

LEARNING OUTCOMES

2.1 Ecosystem Concept

- a) Define ecosystem.
- b) Describe lake ecosystem based on:
 - i. light penetration (photic and aphotic)
 - ii. distance from shore and water depth (littoral, limnetic)
- c) Describe terrestrial ecosystem of tropical rainforest stratification (emergent, canopy, understory, shrub, ground layer /forest floor).

2.2 Energy Flow through ecosystem

- a) State the type of ecological pyramids in relation to trophic level.
- b) Explain the energy transfer in ecological pyramids in relation to trophic level.
- c) Calculate energy loss in each trophic level

2.3 Biogeochemical Cycles

- a) State biogeochemical cycle components (cycling pool and reservoir pool) in carbon and nitrogen cycles.
- b) State examples of biogeochemical cycle (nitrogen cycle, carbon cycle, phosphorus cycle and sulphur cycle).
- c) Explain nitrogen cycle and carbon cycle.

2.4 Conservation and Management

- a) Describe sustainable development.
- b) Explain threats to biodiversity in Malaysia.
- c) Describe conservation of diversity in Malaysia.

2.5 Population Ecology

- a) Explain biotic potential and environmental resistance and their effect on population growth.
- b) Explain carrying capacity and its importance.
- c) Describe natality and mortality and their effects on the rate of population growth.
- d) Explain population growth curves (state the basic forms of growth curves):
 - i. Exponential growth curve – lag phase , log phase (human population) and ;
 - ii. Logistic growth curve- lag phase, log phase, decelerating phase, stationary phase (*Paramecium* sp. population)
- e) Explain the limiting factors affecting the population size:
 - i. Density dependent factors; and
 - ii. Density independent factors

OBJECTIVE QUESTIONS

2.1 ECOSYSTEM CONCEPT

1. Which of the following descriptions about the organization of an ecosystem is CORRECT?
 - A. Communities, which make up population.
 - B. Population makes up species, which make up communities.
 - C. Species make up communities, which make up population.
 - D. Species make up populations, which make up communities.

2. In ecology, the term community is used to describe the
 - A. species of plants and animals in a habitat
 - B. members of one species in a habitat
 - C. food web in an ecosystem
 - D. organism interacting with the surrounding environment.

3. Which layer of the rainforest is this describing: This is the highest layer of the rainforest. Birds of paradise, eagles, and macaws live there.
 - A. Forest Floor
 - B. Understory
 - C. Canopy
 - D. Emergent

4. Which layer has the most epiphytes?
 - A. Emergent
 - B. Canopy
 - C. Understory
 - D. Forest Floor

5. Which of these is the greatest limiting factor for plants on the forest floor?
 - A. space
 - B. soil
 - C. sunlight
 - D. water

6. Which layer do monkeys swing around in?
 - A. Emergent layer
 - B. Canopy layer
 - C. Understory layer
 - D. Forest floor

7. The top of the zone near the shore of a lake or pond is the _____ zone. The species living is food for other creatures such as turtles, snakes, and ducks.
 - A. Limnetic
 - B. Littoral
 - C. Profundal
 - D. Salty

8. The second layer of fresh water is a well-lighted zone dominated by plankton, a crucial part of the food chain.
 - A. Limnetic
 - B. Littoral
 - C. Profundal
 - D. Benthic

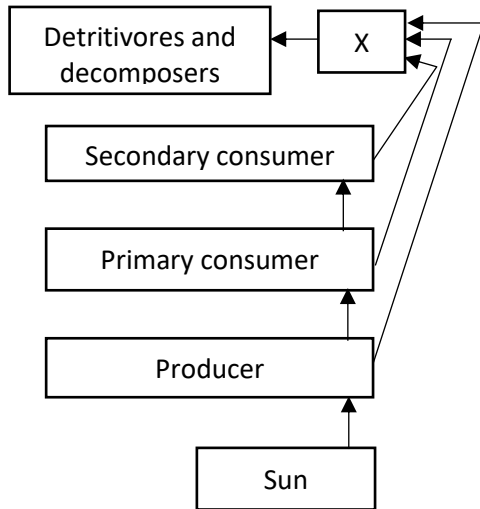
9. In lakes, decomposers are found in
 - A. Limnetic zone
 - B. Benthic zone
 - C. Littoral zone
 - D. Profundal zone

