

Biodiversity

Question Paper 3

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Biodiversity, classification and conservation
Sub Topic	Biodiversity
Booklet	Theory
Paper Type	Question Paper 3

Time Allowed : 71 minutes

Score : / 59

Percentage : /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

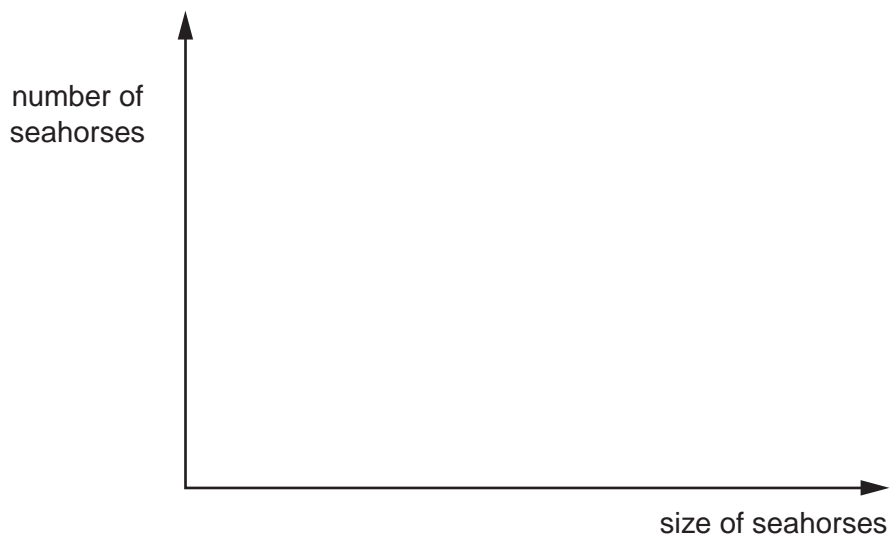
- 1 The seahorse, *Hippocampus*, is an unusual small fish. It gives birth to live young and it is the male rather than the female that becomes pregnant.

Fig. 1.1 shows a seahorse.



Fig. 1.1

- (a) In one species of seahorse, a type of natural selection called disruptive selection occurs. This is where the extreme phenotypes are more likely to survive and reproduce than the intermediate phenotypes.
- Within a population, large females mate with large males and small females mate with small males.
 - Few intermediate-sized individuals are produced and they have a low survival rate.
- (i) Sketch a graph on the axes below to show the distribution in size of seahorses as a result of disruptive selection.



(ii) Explain how disruptive selection has been maintained in this species of seahorse.

.....

.....

.....

.....

.....

.....

.....

..... [3]

(iii) State the term given to the type of selection where variation in a characteristic is maintained in its existing form over time.

..... [1]

(b) Two different species of seahorse are found in the coastal waters shown in Fig. 1.2.



Key: L = large seahorse *H. erectus* S = small seahorse *H. zosterae*

Fig. 1.2

Suggest how these two different species of *Hippocampus* could have arisen.

.....

.....

.....

.....

.....

.....

.....

.....

..... [2]

[Total: 8]

2 (a) The Millennium Seed Bank is located in the UK. So far it has successfully stored seeds from 10% of the world's wild plant species.

(i) Suggest the benefits to humans of conserving plant species.

.....
.....
.....
.....
.....
.....
.....[3]

(ii) In the wild, seeds may be subjected to conditions that can be hostile to successful germination and growth.

Suggest how the seeds should be stored in the seed bank to keep them viable for future use.

.....
.....[1]

- (b) Plant biodiversity varies throughout the world and is dependent on many factors, particularly climate.

Fig. 6.1 shows the relationship between the number of plant genera and the mean annual rainfall in seven countries.

