

4.1 Species, Communities, Ecosystems & Energy Flow

Question Paper

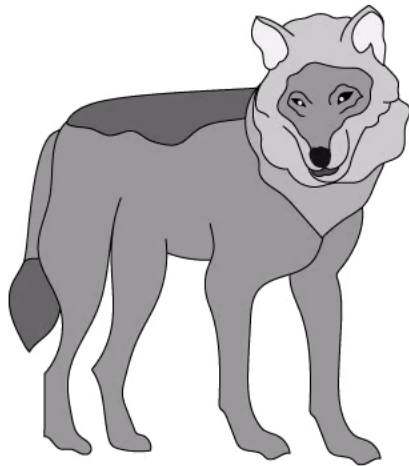
Course	DPIB Biology
Section	4. Ecology
Topic	4.1 Species, Communities, Ecosystems & Energy Flow
Difficulty	Hard

Time allowed: 70
Score: /54
Percentage: /100

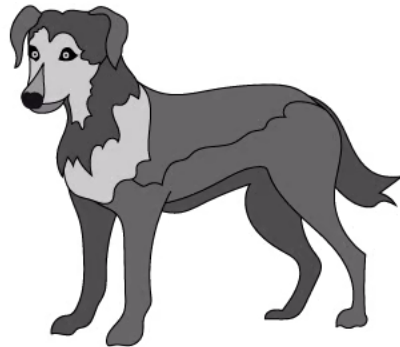
Question 1a

a)
The images show two organisms from the genus *Canis*.
Grey wolves, *Canis lupus*, are wild animals native to Eurasia and North America.
Domestic dogs, *Canis familiaris*, descended from wolves and became domesticated over many years.

Canis lupus



Canis familiaris



A wolfdog is a hybrid produced when a domesticated dog (*Canis familiaris*) breeds with a wolf (*Canis lupus*). Genetically, dogs and wolves are very similar and the resulting offspring are fertile. Wolfdog hybrids are rare as natural habitats and territorial behaviours isolate wolves from domestic dogs.

Using the information provided, discuss the validity of the claim that wolves and dogs are the same species.

[4 marks]

[4 marks]

Question 1b

b)

Suggest how isolation may result in the development of a new species.

[4 marks]

[4 marks]

Question 1c

c)

A taxonomist suggested that the wolf and the domestic dog should be re-categorised as follows:

- *Canis lupus familiaris*
- *Canis lupus lupus*

Identify the genus name and the species name for the wolf and the domestic dog under this re-categorisation.

[2 marks]

[2 marks]

Question 1d

d)

Outline how artificial selection has led to the domestication of wolves over many years to result in the domestic dogs of the modern day.

[3 marks]

[3 marks]

Question 2a

a)

All ecosystems are powered by autotrophic organisms.

Discuss this statement.

