

## TOPIC 2: ECOLOGY

### Learning Outcomes:

#### 2.1 Introduction to Ecology

- a) Define ecology
- b) Define basic terminologies in the field of ecology with examples:
  - i. Niche
  - ii. Habitat
  - iii. Organism
  - iv. Population
  - v. Community
  - vi. Ecosystem
  - vii. Biome
  - viii. Biosphere

#### 2.2 Life hierarchical order

- a) Describe the relationship between the following component of life: organism, population, community, ecosystem, biome and biosphere.

#### 2.3 Ecosystem concept

- a) Define ecosystem
- b) State the examples of ecosystem:
  - i. Terrestrial ecosystem: tropical rainforest and
  - ii. Lake
- c) State the components of the ecosystem with examples:
  - i. Biotic components: autotroph/producer, heterotroph/consumer (herbivores, carnivores, omnivores, detritivores) and decomposers
  - ii. Abiotic components: atmosphere, hydrosphere and lithosphere

#### 2.4 Energy flow through ecosystem

- a) Define the following terms:
  - i. Food chain
  - ii. Food web
  - iii. Trophic levels
- b) Explain energy transfer in the paddy field ecosystem: Food chain, trophic levels, producer, primary consumer, secondary consumer, tertiary consumer, detritivores and decomposers

#### 2.5 Biogeochemical cycles

- a) Define biogeochemical cycles
- b) State examples of biogeochemical cycles: Carbon, Nitrogen, Phosphorus and Sulphur

#### 2.6 Human impact on the ecosystem and biosphere

- a) Explain human impact on the ecosystem and the biosphere based on the following:
  - i. Agricultural effects on nutrient cycling;
  - ii. Combustion of fossil fuel
  - iii. Global warming

**2.7 Population ecology**

- a) Describe population ecology
- b) Describe population growth
- c) Describe natality and mortality and their effects on the rate of population growth
- d) State the basic forms of growth curves
  - i. Exponential growth curve (human population)
  - ii. Logistic growth curve (*Paramecium* sp. population)

1. In ecology, the term community is used to describe the
  - A. all populations in a habitat
  - B. members of one species in a habitat
  - C. food web in an ecosystem
  - D. organism interacting with the surrounding environment.
2. Study of inter-relationships between organisms and their environment is
  - A. ecology
  - B. ecosystem
  - C. phytogeography
  - D. ethology
3. The ecological niche is defining as
  - A. the habitat in which an organism finds its food supply
  - B. the habitat in which an organism finds the most suitable climate.
  - C. the relationship between an organism and other species.
  - D. the role played by a particular species in its environment.
4. Habitat refers to
  - A. a group of organisms of the same species.
  - B. role that an organism plays in its environment
  - C. communities in an ecosystem.
  - D. a place where an organism lives.
5. Niche overlap indicates:
  - A. mutualism between two species
  - B. active cooperation between two species
  - C. Two different parasites on the same host

D. sharing of one or more resources between the two species

6. Choose the **CORRECT** order:
  - A. biome – community – population – biosphere – organism
  - B. organism – population – community – biome – biosphere
  - C. organism – community – population – biome – biosphere
  - D. population – organism – community – biome – biosphere
7. Which of the following is **NOT TRUE** of an ecosystem?
  - A. The last consumer obtains the highest energy.
  - B. Ecosystem is an open system with input and output of energy.
  - C. Phytoplankton are producers.
  - D. Heterotrophs include herbivores, carnivores, omnivores, decomposers and detritivores.
8. The table below shows the living components in an ecosystem.

I	Population	IV	Biome
II	Community	V	Ecosystem
III	Organism		

Which of the following is the **CORRECT** sequence of living components according to an ascending order?