10. Which region of the lake has the highest biodiversity?
- littoral zone
 - limnetic zone
 - profundal zone
 - benthic zone

2.2 ENERGY FLOW THROUGH ECOSYSTEM

- Energy flow from producers to herbivores decreases because
 - herbivores consume a large proportion of plants
 - herbivores cannot digest all the organic compounds ingested.
 - Some energy is lost from the system through cellular respiration.
 - Decomposers consume some of the organic compounds of the producers
- In an ecosystem, snakes feed on frogs, which feed on mosquitoes. Use of a bug spray has decreased the number of mosquitoes. What will probably happen to the number of frogs and snakes?
 - Frogs will increase, snakes will increase
 - Frogs will increase, snakes will decrease
 - Frogs will decrease, snakes will increase
 - Frogs will decrease, snakes will decrease
- A food web consists of?
 - Many overlapping food chains in an ecosystem.
 - A series of events in which one organism eats another and obtains energy.
 - Amount of energy that moves from one feeding level to another.
 - Many types of insects that are stuck.
- In a food web, which of the following statements is TRUE?
 - Only one species may occupy a trophic level.
 - One species may occupy more than one trophic level.
 - Herbivores are always on the first trophic level.
 - The biomass of each trophic level remains constant.
- The arrows in a food chain or web represents what?
 - They point to the organism that is being eaten.
 - It shows how sunlight flows within an ecosystem.
 - They show what direction the energy is flowing between organisms.
 - They represent how water is transferred within a habitat.

6. The flow of energy in an ecosystem is shown in the diagram below.

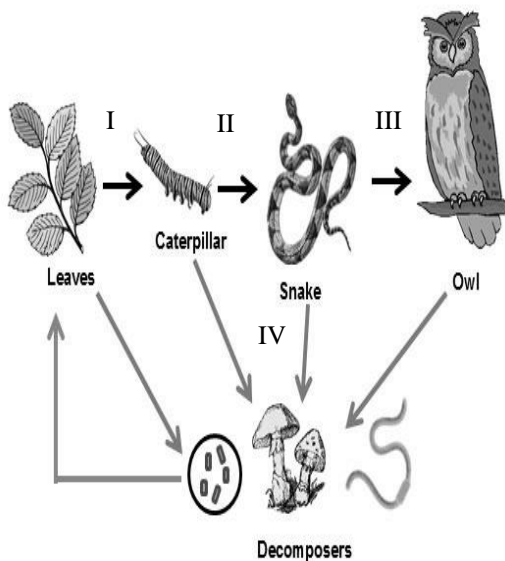


What contributes to X?

- 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

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



At which trophic level is the energy transfer less efficient?

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

8. What is the average percentage efficiency of the energy conversion in each level of a food chain?

- A. 10%
- B. 50%
- C. 70%
- D. 90%

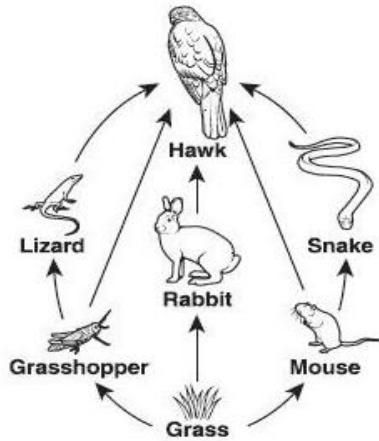
9. What is the form of energy used by the producers and the form of energy that passed on to the consumers?

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

10. Only a small amount of the energy stored in food is available to the next organism in a food chain because

- _____.
- A. there are too many producers
- B. there are fewer top consumers in a food chain
- C. primary and secondary consumers compete for food
- D. most of the available energy is used by the organism or released as heat