[4 marks]**[4 marks]**

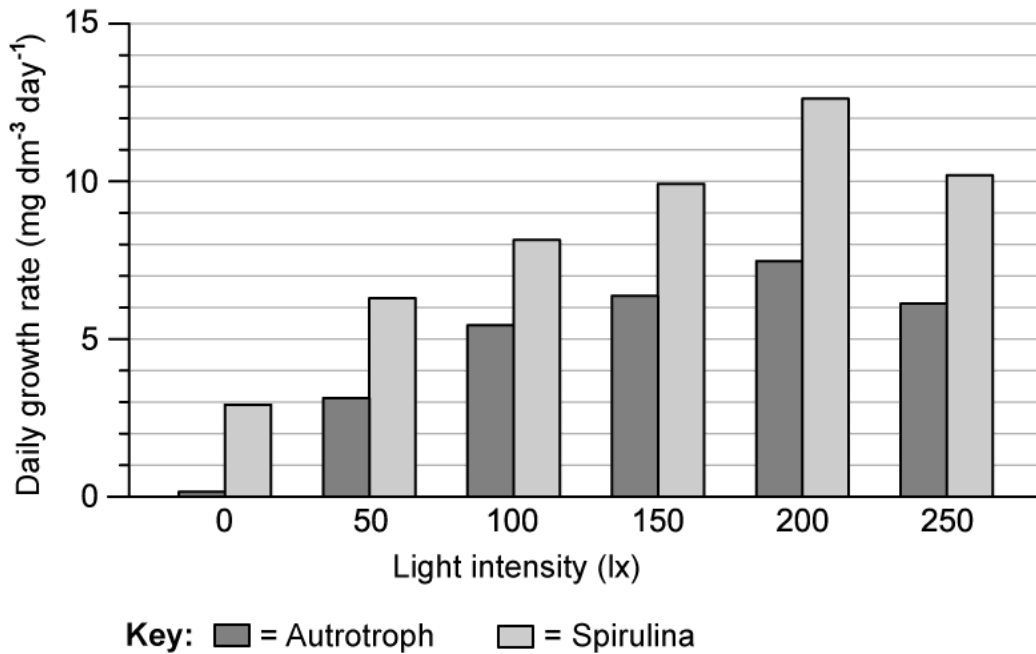
Question 2b

b)

Spirulina (*Athrospira platensis*) is a blue-green alga that is consumed for its nutritional benefits, which are considered to be good for oral health, eye health and maintaining healthy blood pressure, amongst other benefits.

The graph shows the results from an investigation into the optimum growing conditions for Spirulina.

Spirulina was grown in a glucose medium and exposed to different intensities of light. The same method was carried out with an autotrophic species of alga.



Explain how the results show that Spirulina is a mixotrophic organism.

[3 marks]

[3 marks]

Question 2c

c)

Compare the growth rate of Spirulina and the autotrophic algal species when light intensity was increased from 0 to 200 lx.

[2 marks]

[2 marks]

Question 2d

d)

Suggest how *Spirulina* may be adapted to function as a mixotroph.

[2 marks]

[2 marks]

Question 2e

e)

Another species of alga, *Cephaleuros virescens*, has been identified as a plant pathogen living on the leaves and fruit of guava plants in Hawaii. *C. viscerens* is non-photosynthetic and has been shown to cause a disease known as leaf and fruit spots.

Identify, with a reason, the mode of nutrition that is represented by *C. viscerens*.

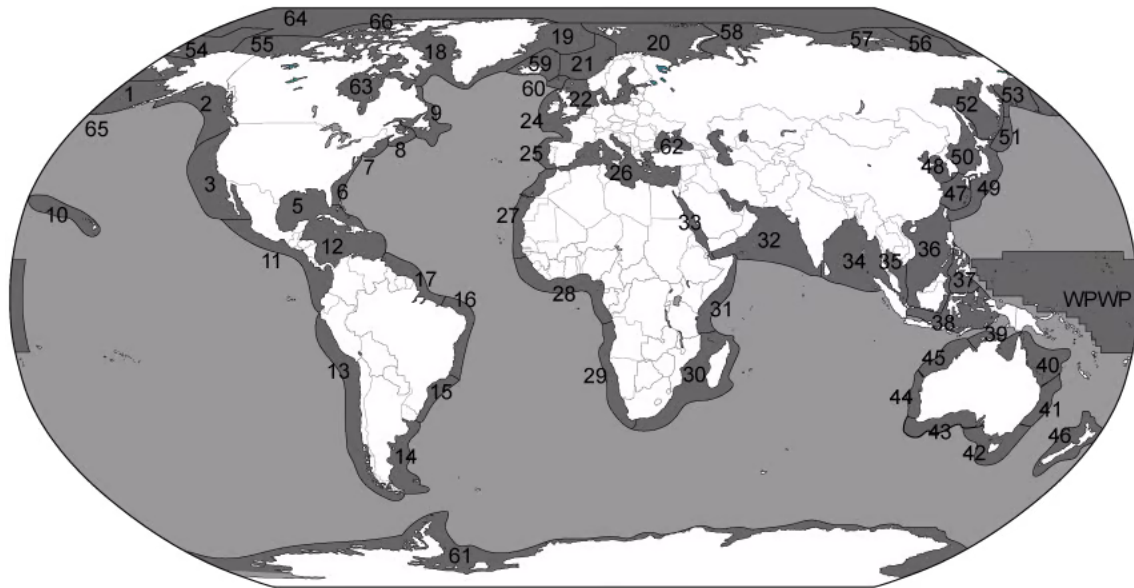
[2 marks]

[2 marks]

Question 3a

a)
Many large marine ecosystems across the world's oceans boast high productivity and biodiversity. As a result, they contribute substantially to the global economy through practices such as fishing.