- A. I, III, II, V, IV
- B. II, I, V, IV, III
- C. III, I, II, V, IV
- D. IV, V, I, III,

9. Which of the following is an example of biome?  
 A. Tropical forest  
 B. Mountain  
 C. Lake  
 D. River

10. Which of the following is an abiotic component?  
 A. Decomposers  
 B. Autotroph  
 C. Hydrosphere  
 D. Endoparasite

11. In the following food chain, the relationship between the rabbit and python is

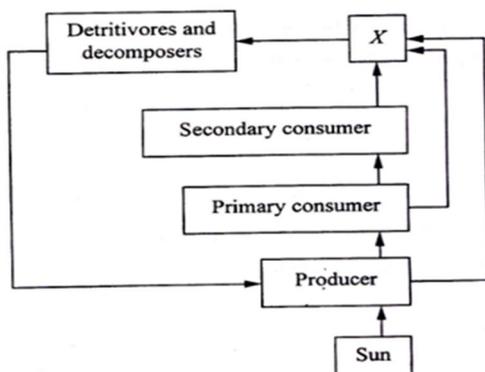
Grass → Rabbit → Python

- A. Predation  
 B. Commensalism  
 C. Competition  
 D. Neutral

12. Which of the following statements appropriately describe a trophic level of an ecosystem?  
 I. Structured feeding relationship  
 II. Who eats whom in an ecosystem  
 III. A hierarchy of energy transfers  
 IV. The recycling of nutrients

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

13. The flow of energy in ecosystem is shown in a diagram:

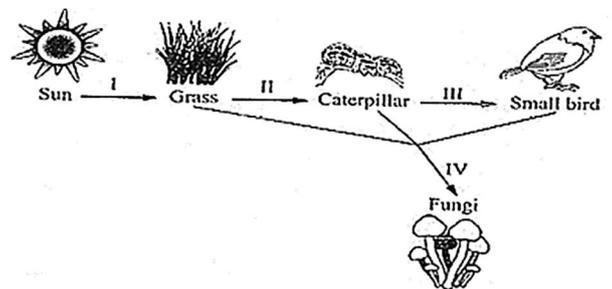


What contribute to X?

- I. Fungi  
 II. Faeces  
 III. Bacteria  
 IV. Fallen leaves

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

14. The energy flow through an ecosystem is shown in diagram below:



In which trophic level is the energy transfer less efficient?

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

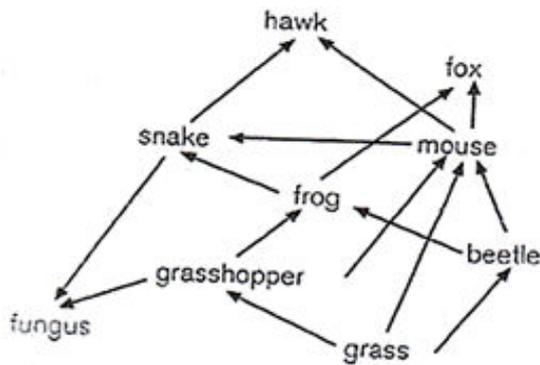
15. The number of trophic levels in a food chain is limited by the

- A. biomass of autotrophs  
 B. Efficiency of energy transfer between the trophic levels.  
 C. net productivity of the ecosystem  
 D. number of species in the ecosystem

16. In particular habitat, this organism obtains energy by feeding on dead or decaying organic matter. What is the term used to describe this organism?

- A. Carnivore  
 B. Herbivore  
 C. Producer  
 D. Decomposer

17. With reference to the food web shown, answer questions 17 – 19.



All of these are primary consumers EXCEPT:

- A. snake
- B. grasshopper
- C. beetle
- D. mouse

18. Which of the following roles are matched correctly to the organisms in the food web?

	Organism	Role
A.	Grasshopper	Producer
B.	Beetle	Secondary consumer
C.	Frog	Primary consumer
D.	Fungus	Decomposer

19. What is the form of energy used by the producers and the form of energy that pass on to the consumers?

	Form of energy used	Form of energy passed on
A	Chemical	Heat
B	Light	Heat
C	Light	Chemical
D	Heat	Chemical

20. The statements below describe a habitat, a niche and a community.

**X:** Oysters living in the intertidal zone.  
**Y:** Snakes preying on rats in an oil palm estate.  
**Z:** Shrimps, fishes, snails, *Elodea* living in the pond

Which of the following of X, Y and Z is correctly matched?

	Habitat	Niche	Community
A.	X	Y	Z
B.	X	Z	Y
C.	Y	X	Z
D.	Z	Y	X

21. Which of the following energy flows in an ecosystem involves the transfer of largest amount of energy?

- A. Plant to decomposer
- B. Carnivore to decomposer
- C. Plant to herbivore
- D. Herbivore to carnivore

22. Which of the following is the reason that the number of links in a food chain is limited to only four or five trophic level.

