NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, APPLIED SCIENCES AND RESOURCES SCIENCES

DEPARTMENT OF NATURAL AND APPLIED SCIENCES

QUALIFICATION : BACHELOR OF SCIENCE	
QUALIFICATION CODE: 07BOSC	**LEVEL:** 7
COURSE: ECOLOGY	**COURSE CODE:** ECO701S
DATE: JULY 2022	SESSION: 2nd OPPORTUNITY
DURATION: 3 HOURS	**MARKS:** 100

SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER (S)	**Dr Norman Muzhinji**
MODERATOR	**Prof Isaac Mapaure**

INSTRUCTIONS

1. All examination **RULES** apply
2. Answer **ALL** questions in the spaces provided
3. Read all the questions carefully before answering
4. Marks are indicated at the end of each question
5. Write clearly and neatly.
6. All written work **MUST** be done in **BLUE** or **BLACK** ink.

PERMISSIBLE MATERIALS

Non-programmable calculators

ATTACHMENTS

None

THIS QUESTION PAPER CONSISTS OF EIGHT (8) PAGES (INCLUDING THIS FRONT PAGE)

Section A: Multiple choice questions (20 marks)

1. The primary stages of the nitrogen cycle are (starting with atmospheric N2):
   A. Ammonification, denitrification, nitrogen fixation, nitrification, assimilation
   B. Nitrogen fixation, ammonification, assimilation, nitrification, phosphorylation
   C. Nitrogen fixation, nitrification, assimilation, respiration, ammonification
   D. Nitrogen fixation, nitrification, assimilation, ammonification, denitrification

2. Which of the following best describes a relationship in which two species both mutually benefit from each other's behaviors?
   A. Competition
   B. Parasitism
   C. Commensalism
   D. Mutualism

3. Which ecological inquiry method is an ecologist using when he or she sets up a greenhouse and measures the effects of different levels of carbon dioxide on an endangered plant species?
   A. Questioning
   B. Experimentation
   C. Modelling
   D. Forecasting

4. Introduced species can threaten biodiversity because they can
   A. Cause desertification.
   B. Cause biological magnification.
   C. Crowd out native species.
   D. Reduce the amount of fertile land.

5. An organism's niche is
   A. The range of physical and biological conditions in which an organism lives and the way it obtains what it needs to survive and reproduce.
   B. All the physical and biological factors in the organism's environment.
   C. The range of temperatures that the organism needs to survive.
   D. A full description of the place an organism lives.

6. In a logistic growth curve, exponential growth is the phase in which the population
   A. Reaches carrying capacity.
   B. Grows quickly.
   C. Growth begins to slow down.
   D. Growth stops.

7. No two species are able to occupy the same niche in the same habitat at the same time?
   A. Because of the interactions that shape the ecosystem.
   B. Unless the species require different abiotic factors.

C. Because of the competitive exclusion principle.
D. Unless the species require different biotic factors.

8. The law of Physics stating "some energy will be lost as heat in any conversion process" is readily applied in ecosystem ecology to understand

   A. Energy transfer efficiency across trophic levels.
   B. The absorption of sun light by primary producers.
   C. The cycles of chemical elements.
   D. The effect of consumers on producers

9. Ideally, sustainable development should
   A. Put the protection of the environment ahead of human needs.
   B. Provide for human needs at the expense of the environment.
   C. Use more natural resources to make goods to meet human needs.
   D. Preserve ecosystems while providing for human needs.

10. A species that exerts a strong control on community structure by having the highest abundance or biomass in a community is a,
    A. Keystone
    B. Dominant
    C. Predator
    D. Mutualistic

11. One of the impacts associated with the current increase in CO_2 in the atmosphere is
    A. An increase in the greenhouse effect leading to higher average global temperatures.
    B. A higher proportion of skin cancers and cataracts in humans.
    C. An increase in nutrient concentration across terrestrial water systems.
    D. A decrease in global temperatures

12. The total amount of living tissue within a given trophic level is called the
    A. Organic mass.
    B. Trophic mass.
    C. Energy mass.
    D. Biomass

13. Only 10 percent of the energy stored in an organism can be passed on to the next trophic level. Of the remaining energy, some is used for the organism's life processes, and the rest is,
    A. Used in reproduction.
    B. Stored as body tissue.
    C. Stored as fat.
    D. Eliminated as heat

14. A population of bats exhibits logistic growth. If the carrying capacity is 500 butterflies and r = 0.1 individuals/(individuals/month), what is the maximum population growth rate for the population?