The map below shows 66 large marine ecosystems, which are identified as being key areas of conservational interest, due to the risks associated with their proximity to developed coastlines and the impact this may have on the biodiversity of these ecosystems.



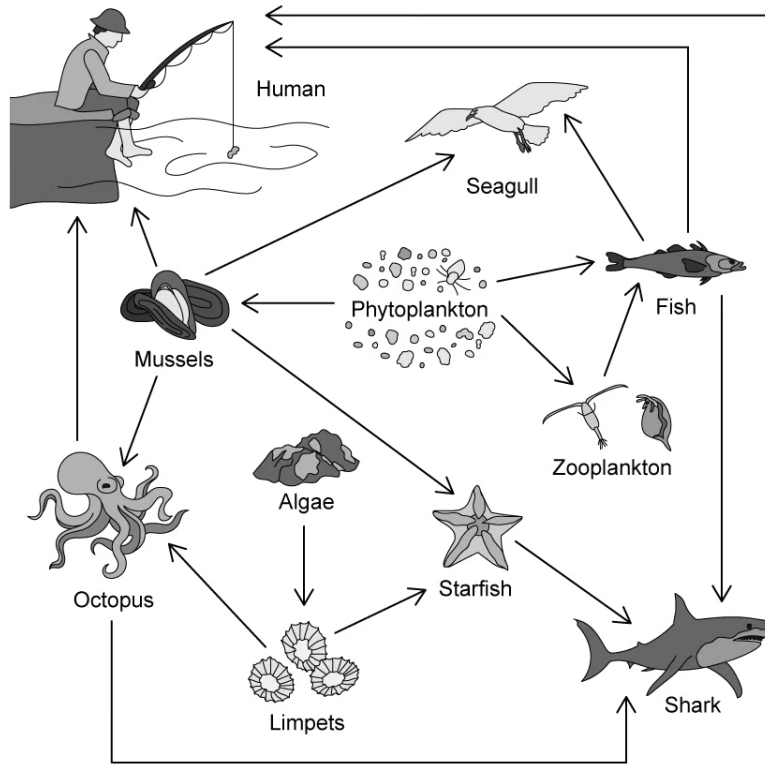
Suggest **four** abiotic factors that may impact communities living within large marine ecosystems.

[4 marks]

[4 marks]

Question 3b

b)
A basic food web for a large marine ecosystem can be seen below.



Nutrient-rich sewage from coastal settlements results in rapid growth of algae (algal blooms), which leads to a reduction in light intensity on the ocean floor.

Suggest the general effects this may have on a community in a marine ecosystem.

[4 marks]

[4 marks]

Question 3c

c)

Since 2013, numbers of starfish in the large marine ecosystems have been seen to dramatically reduce by up to 80% in some regions.

Starfish act as detritivores in the marine ecosystems, feeding on dead and decaying organic matter, as well as preying on organisms such as mussels and limpets.

Some scientists have suggested that a decline in starfish numbers may have a positive impact on the marine ecosystem.

Evaluate this statement.

[4 marks]

[4 marks]