- A. There are different modes of nutrition among the organisms.
- B. There is a high amount of energy lost at every trophic level.
- C. There are different organisms that occupy different trophic levels.
- D. The food chain reaches the carrying capacity.

23. If there is 1000 Kcal available in the producers in trophic level 1, how much energy is available in the herbivores in trophic level 2?

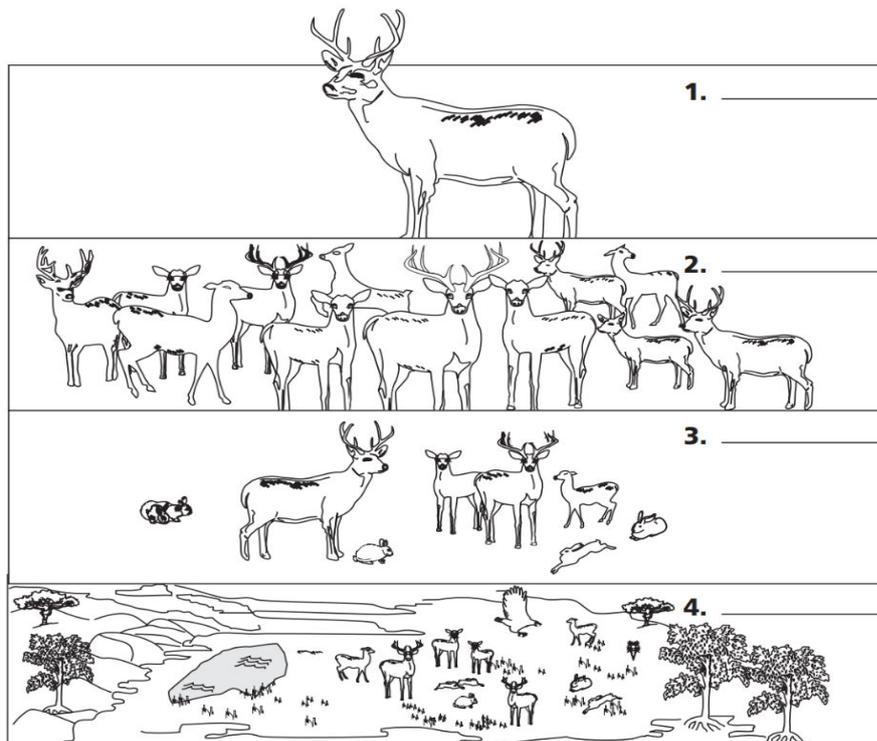
- A. 10 Kcal
- B. 1 Kcal
- C. 100 Kcal
- D. 1000 Kcal

24. Which of the following statements is **FALSE**?
- Heat loss represents a one-way loss of energy from an ecosystem.
  - Organisms in the food chain use all the energy contained in the food that they eat.
  - In some ecosystems, the majority of the energy stored in plants does not become available until the plants die.
  - Heat and energy are lost by each organism in the ecosystem.
25. Which of the following is **NOT** an example biogeochemical cycles?
- Carbon
  - Nitrogen
  - Phosphorus
  - Lipid
26. Which one of these is the definition for a biogeochemical cycle?
- Circulation of chemical elements through the biotic components of an ecosystem.
  - Circulation of chemical elements through the abiotic components of an ecosystem.
  - Circulation of chemical elements through the biotic and abiotic components of an ecosystem.
  - Circulation of organic molecules through the biotic components of an ecosystem.
27. Which of the following statements **DOES NOT** explain natality?
- The number of eggs produced in a reproductive cycle.
  - The number of offspring produced by an individual female per unit time.
  - The number of birth per thousand individuals in the individuals in the population in a year.
  - The number of mortality per thousand individuals in the population in a year.
28. Population grows exponentially when \_\_\_\_\_
- immigration and emigration rates are equal
  - death rate remains above birth rate
  - birth rate exceeds death rate
  - emigration rate exceeds immigration rate
29. Biotic potential is dependent on the following factors which include
- Mortality rate
  - Natality rate
  - Number of progenies per birth
  - Availability of food
- I, II and III
  - I, II and IV
  - II, III and IV
  - I, II, III and IV
30. The rate of \_\_\_\_\_ increases population size while \_\_\_\_\_ rate decreases population size.
- Competition ; natality
  - Natality ; mortality
  - Total fertility ; mortality
  - Mortality ; Natality