(Hint: maximum population growth rate occurs when N = K/2).

A. 12.5 individuals/ month
B. 10 individuals / month
C. 5 individuals/ month
D. 7.5 individuals/moth

15. Excessive nitrate levels are often found in the groundwater of areas with intensive agriculture.
Which is an agricultural practice that can cause such levels?

A. Improper construction or maintenance of animal waste lagoons
B. Use of ammonia in disinfection of meat products
C. Application of pesticides on fields before harvesting
D. Planting monocultures of GMO legume plants for crops

16. Character displacement:

A. Reduces inter-specific competition through "niche differentiation"
B. Is a co-evolutionary response to inter-specific competition
C. Implies that competing species will differ more in allopatry than in sympatry
D. A and B, but not C, are correct
E. A, B and C are correct

17. An ecologist studying several forest-dwelling, insect eating bird species does not find any evidence of interspecific competition. The most likely explanation is
A. Lack of keystone species
B. Low species richness
C. Pronounced intraspecific competition
D. Resource partitioning

18. In a forest community, a shelf fungus and a slug live on the side of a decaying tree trunk. The fungus digests and absorbs materials from the tree, while the slug eats algae growing on the outside of the trunk. These organsims are

A. The same habitat, but different niches
B. The same niche, but different habitats
C. the same niche and the same habitat
D. different habitats and different niches

19. In the National Botanic Garden of Namibia, there are 50 species more than 25 species found at the Ombili Conservative Centre. In between them, they have 5 species in common. Calculate the Sorenson's coefficient

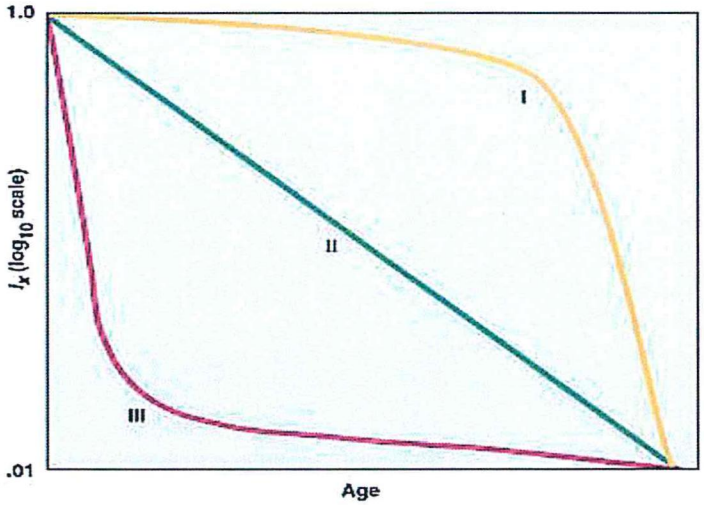
A. 0.067
B. 0.13
C. 5
D. 3

20. Abandoned farms usually reverts to forest after some time. This process of forest regeneration is called:
    A. Primary succession
    B. Biorestoration
    C. Secondary succession
    D. Climax succession

Section B: Answer all questions and use the spaces provided (80 Marks)

1. A fisheries ecologist wishes to optimize her yield by maintaining a population of trout at exactly 1000 individuals. Predict the initial instantaneous growth rate if the population is stocked with an additional 700 fish. Assume r is 0.008 individuals/(individual*day). [4]

2. Study the survivorship curves below: Answer each question with Type I, Type II, or Type III as the answer and explain your choice.



i. Which of the survivorship curves in the graph is typically observed in some lizard species? [2]

ii. Characteristic of species that exhibit r-selection strategy in production of offspring [2]

iii. Which of the survivorship curves in the graph is typically observed in some large mammalian species like elephants? [2]

3. In 2021, a researcher studying the population dynamics of monarch butterflies estimated that the size its population was 7,000. Over two years, he records 980 births and 120 deaths in that population. Estimate r and calculate what the population size is predicted to be in 2024 years. [5]