11. A diagram of a food web is shown below. Which organism receives the least amount of energy from the producers?



- A. Hawk
 - B. Rabbit
 - C. Grasshopper
 - D. Mouse
12. What is biomass?
- A. the total dry weight of organisms in an ecosystem
 - B. the total volume of organisms in an ecosystem
 - C. the total dry weight of producers in an ecosystem
 - D. the total volume of animals in an ecosystem
13. For a pyramid of numbers, the width of the bar shows the _____ of

organisms present in each trophic level at a particular

- A. biomass
- B. energy
- C. numbers
- D. ecology

14. 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
15. There are 40,000g of biomass energy available on trophic level one. How much energy is available for the tertiary consumer?
- A. 400,000g/cm²
 - B. 4,000g/cm²
 - C. 400g/cm²
 - D. 40g/cm²
16. Which of these shows a possible food chain for an ecosystem?
- A. shark--> fish --> plankton -->sun
 - B. plankton --> fish --> shark
 - C. plankton --> sun --> fish --> shark
 - D. plankton --> fish --> shark --> sun

2.3 BIOGEOCHEMICAL CYCLES

1. This process is responsible for most environmental problems of excess nitrogen and phosphorus entering streams, lakes and oceans.

- A. decomposition
- B. emissions from automobiles

- C. agriculture and house hold run off
- D. photosynthesis

2. How do animals get nitrogen
 - A. From the atmosphere
 - B. From the food chain
 - C. Rainwater
 - D. Lightning

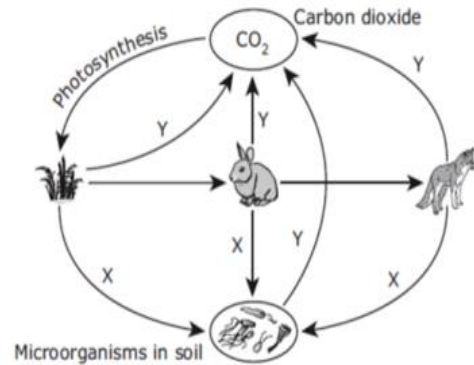
3. The process where rocks are broken down over time by wind and water, releasing phosphorus.
 - A. combustion
 - B. corrosion
 - C. deposition
 - D. erosion

4. Where are nitrogen-fixing bacteria found?
 - A. In the soil
 - B. Root nodules
 - C. In dead things
 - D. In the atmosphere

5. Bacteria fix nitrogen on plant roots. Plant roots provide sugar to bacteria. This is an example of
 - A. Mutualism
 - B. Parasitism
 - C. Commensalism
 - D. Predation

6. How nitrogen is 'fixed' into useable form for plants
 - A. only through action of bacteria
 - B. only through lightning
 - C. through action of bacteria & lightning
 - D. through photosynthesis

7. The diagram shows the flow of organic molecules through an ecosystem. What two processes are identified by labels X and Y?



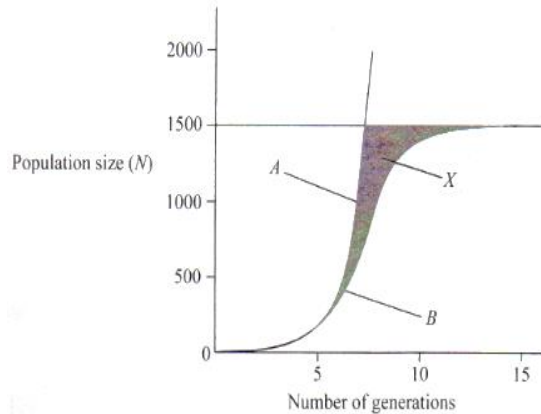
- A. X : Respiration Y: Predation
- B. X :Adaptation Y : Decomposition
- C. X : Fermentation Y : Nitrogen Fixation
- D. X : Decomposition Y :Respiration

2.4 CONSERVATION AND MANAGEMENT

1. Deforestation results in
 - A. increased air temperatures.
 - B. decreased soil fertility.
 - C. increased air temperatures and decreased soil fertility.
 - D. increased air temperatures, decreased soil fertility, and altered rainfall patterns.
2. What is resource depletion?
 - A. Where humans use a resource at a rate that is not sustainable because it cannot be replenished fast enough.
 - B. Where humans use a resource at a rate that maintains the supply of the resource.
 - C. Where humans use a resource at a rate that is not sustainable because of the changes in the behaviour of wildlife.
 - D. The use of any resource by humans.
3. What is Conservation?
 - A. Protection of environment from climate change
 - B. Protection of organisms and environment from harmful effect of humans
 - C. Destruction of environments from climate change
 - D. Destruction of organisms and environment from harmful effect of humans
4. What is mean by in situ?
 - A. Protection, upliftment and scientific management to biodiversity
 - B. The preservation of components of biological outside their natural habitats
 - C. The conservation of species in their natural habitats
5. Taman Negara is the example for
 - A. Ex situ
 - B. In situ
 - C. off-site conservation
 - D. Out situ

2.5 POPULATION ECOLOGY

1. Two types of population growth of organisms A and B are shown in the graph below.



Which is true of X?

