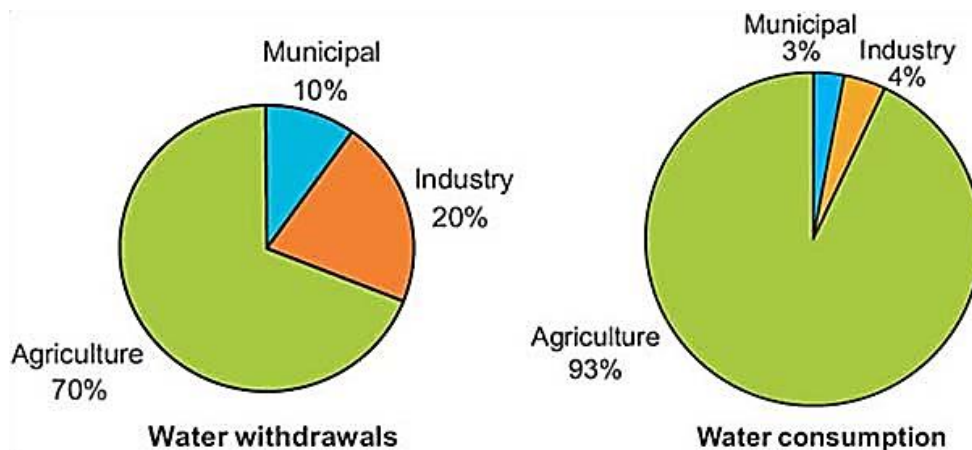
- b) “In the recent past, wetland conservation projects were implemented in Samtengang Lake, Peling Tsho, Buli Tsho, Tali Tsho, and many others. Drying up of water bodies was also reported in popular sites like Dangling Tsho in Trashigang Dzongkhag and freshwater lakes in Gaserling and Goshi gewogs of Dagana”.

(Source: kuenselonline, December 28, 2020)

As these lakes contribute in conserving biodiversity, mention any **FOUR** methods to protect and conserve them.

[2]

- c) Study the given pie chart.



(Source: www.fao.org)

- i. Write the differences between water withdrawal and water consumption. [1]

Water withdrawal	Water consumption

- ii. Why is water consumption by the agricultural sector significantly higher compared to other sectors? [1]

- iii. Which water pollution is commonly associated with agriculture? Why? [1]

- d) Ladakh-based engineer Sonam Wangchuk develops mobile solar-powered tent for the Indian Army. The cost of heating is zero. Even if the temperature outside is minus 20 degrees Celsius, it will be 20 degrees Celsius inside the tent without any heating.

How would you come up with such innovation using locally available materials to build a home to save energy for cooling and heating during hot and cold seasons respectively?

[3]

Question 9

- a) Explain any **ONE** major causes of human-wildlife conflict in our country. [1]

- b) “We have not inherited the earth from our fathers. We have borrowed it from our children”. (*Lester Brown*)

What do you understand by the statement as it relates to the concept of environmental sustainability? [2]

- c) What consequences will Bhutan face without biodiversity management system? Mention any **FOUR**. [2]

- d) Is technology to blame for the deterioration of the climate and the rise of global warming? Why? [2]

- e) Will biodiversity conservation enhance the livelihood of people? Justify with **TWO** reasons. [1]

- f) Should single-use plastics be banned? Why? [2]