1. Find the correct match.

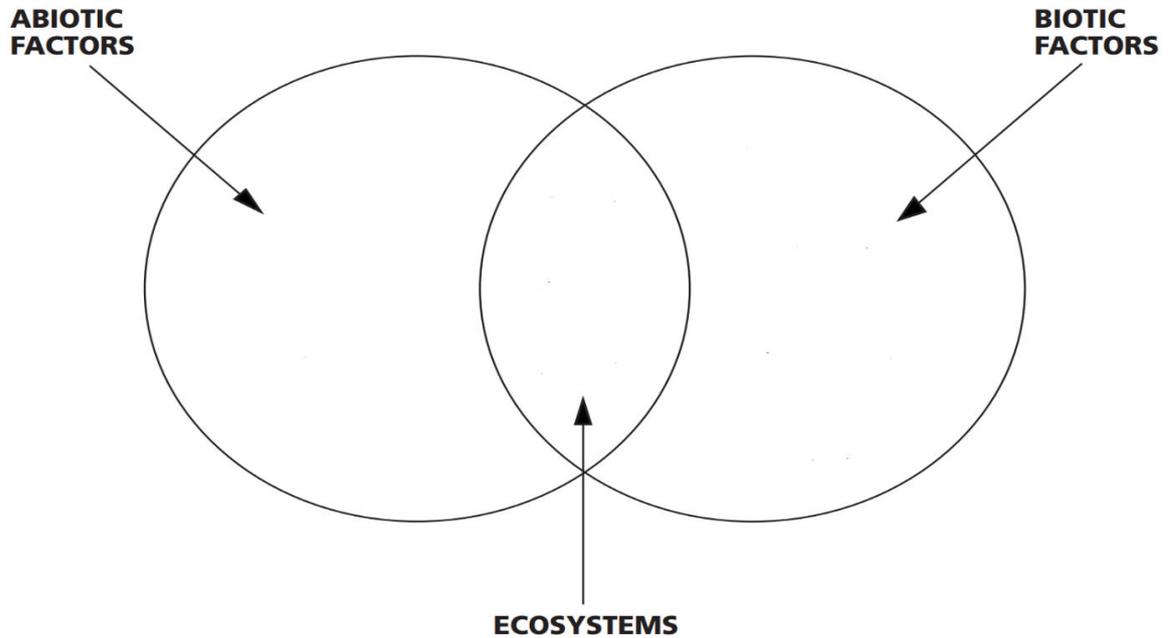
TERMINOLOGY	DEFINITION
Canopy	Large scale ecosystem
Symbiosis	Fungi and bacteria that break the organic material into smaller bits
Food chain	An organism that obtains energy by feeding on other organisms
Producer	Plants that live high up on other plants
Consumer	The traits that helps an organism survive in its environment
Decomposer	The relationship between different species living in close association with one another.
Epiphytes	An organism that makes its own food
Biomes	An organism's role or job in its habitat
Adaptation	The upper portion of the trees in a forest
Niche	A community of organisms where each member is eaten in turn by another

