

## IBDP ESS

### Topic 2: The ecosystem (Questions)

There are a lot of questions in this set – you may not find all the answers in the resources you have been provided. However using the resources, your textbooks and the internet you should be able to find all the answers.

None of these questions assess deep learning but are a starting point to see if you think you understand.

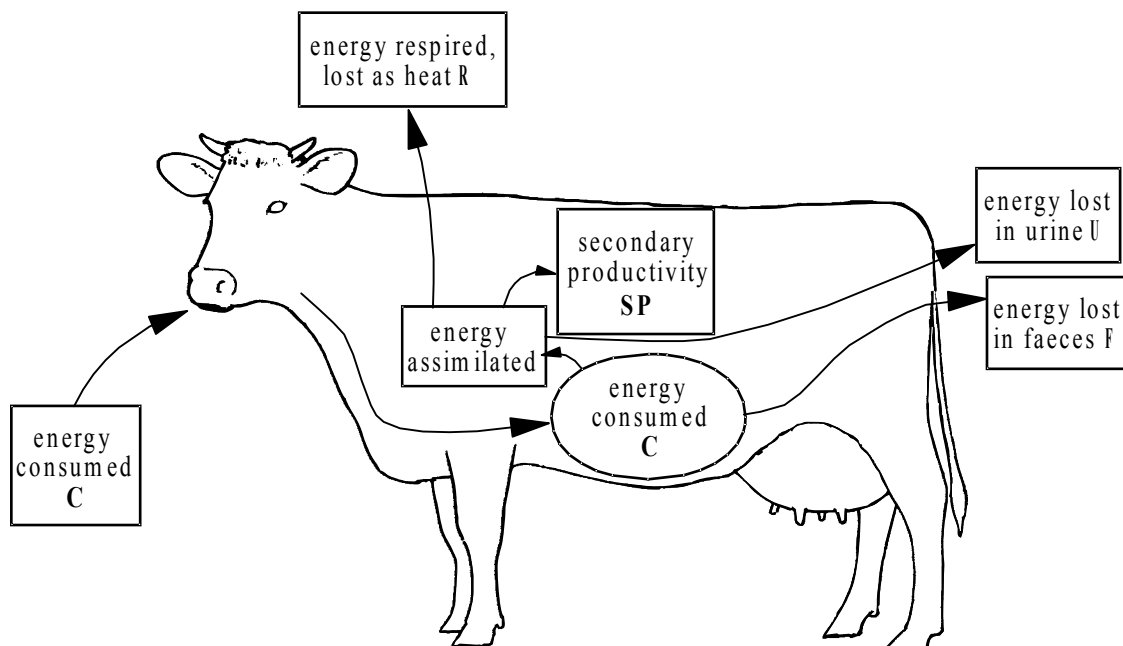
So with your peers between you try to answer all the questions without “looking” up the answers. Then where you may be stuck, discuss your thoughts with someone else. Finally in groups of threes or five decide between on an answer you think is the right one.

PS ignore the numbering

1. Which of the following is a characteristic of K-selected organisms?
  - A. They are typical of pioneer communities.
  - B. Usually a very high percentage of young die during the early part of their life cycle.
  - C. Sexual maturity is reached early in the lifespan.
  - D. They usually have a high degree of parental care of young.

(Total 1 mark)

2. The diagram below shows energy transfer in a cow.

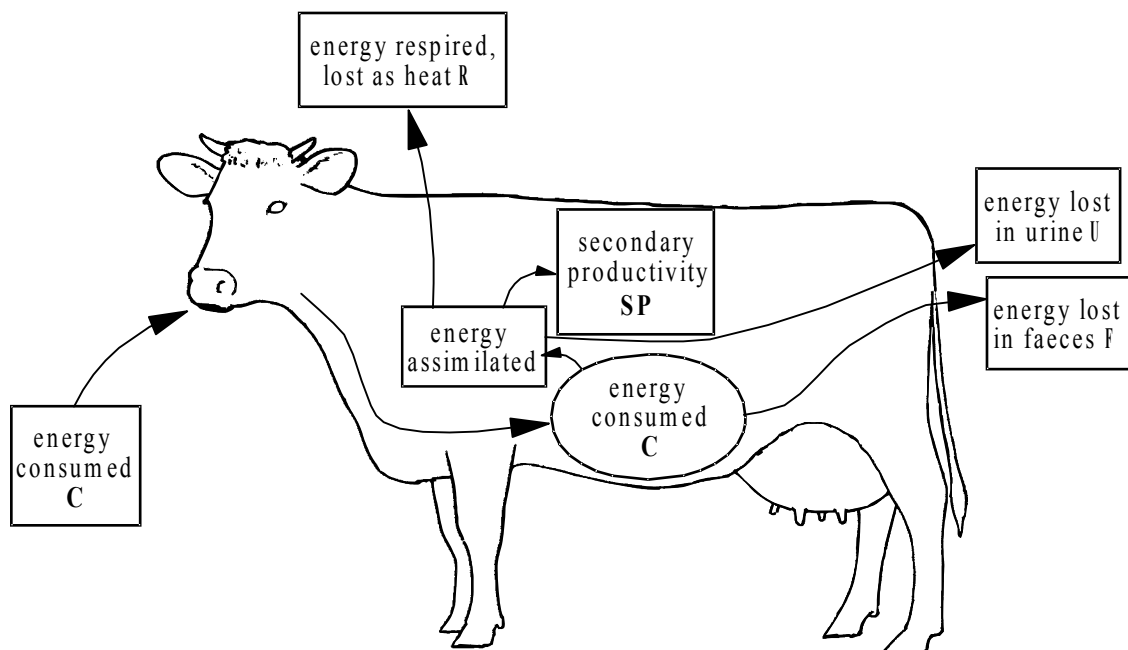


Secondary Productivity (SP) is

- A.  $C + R$ .
- B.  $C - (R + U + F)$ .
- C.  $C - (U + F)$ .
- D.  $C + R + U + F$ .

(Total 1 mark)

3. The diagram below shows energy transfer in a cow.



If  $C = 4000 \text{ kJ day}^{-1}$  and  $SP = 200 \text{ kJ day}^{-1}$ , the efficiency of conversion is

- A. 50 %.
- B. 10 %.
- C. 5 %.
- D. 2 %.