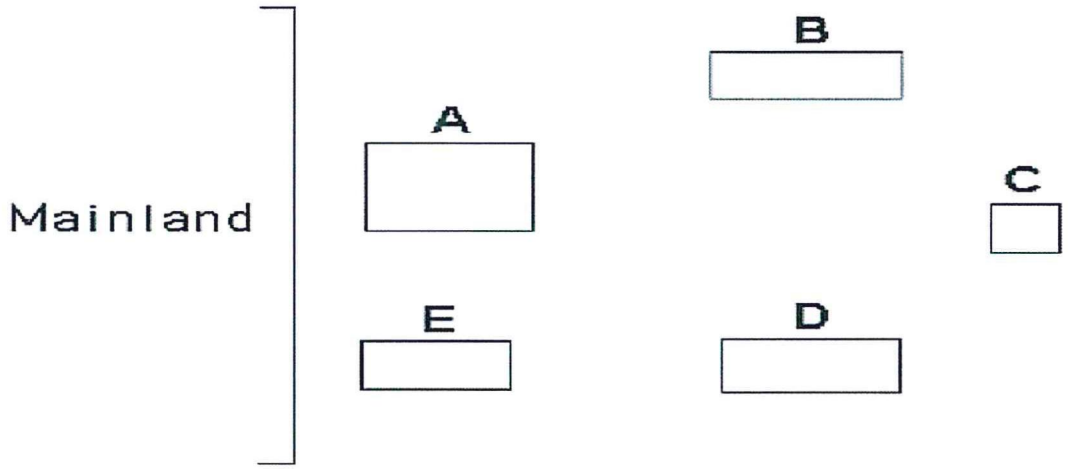
4. Explain, with examples, how interspecific competition influences species coexistence and community diversity [3]

5. Both the dominant and keystone species exert strong effects on the character of a community, but in different ways. How do dominant species and keystone species differ in influencing the character of the community? [2]

6. How are species diversity and genetic diversity different? [2]

7. Why are alien invasive species successfully colonise and spread in native new habitats [2]

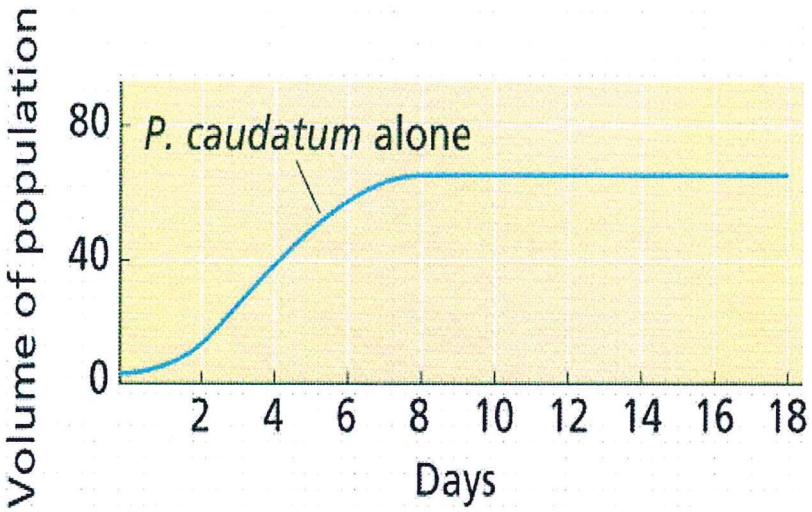
8. The figure below shows five islands (A to E) and their distances from the mainland.



a. Rank the islands from highest number to lowest number of expected species. Justify your ranking. [3]