2. Label each drawing with one of these words: community, ecosystem, organism, population.

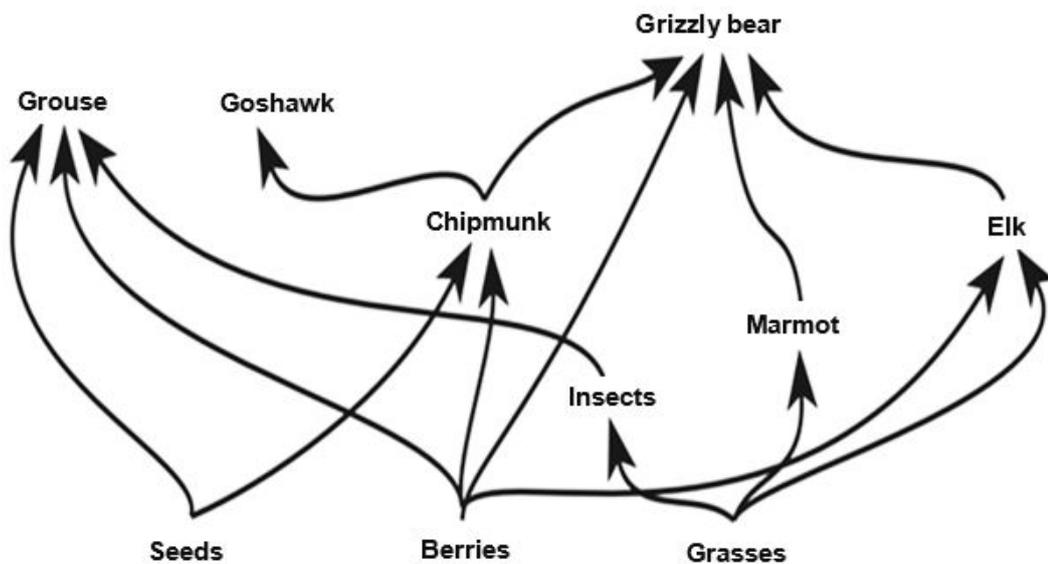


3. Classify these terms correctly.

Forests	Water	Plants	Sunlight	Animals	Deserts	Air	Decomposers	Land	Oceans
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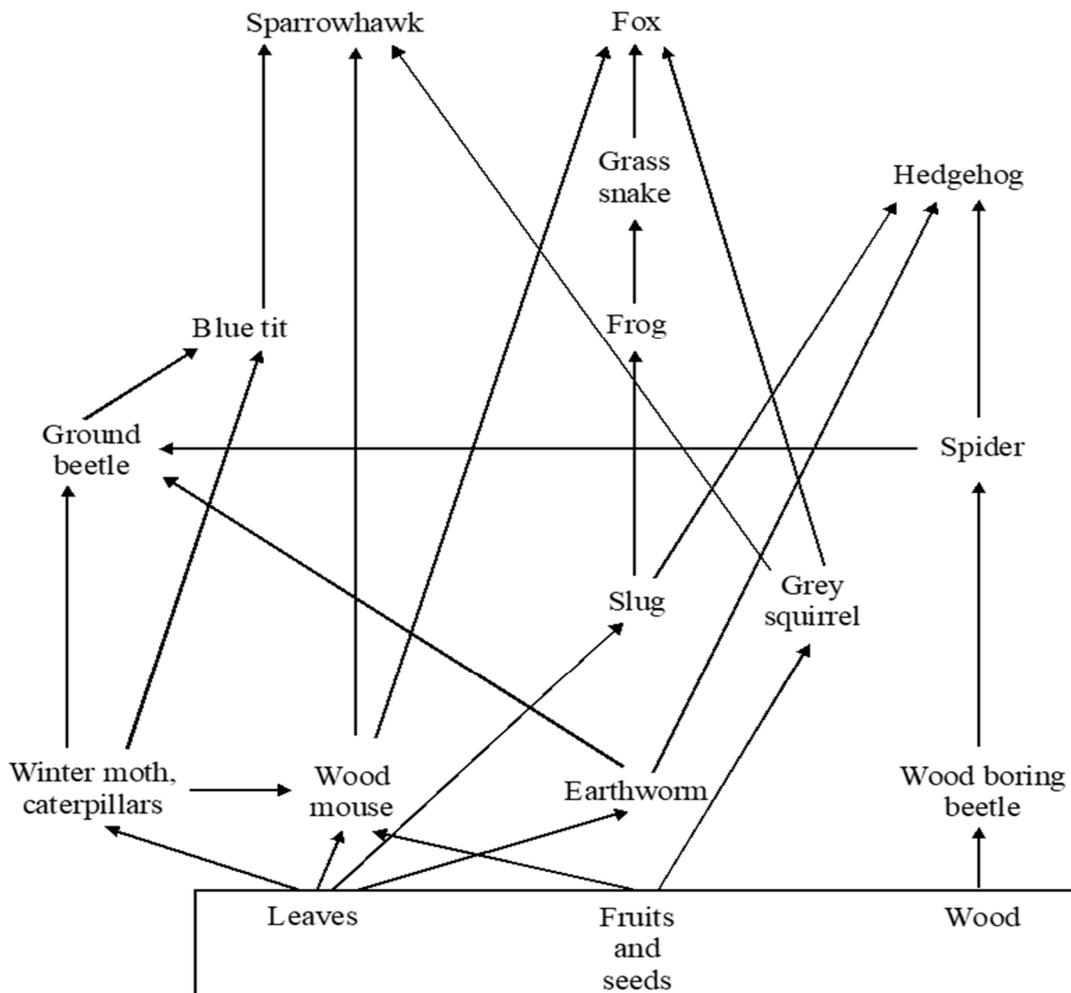