- A. Lack of parental care
 - B. The habitat was disturbed
 - C. Resources become limited
 - D. The production of offspring is low.
2. One reason the world is growing so quickly is because...
- A. The world has infinite resources for everyone
 - B. Birth rate is higher than death rate
 - C. There are more and more places for people to live
 - D. Death rate is higher than birth rate
3. Which of the following is the CORRECT definition for environment resistance?
- A. Biotic factors that oppose the achievement of biotic potential.
 - B. Abiotic factors that oppose the achievement of biotic potential.
 - C. Abiotic factors that promote the achievement of biotic potential.

D. Biotic and abiotic factors that oppose the achievement of the biotic potential.

4. Biotic potential is dependent on the following factors which include:

- I. Mortality rate
- II. Natality rate
- III. Number of progenies per birth
- IV. Availability of food

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

5. When a population continues to grow at a fast rate.

- A. Exponential Growth
- B. Logistic Growth
- C. Carrying Capacity
- D. Infinity Growth

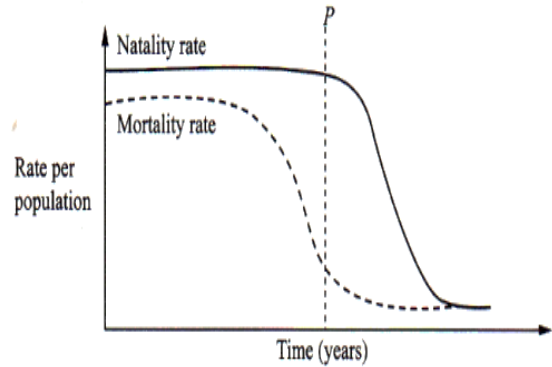
6. Any factor(s) that controls/ limits the size of a population.

- A. Density dependent limiting factors
- B. Limiting factors
- C. Density independent limiting factors
- D. Environmental Resistance

7. Disease outbreaks, predations, competition for resources, famines and parasitism are

- A. density- dependent factor
- B. density-independent factor
- C. sex- specific factors
- D. age- specific factors

8. The largest population that an environment can support is called the
- carrying capacity
 - limiting factor
 - birth rate
 - death rate
9. _____ is the average number of individual of the same species per unit of surface area at a given time.
- Population growth
 - Population density
 - Population size
 - Carrying capacity
10. A population grows exponentially when _____
- Death rates remain above birth rates
 - Birth rates exceed death rates
 - Immigration rates exceed emigration rates
 - Immigration rates and emigration rates are equal
11. Which of the following could be a density-independent factor limiting human population growth?
- social pressure for birth control
 - earthquakes
 - plagues
 - pollution
12. Human mortality and natality rates are shown in the graph below.



- What will happen to the population at P?
- Increases
 - Decreases
 - Unchanged
 - Increase then decreases
13. The rate (increase or decrease) of a population depends on the rate of
- Emigration
 - Immigration
 - Mortality
 - Natality
- I only
 - I and II only
 - II, III and IV only
 - All the above
14. When a specific population grows past the ecosystem's carrying capacity, what happens to the population?
- Density Independent limiting factors start to occur resulting in the population going farther above carrying capacity.
 - Density Dependent limiting factors start to occur resulting in the population going back below carrying capacity.
 - The population will go extinct due to lack of resources

- D. The population grows then finds a new carrying capacity
15. During population growth, a population always:
- A. grows by thousands of individuals.
 B. grows at its maximum per capita rate.
 C. quickly reaches its carrying capacity.
 D. cycles through time.

STRUCTURED QUESTIONS

1. **FIGURE 1** illustrates the zonation of a lake ecosystem.