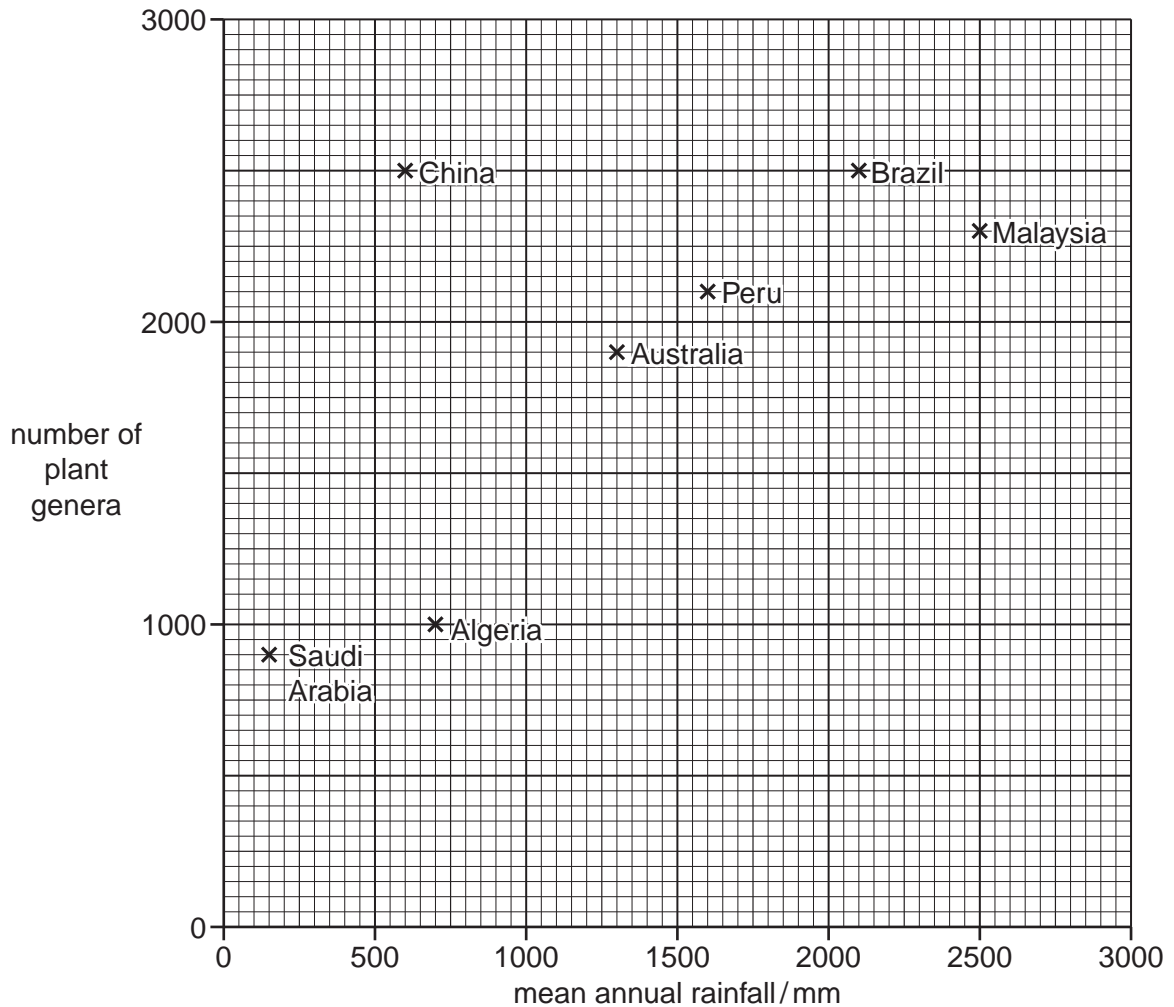


Fig. 6.1

- (i) Describe the relationship between the number of plant genera and the mean annual rainfall in these seven countries.

.....

 [2]

- (ii) Suggest what other climatic factors, apart from rainfall, affect plant biodiversity.

.....

 [2]

- 3 Read the passage below. Parts of the passage are in **bold type**. These are examples of ecological terms and are labelled **A** to **F**.

A class of students carried out an ecological study of a **defined area of seashore (A)** in Brittany, France. One group decided to study a **rockpool (B)** and recorded information such as the **oxygen concentration and temperature of the seawater (C)**. After investigating **all the different living organisms (D)** present in the rockpool, the students decided to study in more detail the **group of limpets, *Patella vulgata* (E)**. They collected information about the **role of the limpets within the rockpool, including interactions with other organisms (F)**. For example, limpets grazed on green seaweeds, while the shore crab, *Carcinus maenas*, fed on small limpets.

- (a) State the correct letter, **A** to **F**, from the passage above that corresponds to each of the ecological terms below.

habitat

ecosystem

abiotic component

ecological niche

population

community

[4]

- (b) State the trophic levels to which each of the organisms named in the passage belong **and** outline the energy losses that occur in the food chain.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 8]

- 4 When gold is associated with mineral ores such as iron sulfide, the sulfides must be oxidised to release the gold particles. Since the mid 1990s, gold has been extracted from such ores by bioleaching.