4. Use the diagram to complete the table below. Classify each member of the food web as autotroph or heterotroph and identify each heterotroph as herbivore, carnivore, or omnivore.



Autotrophs	Heterotrophs	Roles of Heterotroph
1.	4.	11.
2.	5.	12.
3.	6.	13.
	7.	14.
	8.	15.
	9.	16.
	10.	17.

5. **FIGURE 1** shows some of the feeding relationships in a food web for a forest.



**FIGURE 1**

a) What is meant by a food web? [1 mark]

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b) Based on the food web shown in **FIGURE 1**, outline the food chain with the most trophic levels. [1 mark]

c) Identify **ONE** organism from this food web that act as a: [3 marks]

i. Producer : \_\_\_\_\_

ii. Secondary consumer : \_\_\_\_\_

iii. Tertiary consumer : \_\_\_\_\_

d) Name an organism that is both a primary and a secondary consumer in this food web  
 \_\_\_\_\_  
 [1 mark]

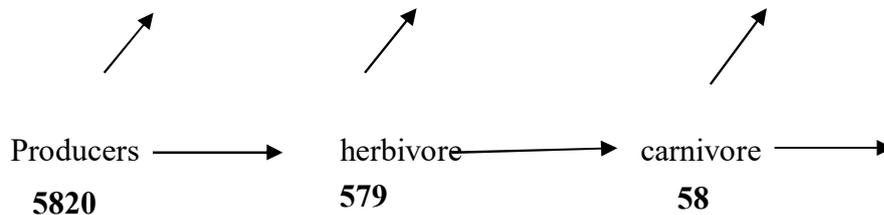
e) Name **TWO** example of organisms that act as decomposer (not shown in the food web above). [2 marks]

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6. **FIGURE 2** shows the flow of energy in  $\text{kJm}^{-2}\text{yr}^{-1}$  in an ecosystem from a tropical rainforest:



**FIGURE 2**

a) State the type of energy that enters the food chain. [1 mark]

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b) Explain why there is a reduction in energy that is transferred between the different trophic levels down a food chain. [3 marks]

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- c) Calculate the percentage of reduction in energy from the producers to the herbivores and from the herbivores to the carnivores.

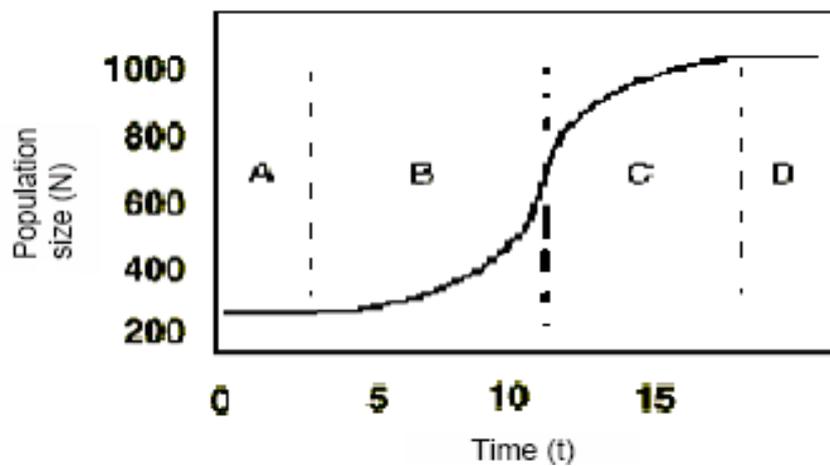
[2 marks]

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7. **FIGURE 3** shows the growth pattern of a population.