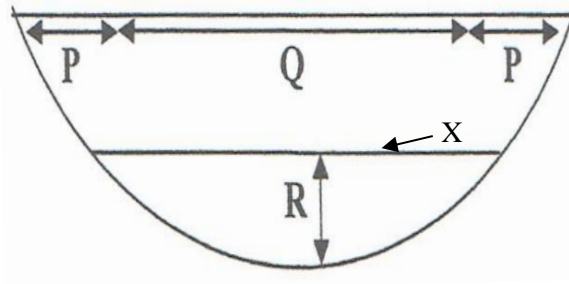


FIGURE 1

a) Identify the following zones. Give **ONE** example of organism living in each zone. [6 marks]

b) What is labelled by X? [1 mark]

c) How does the presence of X affect the lake zonation? [1 mark]

d) Which is the most fertile zone in the lake ecosystem? Give the reason. [2 marks]

2. **FIGURE 2** shows tropical rainforest stratification.

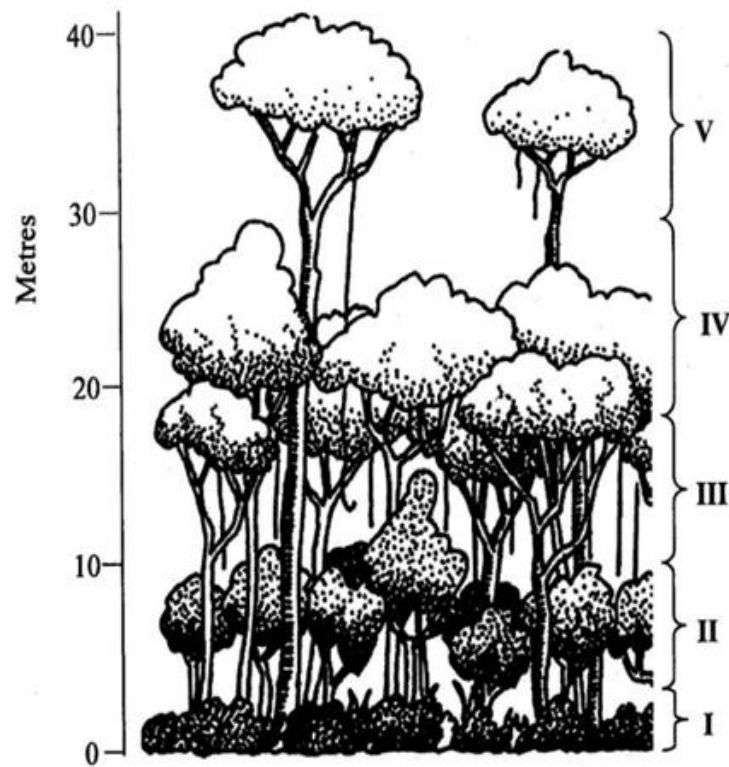


FIGURE 2

a) Name layers II and IV.

[2 marks]

b) Give **ONE** example of dominant plant and animal at layer V.

[2 marks]

c) Why this forest is called as tropical rainforest?

[1 mark]

3. **FIGURE 3** shows a food web from the African grassland.

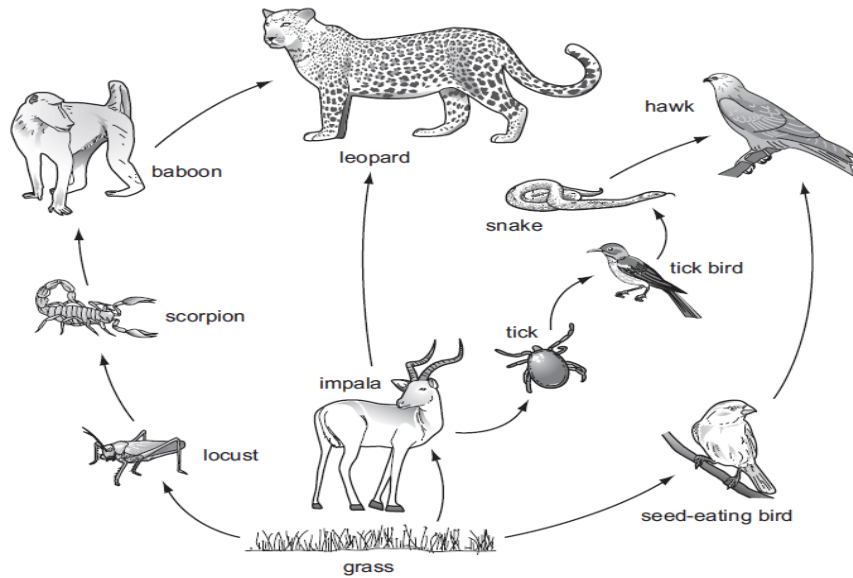


FIGURE 3

a) Identify an organism from this food web that is a:

[3 marks]

- a. producer : _____
- b. secondary consumer : _____
- c. tertiary consumer : _____

b) Using information from **FIGURE 3**, complete the following food chain [1 mark]

grass → _____ → tick → _____ → *snake* → _____

4. **FIGURE 4** shows a pyramid of numbers for a food chain from this food web

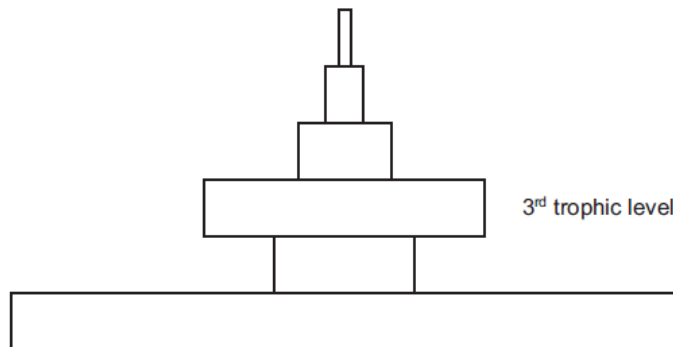


FIGURE 4

a) Which organism in the food web would occupy the 3rd trophic level in this pyramid of numbers? Give your reason.

[2 marks]

b) In some years a plague of locusts occurs. Predict and explain what could happen to the population of baboons when this occurs.

[2 marks]

5. **FIGURE 5** shows the flow of energy in $\text{kJm}^{-2}\text{yr}^{-1}$ in an ecosystem from a tropical rainforest:

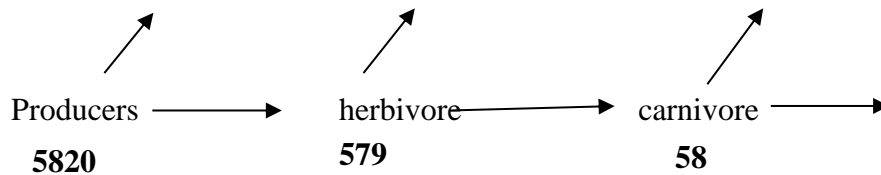


FIGURE 5

a) State the type of energy that enters the food chain.

[1 mark]

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

[3 marks]

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

d) Explain **ONE** way in which humans interfere with the nitrogen cycle.

[1 mark]

7. The main stages of the carbon cycle are shown in **FIGURE 7**.

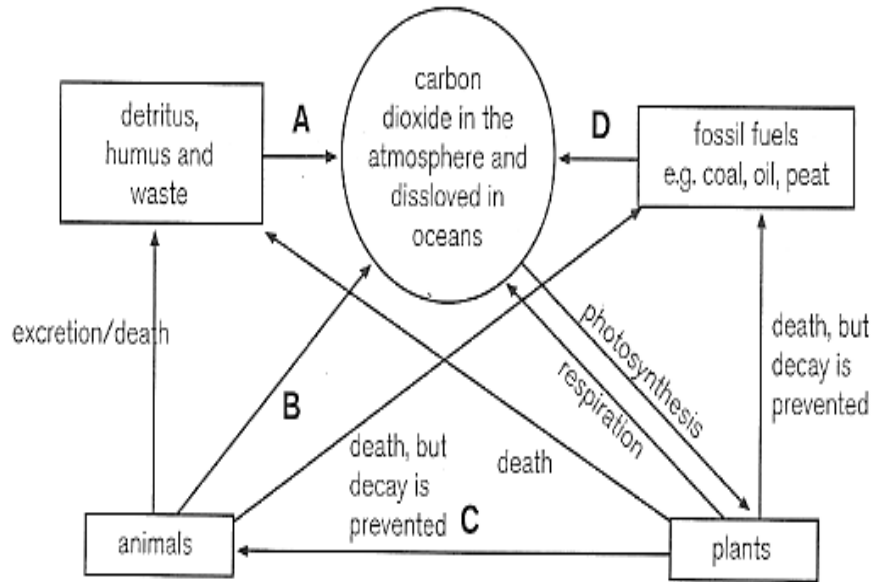


FIGURE 7

a) Name processes A, B, C and D.