(Total 1 mark)

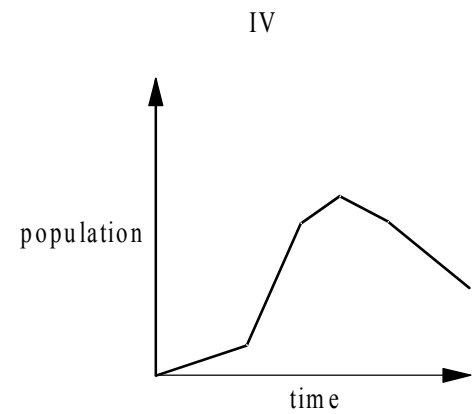
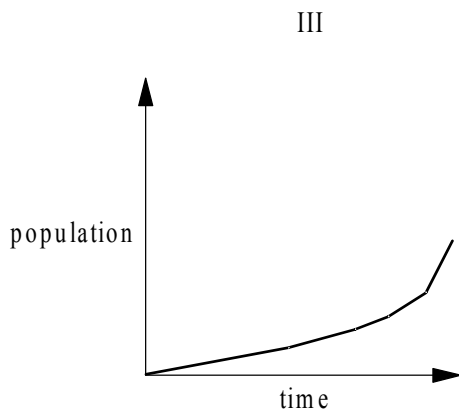
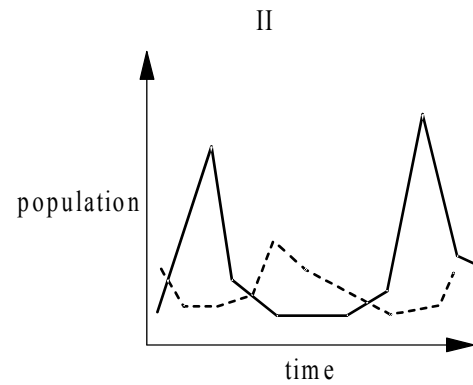
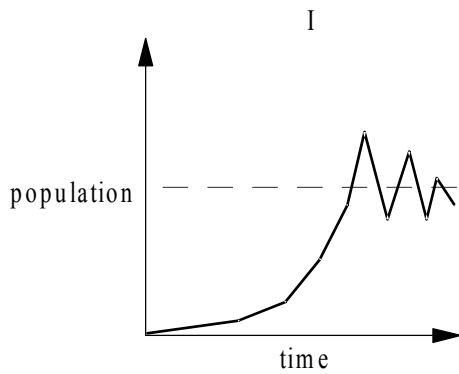
4. Modern commercial agricultural practices tend to

- A. lower species diversity in the community.
- B. reproduce early stages of succession to maximise net productivity.
- C. create conditions favourable for r-selected species.

D. do all the above.

(Total 1 mark)

5. The graphs below show four different population growth curves. Which best represents (i) the total human population; (ii) a bacterial population in a laboratory; (iii) a predator/prey relationship?



- |    | (i) | (ii) | (iii) |
|----|-----|------|-------|
| A. | III | I    | IV    |
| B. | III | IV   | II    |
| C. | IV  | III  | II    |
| D. | I   | IV   | I     |

(Total 1 mark)

6. Which interaction would benefit both organisms in a relationship?

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

(Total 1 mark)

8. Which of the following groups of organisms can convert ammonium and nitrate ions into amino acids?

- A. Producers
- B. Primary consumers
- C. Decomposers
- D. Top carnivores

(Total 1 mark)

9. Net Primary Production is the amount of energy

- A. produced from 'alternative' sources in developing countries.
- B. fixed in an ecosystem by photosynthesis.
- C. fixed in an ecosystem by photosynthesis, minus the losses due to respiration by producer organisms.
- D. fixed by the herbivores in an ecosystem.

(Total 1 mark)

10. Most food chains seldom have more than four trophic levels because

- A. in most ecosystems, competition for food is very great.
- B. the total biodiversity in any ecosystem is limited.
- C. energy is lost as it moves along a food chain and little remains at the level of the top carnivore.
- D. in many parts of the world, many species have become extinct and complex ecosystems are rare.

(Total 1 mark)

12. Which of the following correctly describes the components of a population, community, ecosystem and habitat?

|    | <b>Population</b>  | <b>Community</b>   | <b>Ecosystem</b>   | <b>Habitat</b>     |
|----|--------------------|--------------------|--------------------|--------------------|
| A. | Biotic only        | Biotic only        | Biotic and abiotic | Biotic and abiotic |
| B. | Biotic only        | Biotic and abiotic | Biotic and abiotic | Biotic and abiotic |
| C. | Biotic and abiotic | Biotic and abiotic | Biotic only        | Abiotic only       |
| D. | Biotic only        | Biotic only        | Biotic and abiotic | Abiotic only       |

(Total 1 mark)

13. An *ecological niche* is

- A. where a species lives.
- B. all the populations of an ecosystem.
- C. what a species eats.
- D. the role a species has in an ecosystem.

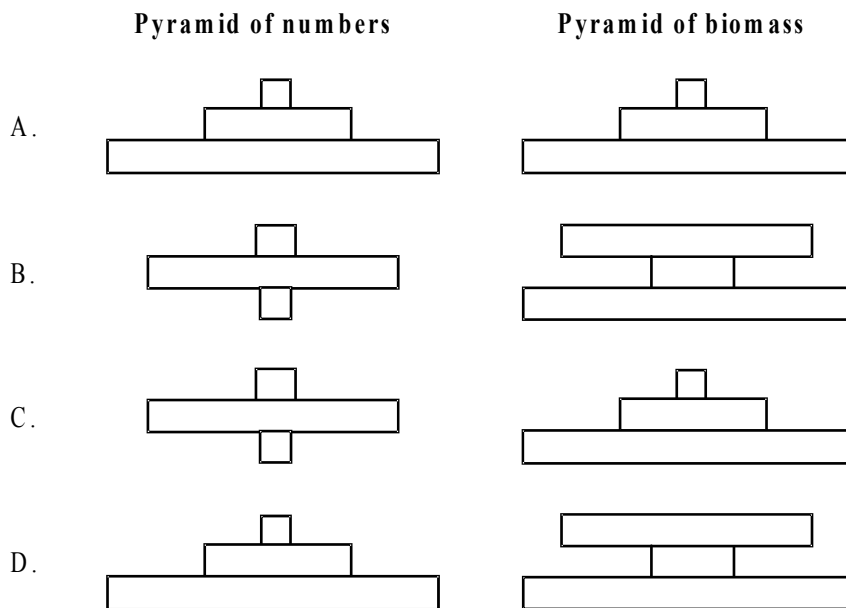
(Total 1 mark)

14. If the rates of photosynthesis and respiration (in a plant) were exactly equal, which of the following would be true?