Suitable bacteria oxidise iron sulfide to soluble iron sulfate, releasing Fe^{3+} and SO_4^{2-} ions. The reaction releases heat energy and temperatures within a heap of ore that is being bioleached (a bioheap) can reach 70°C or higher.

Examples of bacteria used in this bioleaching are shown in Table 2.1.

Table 2.1

example of bacterium	temperature range for growth / $^\circ\text{C}$	activity	natural habitat
<i>Acidithiobacillus ferrooxidans</i>	35 – 45	oxidise iron and sulfur compounds	acid springs
<i>Sulfobacillus thermosulfidooxidans</i>	45 – 65		
<i>Sulfolobus metallicus</i>	65 – 95		

- (a) With reference to Table 2.1, suggest
- (i) a natural habitat for organisms such as *S. thermosulfidooxidans* and *S. metallicus*
-
- [1]
- (ii) why all three species of bacteria, rather than just one species, are mixed with ore in a bioheap.
-
-
-
-
-
- [3]

- (b) The rate of oxidation of the iron in iron sulfide ore was compared in the presence and absence of *A. ferrooxidans* at pH 2.0.

The results are shown in Fig. 2.1.

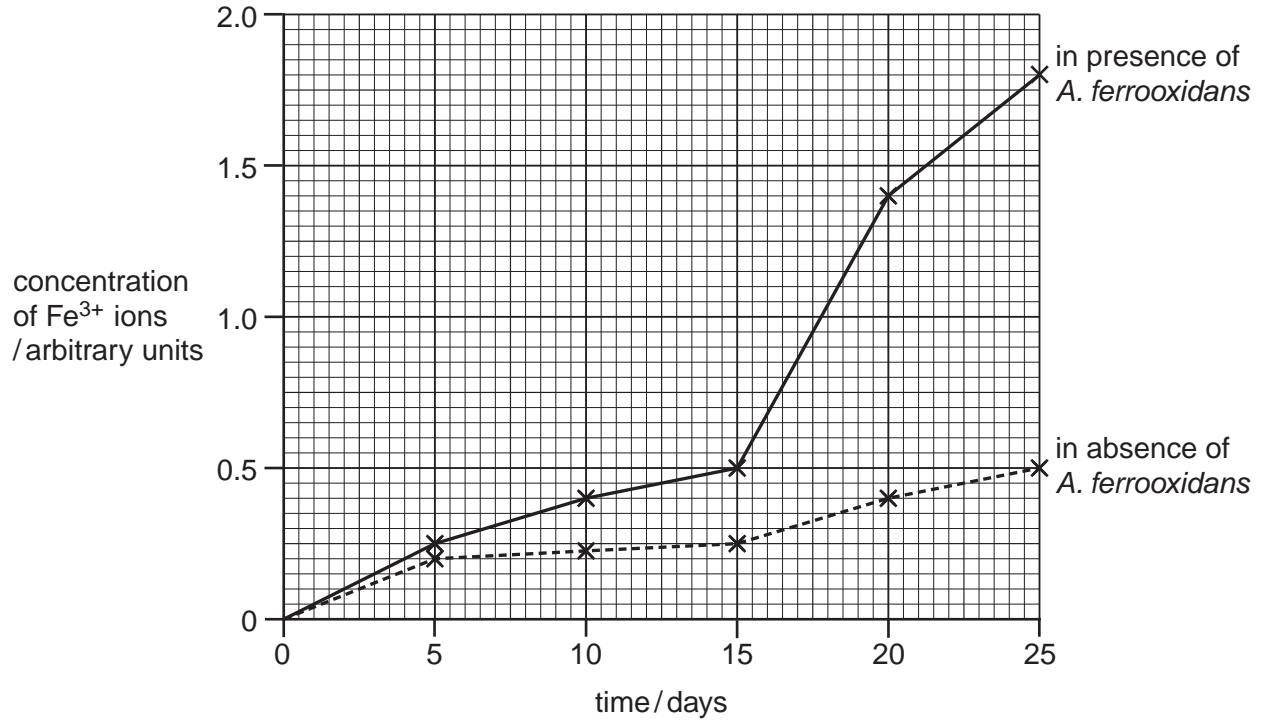


Fig. 2.1

- (i) With reference to Fig. 2.1, describe the effect of *A. ferrooxidans* on the oxidation of the ore.

.....

.....

.....

.....

.....

.....

.....

..... [3]

(ii) Explain why bioleaching is now used on a large scale throughout the world.