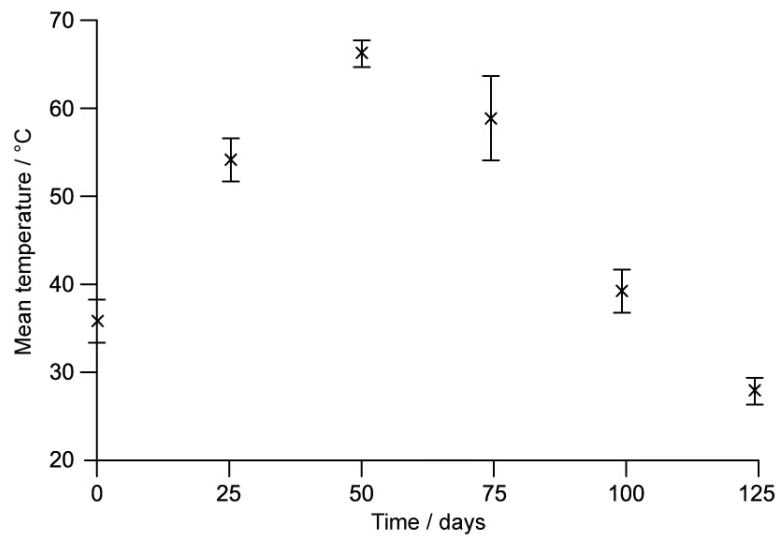
Question 4a

a)
Scientists investigated the production of high nutrient compost made from organic household waste.

The method they used was as follows:

1. Place waste in a large container for 125 days
2. Rotate the container each day
3. Record the temperature of the waste every 25 days
4. Remove samples of waste and test nutrient content

The temperature changes that they recorded were as follows:



Describe and explain what these data show about the processes occurring in the composter.

[4 marks]

[4 marks]

Question 4b

b)

Explain the reason for step 2. in the method described in part a).

[2 marks]

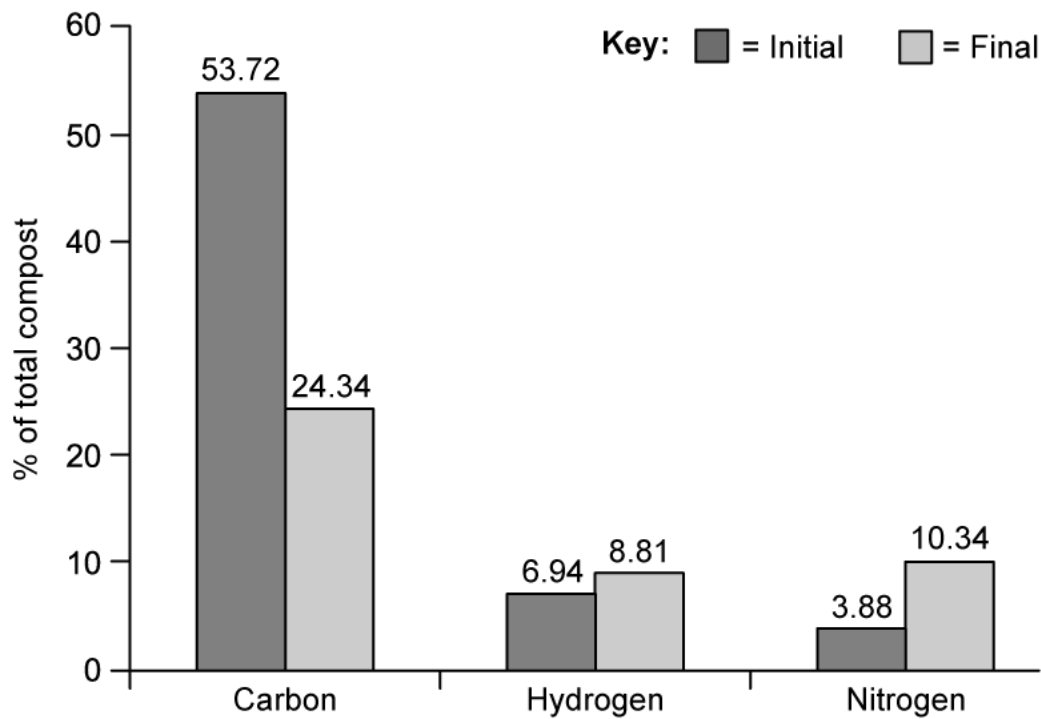
[2 marks]

Question 4c

c)

Nutrient content of the compost was measured at the start and the end of the process.

The results can be seen in the chart below.



Suggest reasons for the changes in carbon and nitrogen shown in the graph.

[3 marks]

[3 marks]

Question 5a

One mark is available for clarity of communication in this question.

a)

Outline how scientists may simulate a naturally occurring ecosystem to establish how the sustainability of that ecosystem may be influenced by global warming.

[4 marks]

[4 marks]

Question 5b

b)

Explain the use of the chi-squared test to analyse data collected from the simulated ecosystem.

[3 marks]

[3 marks]