- A. Net Productivity would equal respiration
- B. Net Productivity is at a maximum
- C. Net Productivity would equal Gross Productivity
- D. Net Productivity would be zero

(Total 1 mark)

15. In a mature forest, the trees are eaten by small primary consumers which are then eaten by much larger secondary consumers. Which of the following pyramids best represent this ecosystem?



(Total 1 mark)

16. Which of the following statements about food chains is true?

- A. Herbivores are usually found at the third trophic level.
- B. Carnivores are never at the second trophic level.
- C. Primary producers can be found at any trophic level.
- D. Secondary consumers are at the second trophic level.

(Total 1 mark)

18. An animal population is given 50 kg of feed per day, of which 40 kg is consumed. 20 kg of feed per day is used in respiration and 15 kg of faeces per day is released. Which of the following are the correct values for gross and net productivity?

|    | Gross Productivity<br>(kg day <sup>-1</sup> ) | Net Productivity<br>(kg day <sup>-1</sup> ) |
|----|---|---|
| A. | 40  | 25  |
| B. | 25  | 5   |
| C. | 50  | 35  |
| D. | 40  | 5   |

(Total 1 mark)

**19.** A parasite, infecting the organs of its host, spreads from host to host more rapidly when the host population, in a given area, is higher. Assuming infection with the parasite reduces fertility, this would be an example of control of the host population through

- A. an external, density independent factor.
- B. an internal, density dependent factor.
- C. an external, density dependent factor.
- D. an internal, density independent factor.

(Total 1 mark)

**20.** In the process of succession, earlier communities disappear because

- A. they are displaced through competition.
- B. their gross productivity decreases with age.
- C. they eventually produce disadvantageous changes to their physical environment.
- D. their biodiversity is low.

(Total 1 mark)

**21.** The main difference between 'S' and 'J' population growth curves is that

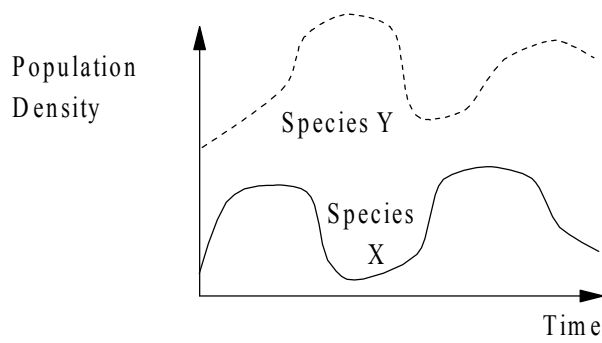
- A. 'S' curves demonstrate exponential growth.
- B. 'J' curves demonstrate exponential growth.
- C. 'S' curves reach no stable maximum.
- D. 'J' curves reach no stable maximum.

(Total 1 mark)

**22.** The main deserts of the world are found at

- A. latitudes between the tundra and temperate forests.
- B. lower latitudes than temperate and tropical forests.
- C. latitudes between the temperate and tropical forests.
- D. higher latitudes than the tundra.

23. The following graphs represent the changes in population density of two species:



Which of the following most likely represents the relationship between these two species?

- |    | X        | Y        |
|----|----------|----------|
| A. | predator | prey     |
| B. | prey     | predator |
| C. | parasite | host     |
| D. | host     | parasite |

(Total 1 mark)

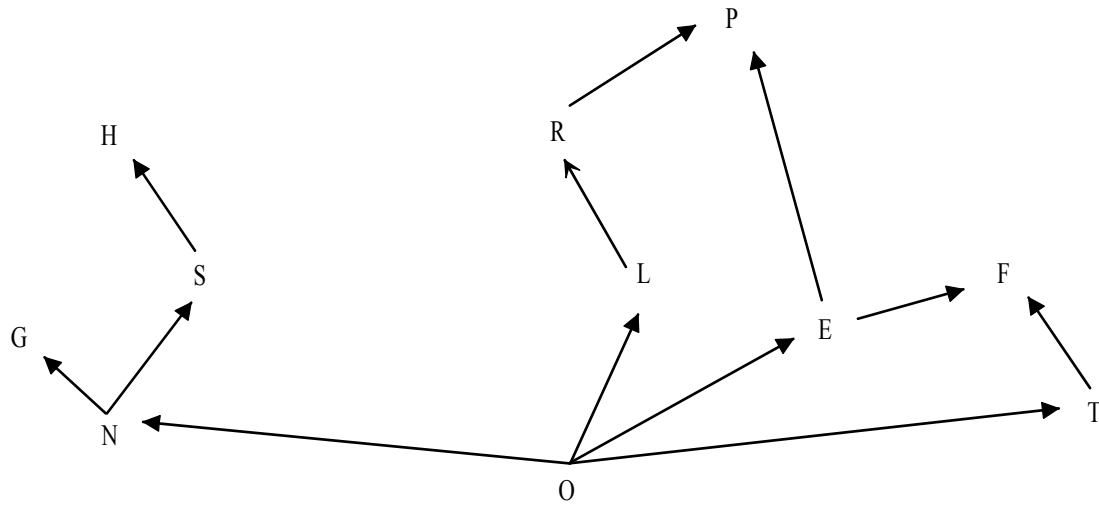
24. Major climatic factors affecting ecosystems are

- A. temperature and precipitation.
- B. temperature and salinity.
- C. ocean and air currents.
- D. Rossby waves and Hadley cells.