.....
.....
.....
.....
.....
..... [3]

(c) Gold-bearing sulfide ores often contain arsenic, which is potentially toxic to the bacteria used in bioleaching. However, arsenic-resistant strains of *A. ferrooxidans* have been found in some mines.

The activity of two strains of the bacterium, in the presence and absence of arsenic ions, is shown in Table 2.2.

Table 2.2

strain of <i>A. ferrooxidans</i>	oxidation rate of iron in the ore / $\text{mg dm}^{-3} \text{h}^{-1}$	
	arsenic ions absent	arsenic ions present
1	16	15
2	48	47

Describe the results shown in Table 2.2 **and** explain the role of natural selection in the evolution of arsenic-resistant bacteria.

.....
.....
.....
.....
.....
.....
.....
.....
..... [4]

- 5 The hedgehog, *Erinaceus europaeus*, is a small carnivorous mammal native to Northern Europe.

Fig. 8.1 shows a hedgehog.



Fig. 8.1

Hedgehogs were introduced onto a small group of islands off the west coast of Scotland in 1974. The hedgehog population has increased so that there are now over 5000 breeding pairs. These hedgehogs have no natural predators on these islands and their diet consists mainly of bird's eggs.

Fig. 8.2 shows the hedgehog population density in the year 2000.

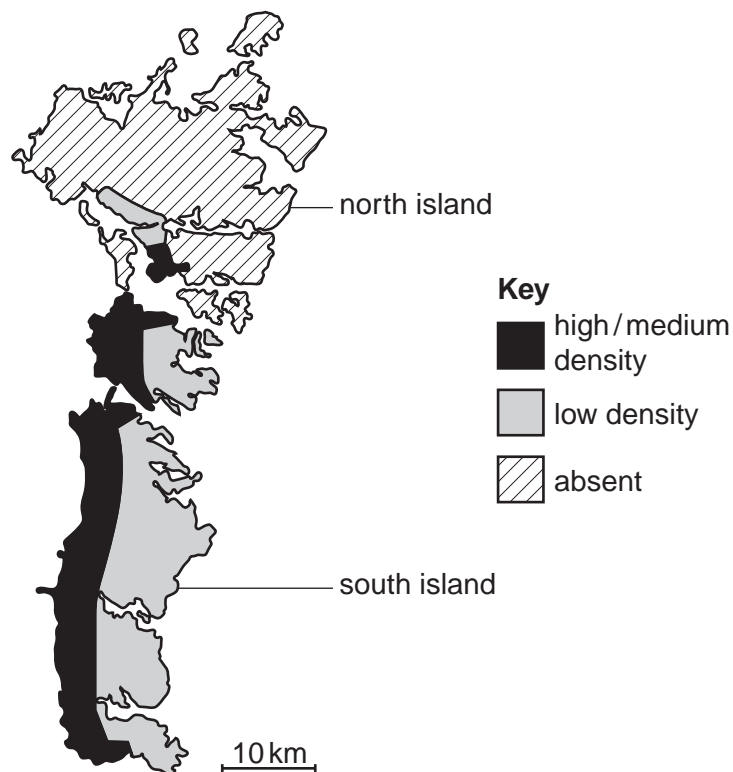


Fig. 8.2

Table 8.1 shows the changes in the populations of the species of birds from 1983 to 2000.

Table 8.1

	breeding pairs in 1983	breeding pairs in 2000	% change in population
north island			
oystercatcher	928	1122	+21
lapwing	1104	1364	+24
redshank	486	733	+51
south island			
oystercatcher	907	1403	+55
lapwing	1869	1287	-31
redshank	1288	760	-41

- (a) Using Fig. 8.2 and Table 8.1, describe the relationship between the hedgehog population density and the changes in the populations of **lapwings** and **redshanks**.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [3]

- (b) Suggest an explanation for the increase in the oystercatcher population on the south island, despite the increase in the hedgehog population.

.....

.....

.....

.....

..... [2]

- (c) Explain why the population of hedgehogs on one of these islands may eventually become a different species from that on mainland Scotland.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 9]

- 6 Many species of legume grow in nitrate-deficient soils in the tropics. Some of these are large trees such as the flamboyant tree, *Delonix regia*.

Bacteria of the genus *Rhizobium* live inside swellings along the roots of legumes. These swellings are known as root nodules.

A student followed the cycling of nitrogen in an area with many flamboyant trees.

Fig. 6.1 summarises the flow of nitrogen in the area.