**FIGURE 3**

- a) Based on the above graph, determine the carrying capacity of the population.

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[1 mark]

- b) List **TWO** environmental factors that probably cause the slow population growth.

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[2 marks]

- c) Name the type of growth curve and give an example of an organism that exhibit this type of population growth curve.

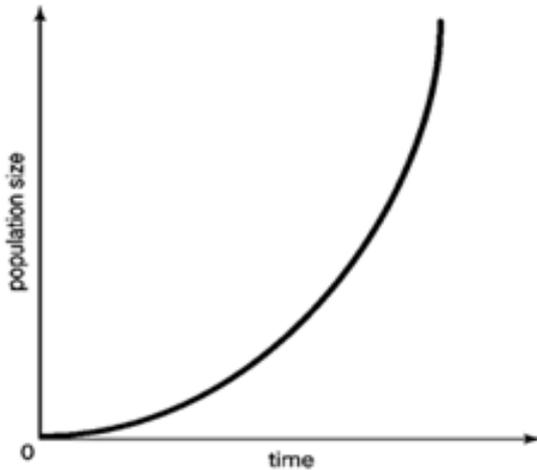
Type of growth curve: \_\_\_\_\_

Example : \_\_\_\_\_

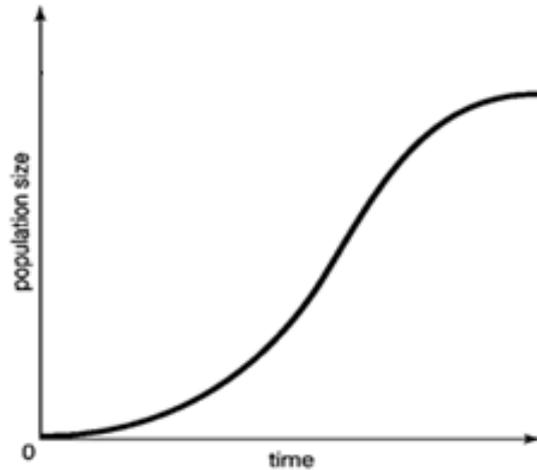
[2 marks]

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8. State the basic forms of **growth curves** for **A** and **B**



**A**



**B**

Type : \_\_\_\_\_

Type : \_\_\_\_\_

Example: \_\_\_\_\_

Example: \_\_\_\_\_

(b) Draw and label a dotted line on graph **B** that would represent carrying capacity.

9. Use each of the terms below just once to complete the passage.

**ecology    biotic factors    non-living environments    atmosphere    humans**  
**organisms    soil    biosphere    abiotic factors**

Living organisms in our world are connected to other (1) \_\_\_\_\_ in a variety of ways. The branch of biology called (2) \_\_\_\_\_ is the scientific study of interactions among organisms and their (3) \_\_\_\_\_, including relationships between living and (4) \_\_\_\_\_ things. All living things on Earth can be found in the (5) \_\_\_\_\_, the portion of Earth that supports life. It extends from high in the (6) \_\_\_\_\_ to the bottom of the oceans. Many different environments can be found in the biosphere. All living organisms found in an environment are called (7) \_\_\_\_\_. Non-living parts of an environment are

called (8) \_\_\_\_\_ . For example, whales, trees, and (9) \_\_\_\_\_ are biotic factors. Ocean currents, temperature, and (10) \_\_\_\_\_ are abiotic factors.

10. Use each of the terms below just once to complete the passage.

**grows   carrying capacity   below   births   above   under   deaths   exceed**

The number of organisms of one species that an environment can support is called its (1) \_\_\_\_\_ . If the number of organisms in a population is (2) \_\_\_\_\_ the environment's carrying capacity, births (3) \_\_\_\_\_ deaths and the population (4) \_\_\_\_\_ . If the number of organisms rises (5) \_\_\_\_\_ the carrying capacity of the environment, (6) \_\_\_\_\_ will exceed (7) \_\_\_\_\_ . This pattern will continue until the population is once again at or (8) \_\_\_\_\_ the carrying capacity.