(Total 1 mark)



25. The diagram below shows a complete food web. Each letter represents a species.

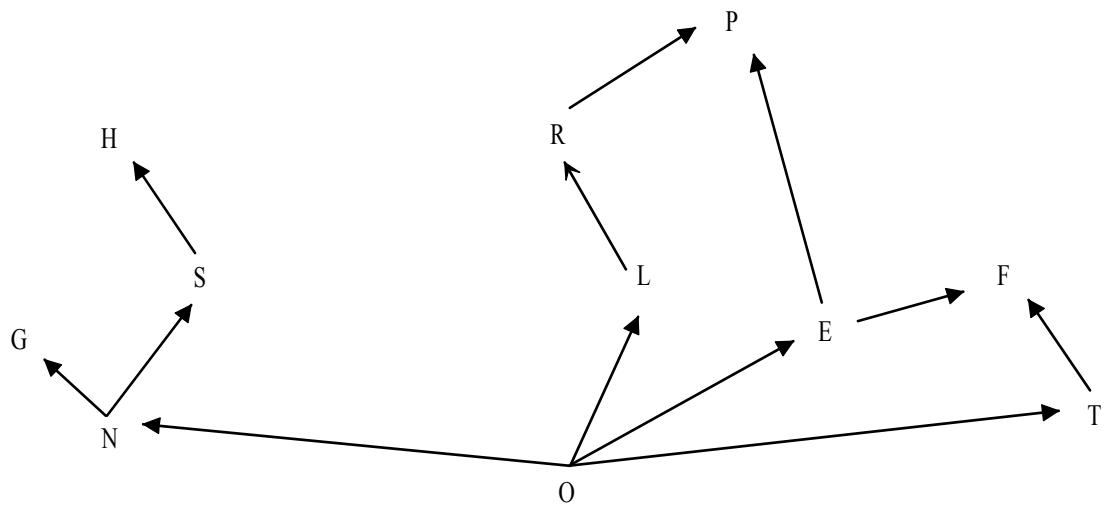


Which are producers?

- A. P and H
- B. P, H, R and F
- C. O, N and T
- D. O

(Total 1 mark)

26. The diagram below shows a complete food web. Each letter represents a species.

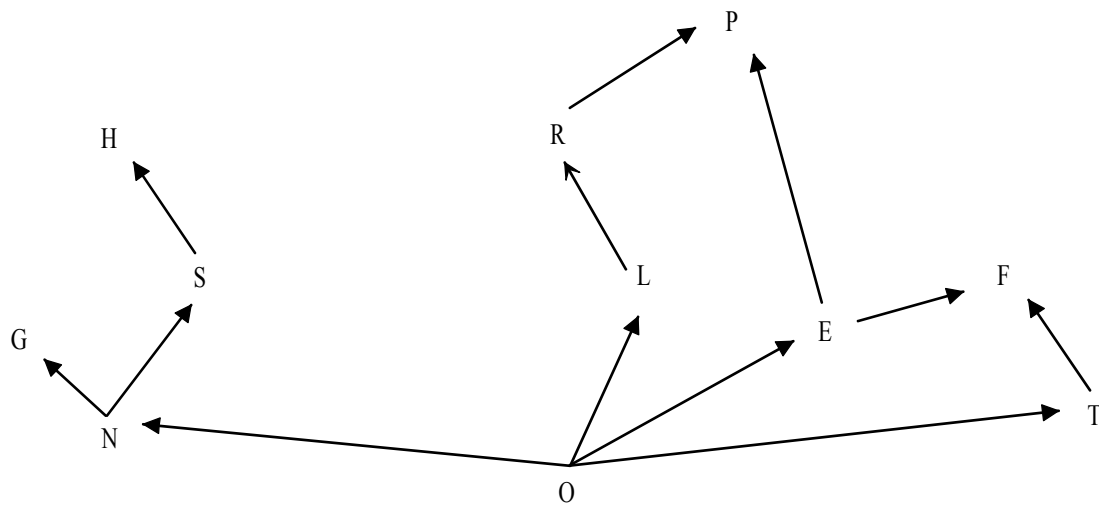


Which are secondary consumers?

- A. G, S, R, P and F
- B. H and P
- C. N, L, E and T
- D. O

(Total 1 mark)