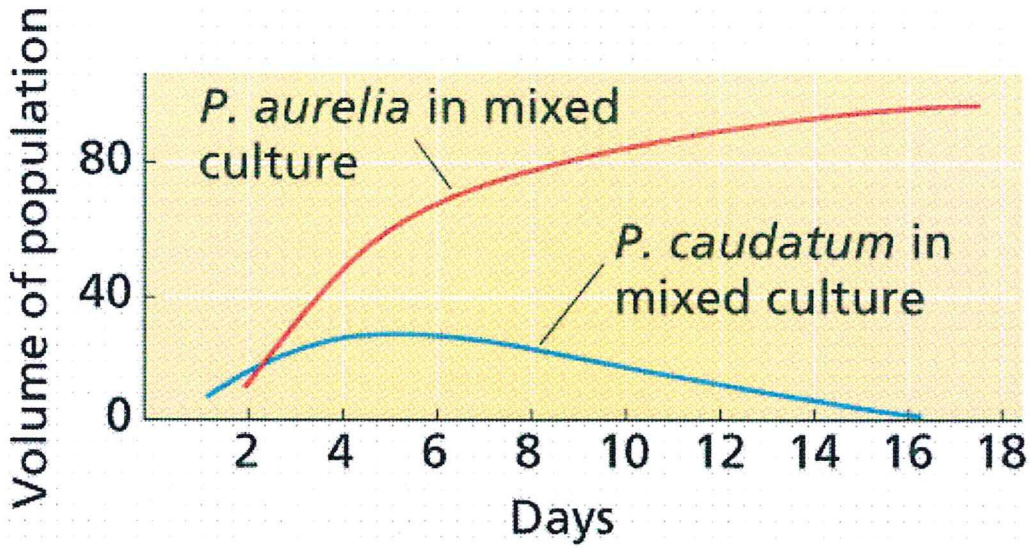
b. Explain why diversity of species decline as we move away from the equator. [3]

9. The figure below shows the growth of protozoan species *Paramecium caudatum* when grown individually in the laboratory chamber environment.



a. What is the mean growth rate of *P. caudatum* from day 2 to 6? [2]

b. Figure below shows *P. caudatum grown together with P. aurelia (mixed culture)* in the same laboratory chamber (habitat). What effect does growing *P. aurelia* have on the population growth rate of *P. caudatum*? What could be an explanation for this? [2]

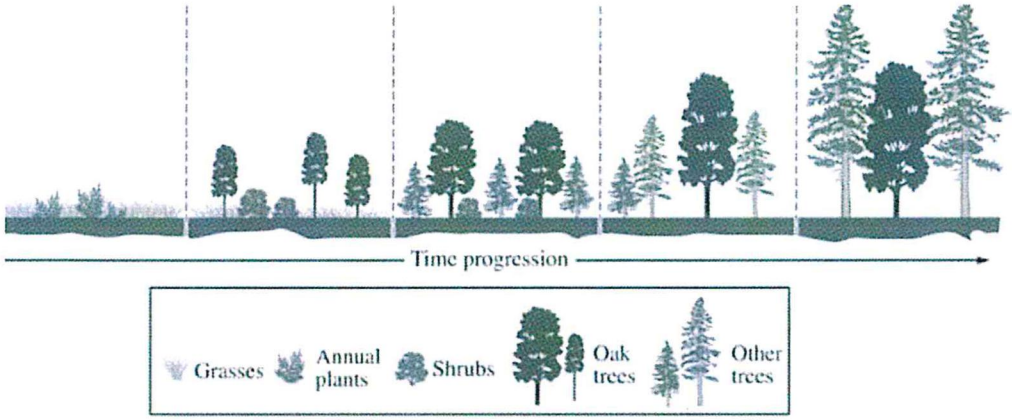


10. Outline the human activities that have changed the global nitrogen cycle. How do changes in nitrogen cycle affect the carbon cycle? [4]

11. Suggest three measures that can be implemented to manage loss of biodiversity in a community with resources managed under "Tragedy of the Commons". [3]

12. Your friend tells you that a good way to increase biodiversity is by intentionally introducing a species to a new environment because it will increase species richness of that area by one species. Do you agree or disagree with your friend's statement? Support your answer. [2]

13. Describe the changes in biotic factors that are visible in the figure below showing ecological succession following a fire [4]



14. List any five (5) human activities that that leads to loss of biodiversity [5]

15. One of the goals of Namibia 's Ministry of Environment, Forest and Tourism is to draft a five year strategy (2020-2025) that outlines a path towards a sustainable future for the environment focusing on four priority areas of climate change and energy, resources and waste management, water management and urban environment. Imagine, you have been appointed by the Minister as a consultant to carry out this task, outline and discuss the strategies that you would propose and present to the Minister for creating a sustainable environment in Namibia for each priority area. [2]

16. The table below shows the number of different species of insects on an experimental field. Complete the table below and compute the Simpson Index (D)) as well as Shannon index (H) of the insects in the field. [8]

Insect order	**Description**	**Number of individuals**	**n/N**	**pi**	**pi^2**	**ln pi**	**pi ln pi**
Wasp	black	6					
Wasp	Purple	5					
Bee	Stripped	1					
Grasshopper	Green with red legs	3					
Butterfly	Large blue	12					