[4 marks]

b) Explain the importance of photosynthesis to living organisms.

[2 marks]

—

c) Explain the significance of the carbon cycle. [3 marks]

d) Describe the effect of human activities on the carbon cycle. [2 marks]

8. **FIGURE 8** shows population growth curve of two species of *Paramecium* (a) cultured separately (b) cultured together.

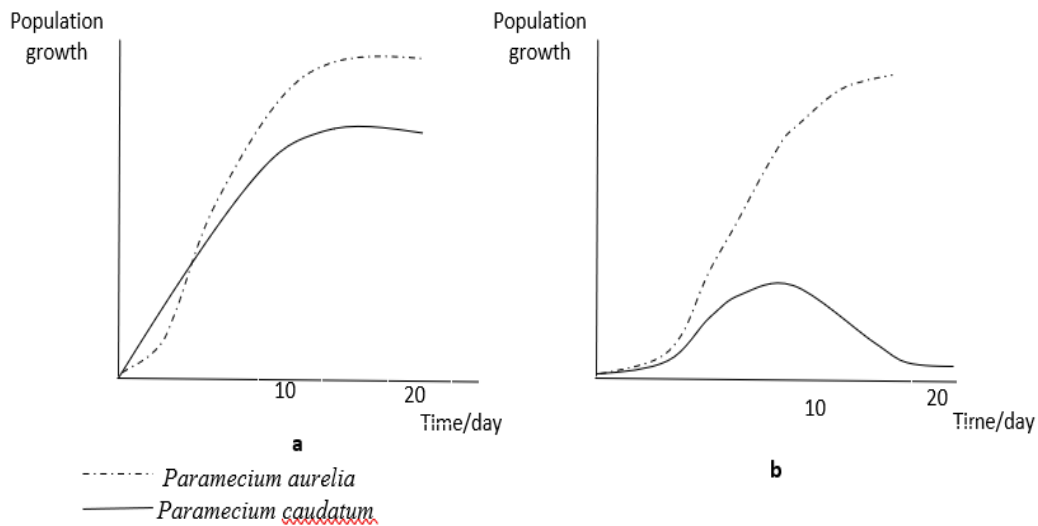


FIGURE 8

a) What type of population growth curve is shown by the two species when grown in isolation? [1 mark]

b) What resources are the two species competing for in the mixed culture? [2 marks]

c) State the type of limiting factors that limit the growth of *P. caudatum*. Give one example of that factor.

[2 marks]

d) i. Based on graph (b) state what happen to the numbers of *P. caudatum* from day 8 to day 20.

[2 marks]

ii. What are the possible factors that give *P. aurelia* a competitive advantage over *P. caudatum*?

[3 marks]

9. The population growth curves, P and Q are shown in the graph below.

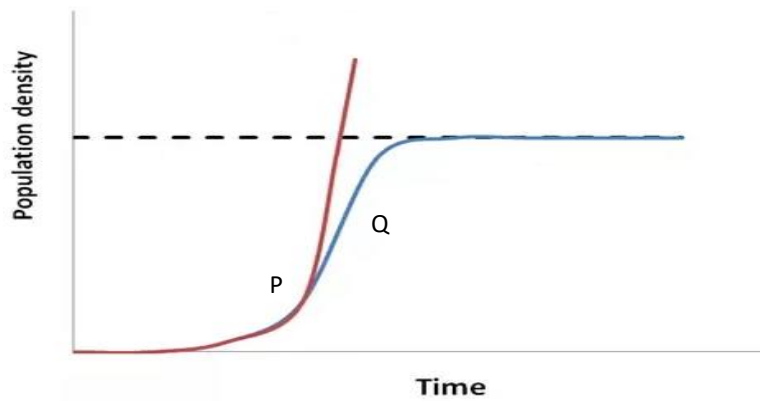


FIGURE 9

a) State the types of curves and their shapes.

[2 marks]

	P	Q
Type of curve		
Shape		

b) What is meant by carrying capacity of the environment?

[2 marks]

c) Give two factors which may limit the size of the carrying capacity of the environment.

[2 marks]

d) Describe the characteristics of curves P and Q.

[2 marks]