27. The diagram below shows a complete food web. Each letter represents a species.

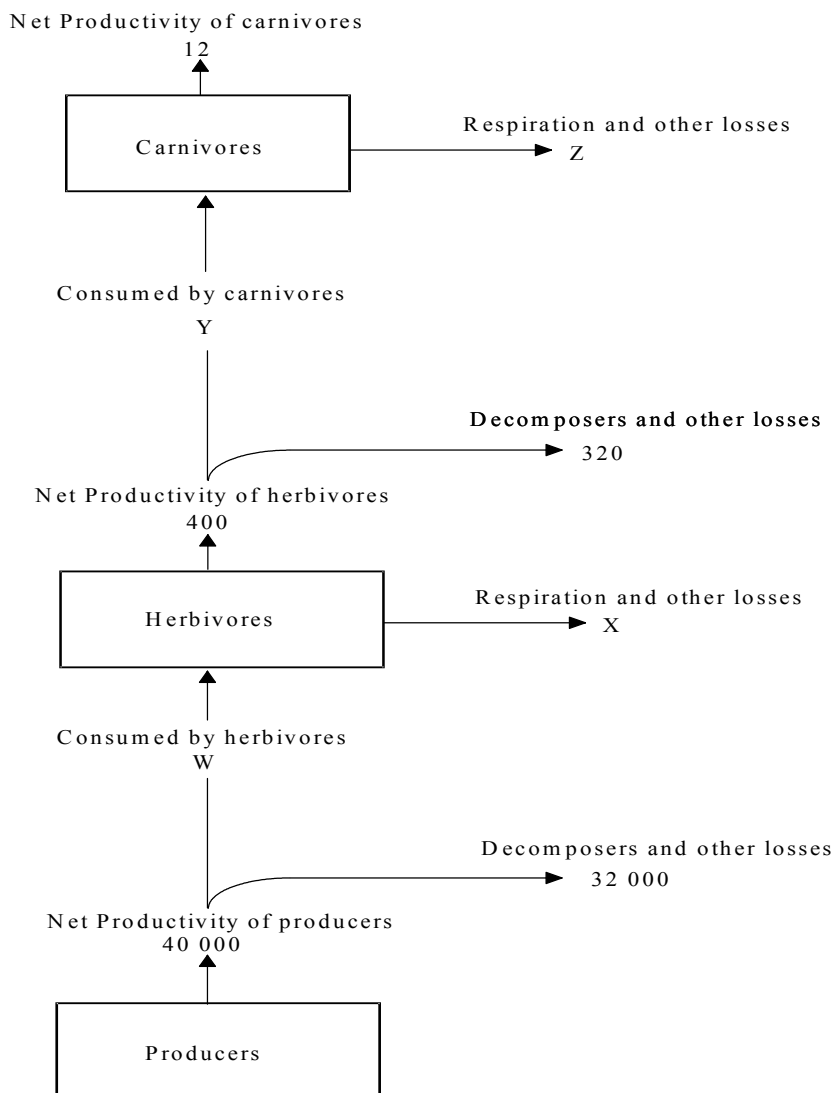


If the population size of P decreases through human activity, what would be the likely effect on the population size of L?

- A. It would increase due to greater competition from E.
- B. It would decrease due to greater predation by R.
- C. It would decrease due to greater competition from F.
- D. It would decrease due to less predation by P.

(Total 1 mark)

28. In the diagram below all values are in  $\text{kJ m}^{-2} \text{yr}^{-1}$



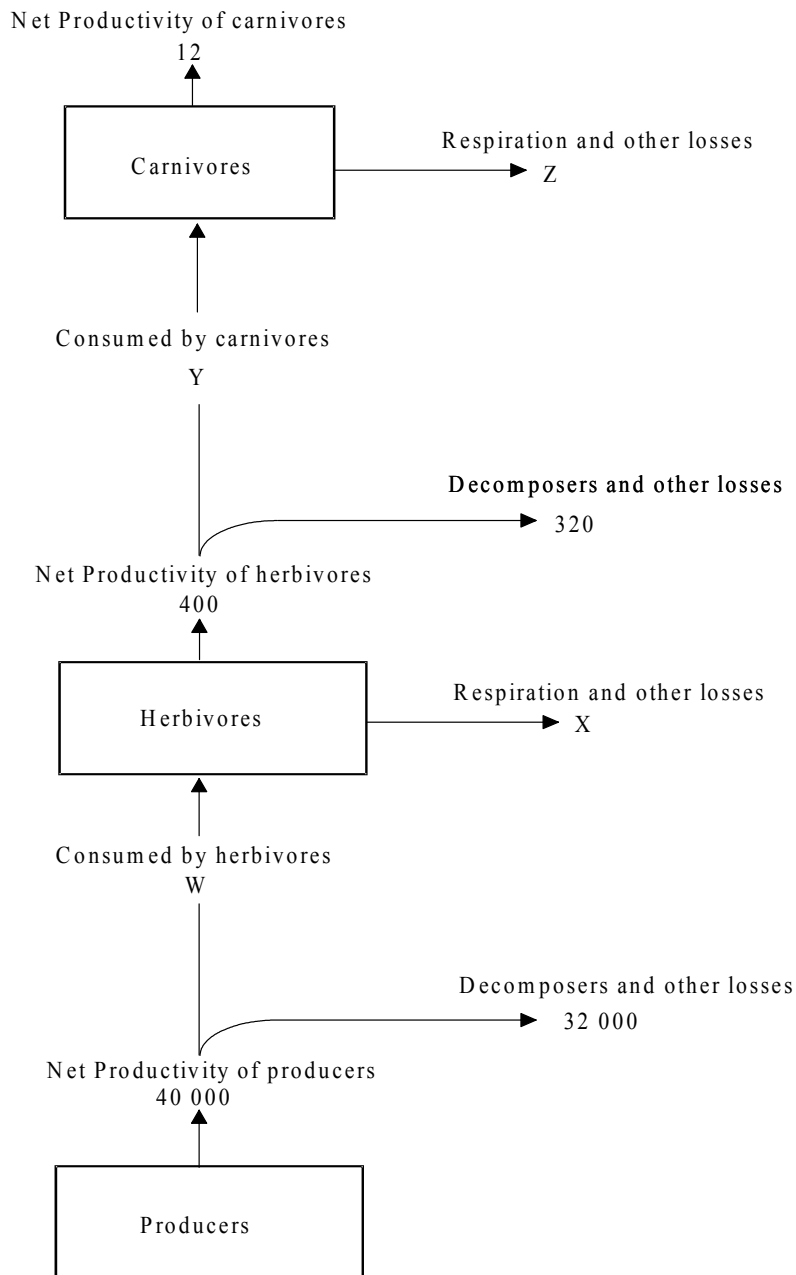
[Ian Bradbury, The Biosphere, (John Wiley & Sons Ltd., 1991). Reproduced by permission of Wiley-Blackwell.]

The values of W, X, Y and Z are

|    | W      | X    | Y   | Z  |
|----|--------|------|-----|----|
| A. | 72 000 | 8400 | 720 | 92 |
| B. | 8000   | 8400 | 720 | 92 |
| C. | 8000   | 7600 | 80  | 92 |
| D. | 8000   | 7600 | 80  | 68 |

(Total 1 mark)

29. In the diagram below all values are in  $\text{kJ m}^{-2} \text{yr}^{-1}$



[Ian Bradbury, *The Biosphere*, (John Wiley & Sons Ltd., 1991). Reproduced by permission of Wiley-Blackwell.]

The carnivores' productivity as a percentage of primary productivity is

- A. 0.003.
- B. 0.03.
- C. 0.3.
- D. 3.