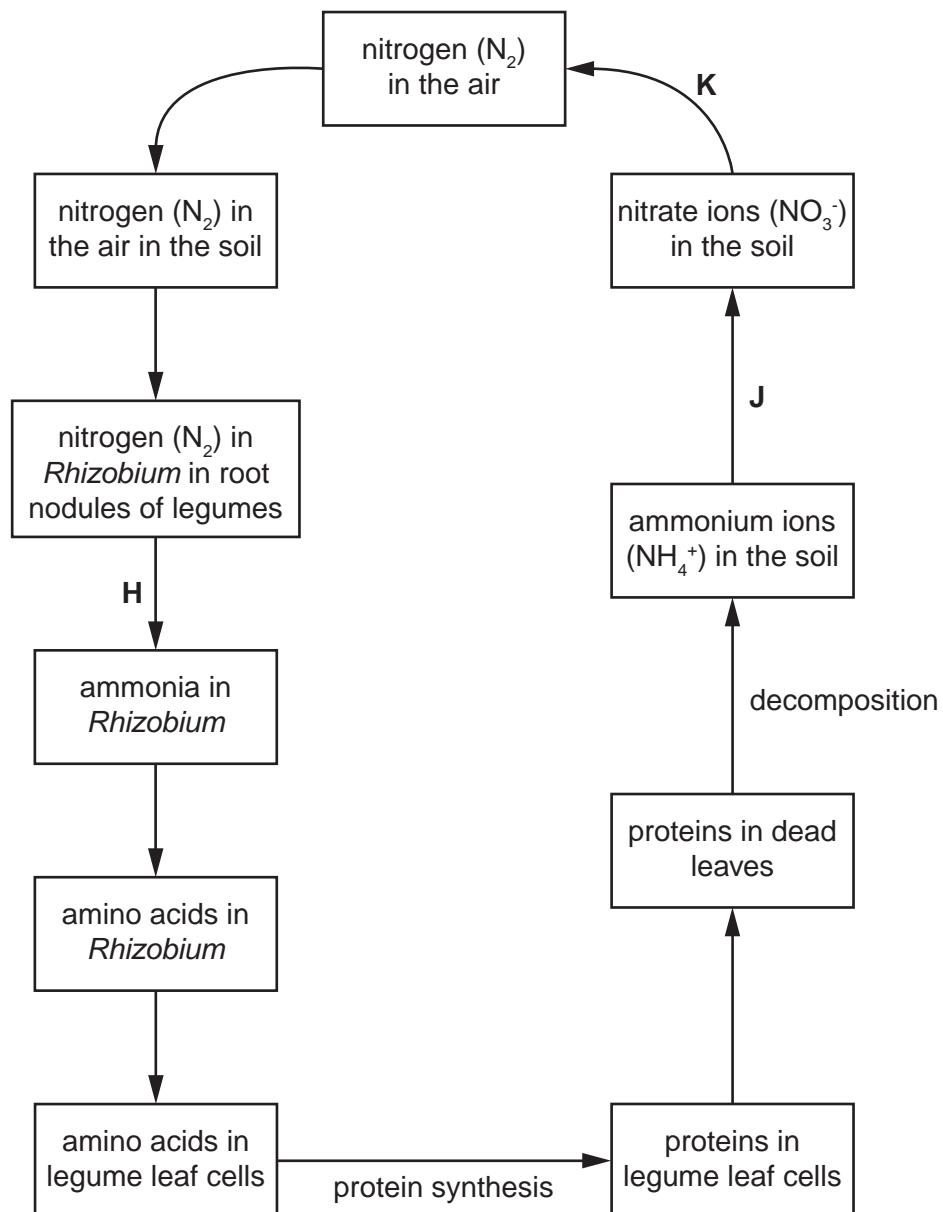


Fig. 6.1

- (a) Name the processes that occur at H, J and K.

H

J

K [3]

(b) Suggest the advantages gained by legumes of having *Rhizobium* living in their roots.

.....

.....

.....

.....

..... [2]

[Total: 5]

- 7 When investigating ecosystems, food chains and food webs are constructed.

Read the passage below about trophic relationships on one of the Galapagos Islands.

Marine iguanas feed on kelp, which grows attached to rocks in shallow waters. Kelp is a photosynthetic organism. Further inland, xerophytes are grazed upon by land iguanas. A great diversity of herbivorous insects, including many species of short-horned grasshoppers, feed on the xerophytes. An analysis of the gut contents of lava lizards reveals that these insects are prey for the lizards. The lizards are preyed upon by Galapagos snakes. The snakes also hunt grasshoppers and newly hatched iguanas. The Galapagos hawk has a varied diet and catches animals such as Galapagos snakes, short-horned grasshoppers, small lava lizards and newly hatched iguanas.