(Total 1 mark)

30. Which is **least** likely to be an example of mutualism?

- A. Bacteria fixing nitrates in the roots of a tree
- B. Birds feeding on fruit containing indigestible seeds
- C. Small plants of another species attached to the surface of a tree
- D. Fungi on roots increasing uptake of minerals by a tree

(Total 1 mark)

32. The following data were collected in a study of secondary productivity in a population of woodlice. Some of the woodlice produced offspring during the experiment.

|                    | Estimated Dry Mass at start of experiment (g) | Estimated Dry Mass at end of experiment (g) |
|--------------------|---|---|
| Adult woodlice     | 1.53  | 1.59  |
| Young woodlice     | –   | 0.63  |
| Food (dead leaves) | 22  | 19.45                                       |
| Faecal matter      | –   | 0.84  |

Gross productivity (g) of this population over the period of the experiment was

- A. 2.55.
- B. 2.22.
- C. 1.71.
- D. 1.59.

(Total 1 mark)

33. The following data were collected in a study of secondary productivity in a population of woodlice. Some of the woodlice produced offspring during the experiment.

|                    | Estimated Dry Mass at start of experiment (g) | Estimated Dry Mass at end of experiment (g) |
|--------------------|---|---|
| Adult woodlice     | 1.53  | 1.59  |
| Young woodlice     | –   | 0.63  |
| Food (dead leaves) | 22  | 19.45                                       |
| Faecal matter      | –   | 0.84  |

Net productivity (g) of this population over the period of the experiment was

- A. 0.06.
- B. 0.63.
- C. 0.69.
- D. 2.22.

(Total 1 mark)

34. Compared to a pioneer community, a climax community would have

- A. higher net productivity.
- B. higher gross productivity.
- C. more available mineral nutrients.
- D. more short-lived species.

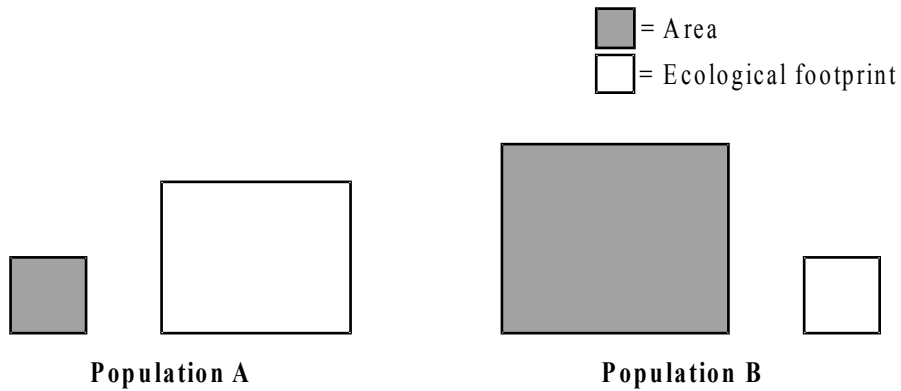
(Total 1 mark)

35. *Biomass* is best defined as

- A. living material.
- B. non-biodegradable material.
- C. the dry weight of organic material.
- D. the total mass of organic and inorganic material.

(Total 1 mark)

36. The diagrams below represent the area inhabited by, and the ecological footprint of, two human populations. One population is from a developed country and the other from a developing country. The diagrams are drawn to the same scale.



(a) Which of the populations, **A** or **B**, is exceeding the carrying capacity of the area? Explain your answer.

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(2)

38. A *biome* is

- A. a collection of ecosystems that contain the same species.
- B. a collection of ecosystems sharing similar climatic conditions.
- C. an ecosystem that is undergoing change.
- D. a collection of populations living and interacting with each other.

(Total 1 mark)

39. Which term could **not** be applied to an organism feeding on the biomass of a producer?

- A. Primary consumer
- B. Secondary consumer
- C. Herbivore
- D. Decomposer

(Total 1 mark)



40. Consider these statements concerning the flow of energy through ecosystems:

**Statement 1:** The amount of energy that is available to living things decreases as it is transformed and passed along food chains.

**Statement 2:** As energy is transformed along food chains, no energy is destroyed.

Which is a correct evaluation of these statements?

**Statement 1**

**Statement 2**

- |    |   |   |
|----|---|---|
| A. | Demonstrates the first law of thermodynamics<br>second law of | Demonstrates the<br>thermodynamics              |
| B. | Is unrelated to the laws of thermodynamics<br>of              | Demonstrates the second law<br>thermodynamics   |
| C. | Demonstrates the second law of<br>thermodynamics              | Demonstrates the first law of<br>thermodynamics |
| D. | Demonstrates the second law of<br>thermodynamics              | Is unrelated to the laws of<br>thermodynamics   |

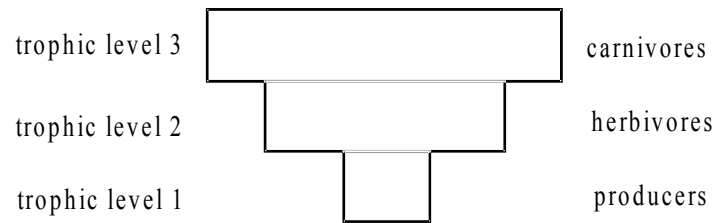
(Total 1 mark)

41. Which statement relating to trophic levels is true?

- A. In a food chain there may be many species at each trophic level.
- B. The number of trophic levels is generally less in ecosystems with high primary productivity.
- C. Higher trophic levels always have fewer species than lower trophic levels.
- D. A single species may occupy more than two different trophic levels.

(Total 1 mark)

42. The diagram below represents the pyramid of biomass for a certain ecosystem.

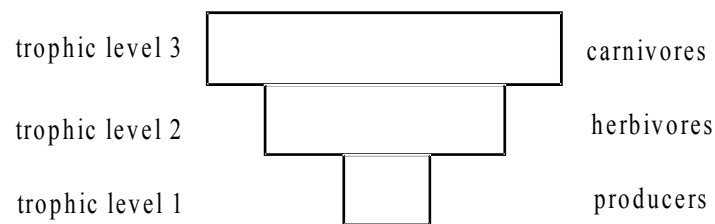


The most likely explanation for the biomass of trophic level 2 being greater than that of trophic level 1 is that the

- A. system shows seasonal fluctuations and the plants have died off before the herbivores.
- B. number of plants is greater than the number of herbivores.
- C. number of herbivores is greater than the number of plants.
- D. productivity of the herbivores is greater than the productivity of the plants.

(Total 1 mark)

43. The diagram below represents the pyramid of biomass for a certain ecosystem.



Species X and Y are both at trophic level 2 and species Z is at trophic level 3. Which are the most likely relationships between the species?

| Relationship between<br>species X and Y | Relationship between<br>species Z and X |
|---|---|
|---|---|

- |    |             |             |
|----|-------------|-------------|
| A. | Parasitism  | Predation   |
| B. | Mutualism   | Herbivory   |
| C. | Mutualism   | Competition |
| D. | Competition | Predation   |

(Total 1 mark)

44. An ecological niche is

- A. where a species lives and what it does in its environment.
- B. the specific location of a species.
- C. the general type of ecosystem where a species is found.
- D. the type of burrow where a species lives.

(Total 1 mark)

45. Which of the following correctly represents the energy transformations involved in respiration and photosynthesis?

- |    | <b>Respiration</b> | <b>Photosynthesis</b> |
|----|--------------------|-----------------------|
| A. | Heat to chemical   | Light to chemical     |
| B. | Chemical to heat   | Heat to chemical      |
| C. | Chemical to heat   | Light to chemical     |
| D. | Heat to chemical   | Heat to light         |

(Total 1 mark)

46. Which process involved in the cycling of matter could be described as a transformation process requiring the input of solar radiation?

- A. Decomposition of organic matter releasing phosphates
- B. Movement of water vapour inland from over the oceans
- C. Conversion of nitrates into organic molecules containing nitrogen
- D. Conversion of organic matter into fossil fuels

(Total 1 mark)

47. *Net primary productivity* is the total biomass

- A. made from inorganic matter that remains after respiratory losses.
- B. obtained from other organisms that remains after respiratory losses.
- C. obtained from other organisms before any respiratory losses.
- D. made from inorganic matter before any respiratory losses.

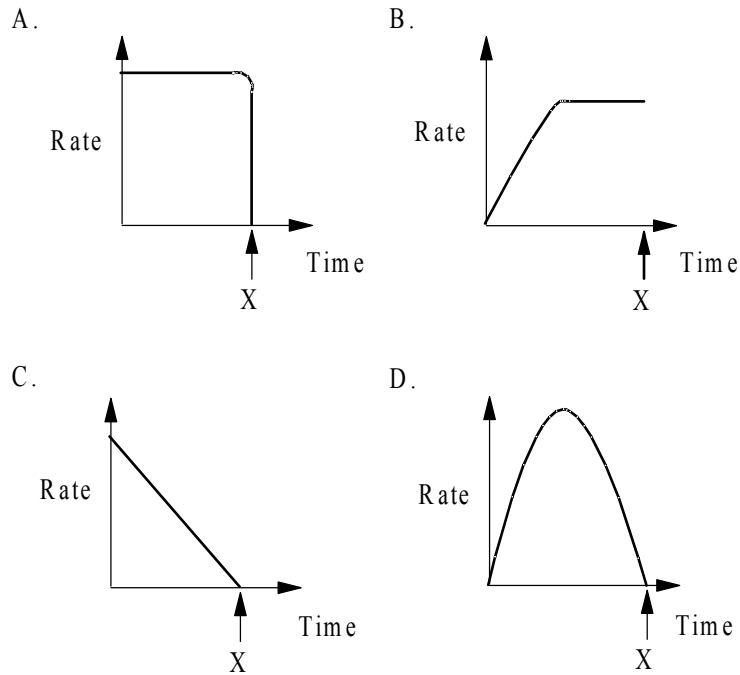
(Total 1 mark)

48. As succession approaches a climax, which changes are likely to occur in an ecosystem?

- |    | <b>Gross productivity of whole ecosystem</b> | <b>Net productivity of whole ecosystem</b> | <b>Inorganic mineral storages</b> |
|----|--|--|-----------------------------------|
| A. | Increase                                     | Increase                                   | Increase                          |
| B. | Decrease                                     | Increase                                   | Decrease                          |
| C. | Increase                                     | Decrease                                   | Decrease                          |
| D. | Increase                                     | Decrease                                   | Increase                          |

(Total 1 mark)

49. Which graph best represents the change in growth rate of an S-shaped population growth curve?



X = time at which carrying capacity is reached

(Total 1 mark)

50. Which is most likely to be an internal density dependent factor regulating a population of herbivores?

- A. An increase in predators as the herbivores increase in number
- B. An increased fertility rate as herbivores decrease in number
- C. An increased size of breeding territory when food *per capita* is high
- D. Less aggression leading to more mating success when population numbers are low

(Total 1 mark)

52. The table below gives the approximate number of bird species found at different altitudes in tropical South America.

| Altitude (m) | Number of species |
|--------------|-------------------|
| 0–500        | 2000              |
| 500–1000     | 1950              |
| 1000–1500    | 1550              |
| 1500–2000    | 1100              |
| 2000–3000    | 950               |
| 3000–4000    | 500               |
| 4000–5000    | 200               |

[Data from a diagram in Gaston K and Spicer J, *Biodiversity: an Introduction*, Blackwell Science, 1998]

- (a) Describe and explain the relationship between altitude and number of species shown in the table.

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(3)

53. Two herbivorous animals are part of the same community. One of them is prey to many predators and the other has no natural predator. They are

- A. primary consumers and occupy the same ecological niche.
- B. primary producers and occupy the same ecological niche.
- C. primary consumers and occupy different ecological niches.
- D. primary producers and occupy different ecological niches.

(Total 1 mark)

54. The main factors that determine the type of biome found are

- I. temperature.
- II. precipitation.
- III. soil type.
- IV. wind direction.

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

(Total 1 mark)

55. The table below shows processes carried out by three different organisms. Which statement is correct?

|    |  | Green plants | Decomposer organisms | Fish |
|----|--|--------------|----------------------|------|
| A. | produce carbohydrates by photosynthesis    | Yes          | Yes                  | No   |
| B. | release carbon dioxide from respiration    | Yes          | Yes                  | No   |
| C. | obtain organic matter from other organisms | No           | Yes                  | Yes  |
| D. | release oxygen as a waste product          | Yes          | Yes                  | No   |

(Total 1 mark)

56. Nitrogen is returned to the atmosphere by

- A. lightning discharges.
- B. denitrifying bacteria.
- C. nitrifying bacteria.
- D. leguminous plants.