- (a) Complete Fig. 6.1 to make a food web by:

- filling in the blank boxes with the names of the organisms
- adding arrows to show the direction of energy flow between all the different links in the food web.

[4]

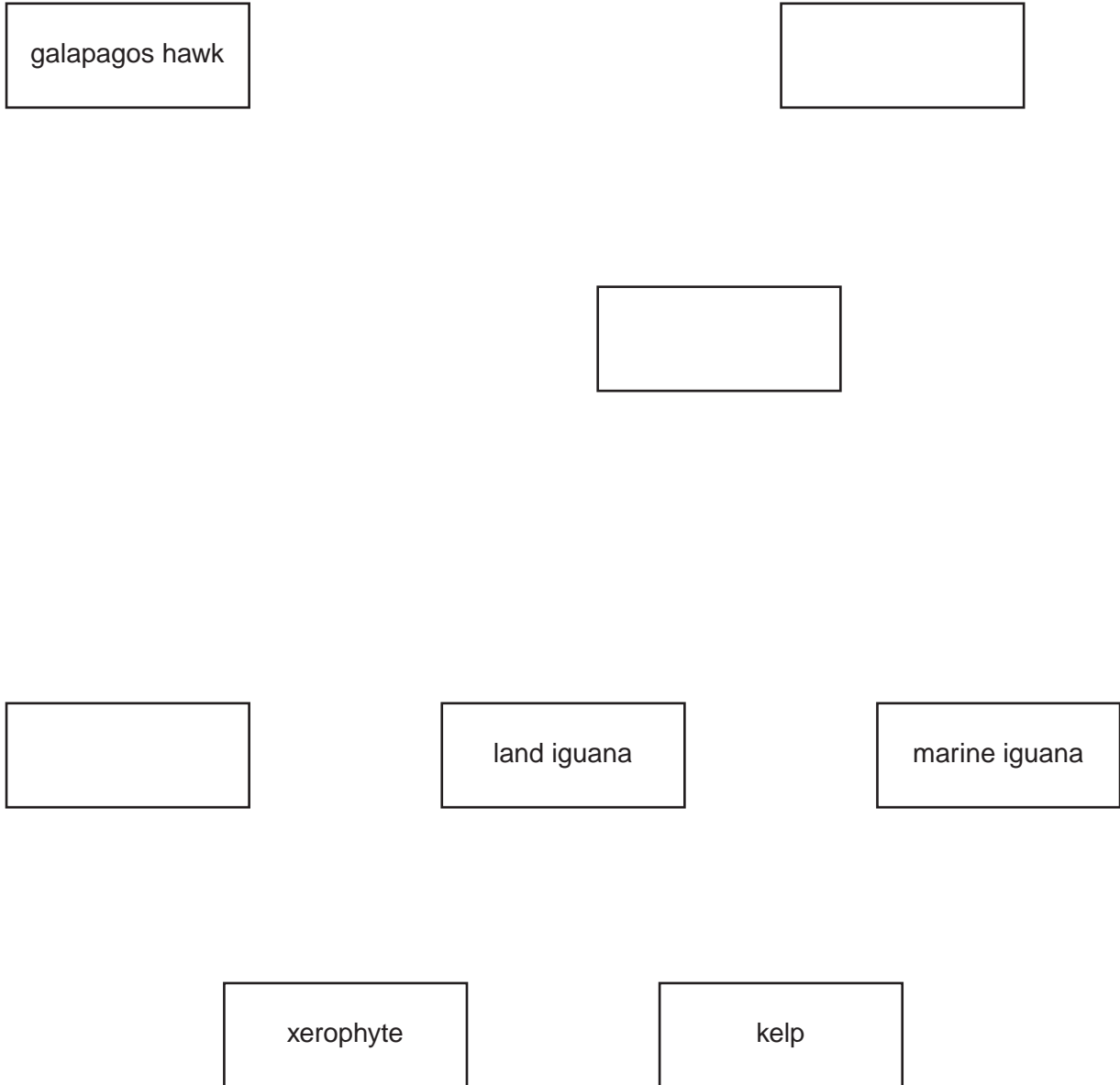


Fig. 6.1

(b) State which of the organisms in Fig. 6.1 are the producers. Explain your choice.

.....

.....

.....

.....

..... [3]

[Total: 7]