(Total 1 mark)

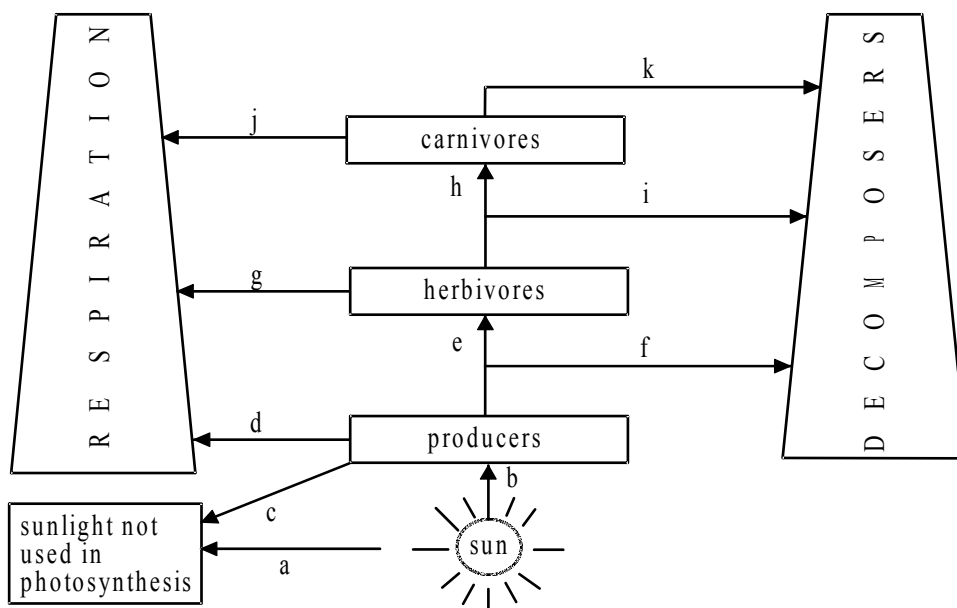
57. Food chains seldom have more than four members because
- in most ecosystems competition for food is great.
  - the total biodiversity of any area is limited.
  - energy is lost as it moves along a food chain and little remains at the top carnivore level.
  - in many parts of the world, species have become extinct and complex ecosystems are rare.

(Total 1 mark)

58. Ecological succession generally involves
- a decrease in the entropy of an ecosystem.
  - loss of communities through competition.
  - an increase in the ratio of organic to inorganic storages.
- III only
  - I and II only
  - II and III only
  - I, II and III

(Total 1 mark)

59. The diagram below shows the flow of energy through a food web.

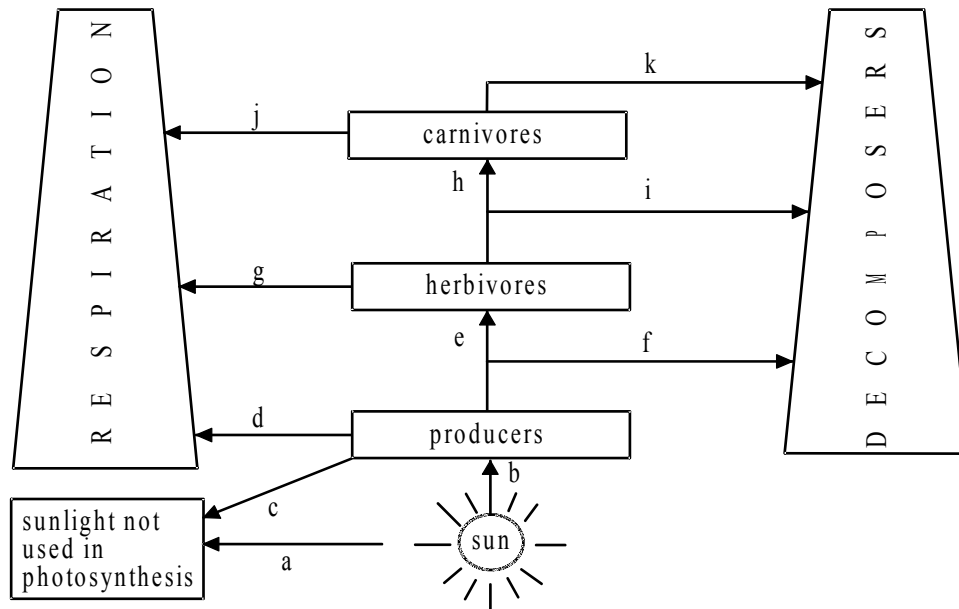


Gross Primary Productivity (GPP) is

- A.  $b - c$
- B.  $b - a$
- C.  $b$
- D.  $b - c - d$

(Total 1 mark)

60. The diagram below shows the flow of energy through a food web.



Net Primary Productivity (NPP) is

- A.  $b - c - d$
- B.  $d + e + f$
- C.  $e$
- D.  $e - d$

(Total 1 mark)

61. The net productivity for the consumer community is

- A.  $e + h$
- B.  $e + h - g - j - k - i$
- C.  $e - g - j$
- D.  $e - g - j - i - k$

(Total 1 mark)

62. A community is composed of

- A. several habitats.
- B. several populations.
- C. several abiotic factors.
- D. biotic and abiotic factors.

(Total 1 mark)





**66.** Which combination of abiotic factors is typical of the tropical forest biome?

- A. Low insolation and high rainfall
- B. Wide range of temperatures and high rainfall
- C. Narrow range of temperatures and high rainfall
- D. High insolation and low rainfall

**(Total 1 mark)**

**67.** Which of the following combinations is typical of r-selected organisms?

- I. A high number of offspring
  - II. A tendency to be associated with temporary habitats
  - III. Completion of the life-cycle in a relatively short period
  - IV. A low number of offspring
  - V. A high level of parental care
  - VI. A rapid rate of growth
- A. IV and V only
  - B. I, II and III only
  - C. I, II, III and VI only
  - D. II, IV and V only

**(Total 1 mark)**