1 Bacteria and animals are found in many habitats on land and in the sea.

(a) State **two** ways in which the structure of a bacterial cell differs from the structure of an animal cell.

1 .....

2 ..... [2]

(b) Some bacteria were grown in the laboratory. Fig. 6.1 shows the change in numbers of bacteria when grown in a closed flask containing nutrients and oxygen.

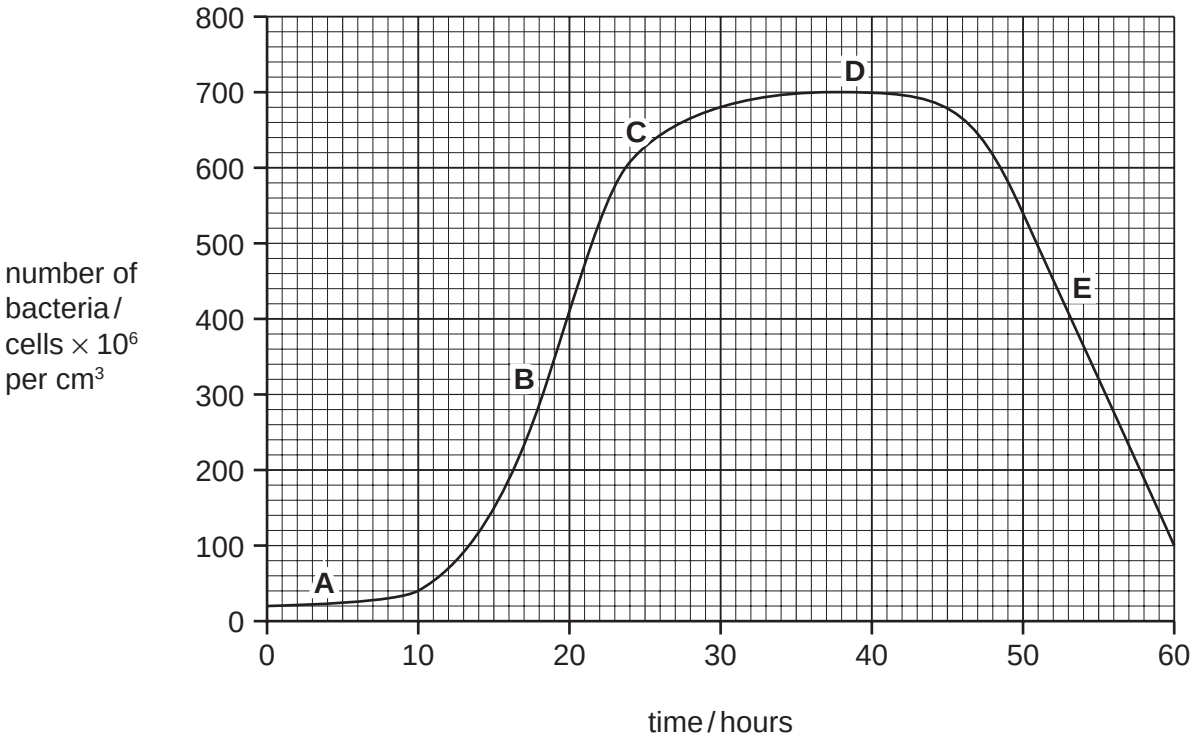

Fig. 6.1

(i) Name the phases of growth, **A** and **B**.

A .....

B ..... [2]

(ii) Explain why the numbers of bacteria do not change in phase **D and** decrease in phase **E**.

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..... [3]

(c) Fig. 6.2 shows the vent crab, *Bythograea thermydron*, which lives at great depths in the sea where there is no light.

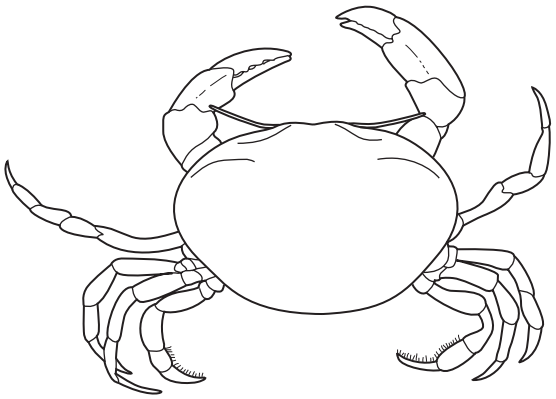

Fig. 6.2

(i) State **one** feature, **visible** in Fig. 6.2, that show that *B. thermydron* is an arthropod.

..... [1]

(ii) Although most species of crabs are red, brown or green, *B. thermydron* is white.

Suggest **and** explain how white crabs evolved at great depths in the sea.

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..... [4]

[Total: 12]

2 **(a** The production of yoghurt involves the fermentation of milk by two types of bacteria that use the protein and sugar (lactose) in milk.

Lactobacillus bulgaricus breaks down proteins into short chains of amino acids.

Streptococcus thermophilus uses the chains of amino acids to make formic acid.

L. bulgaricus then uses lactose and formic acid to make lactic acid.

The flow diagram in Fig. 3.1 shows the production process.

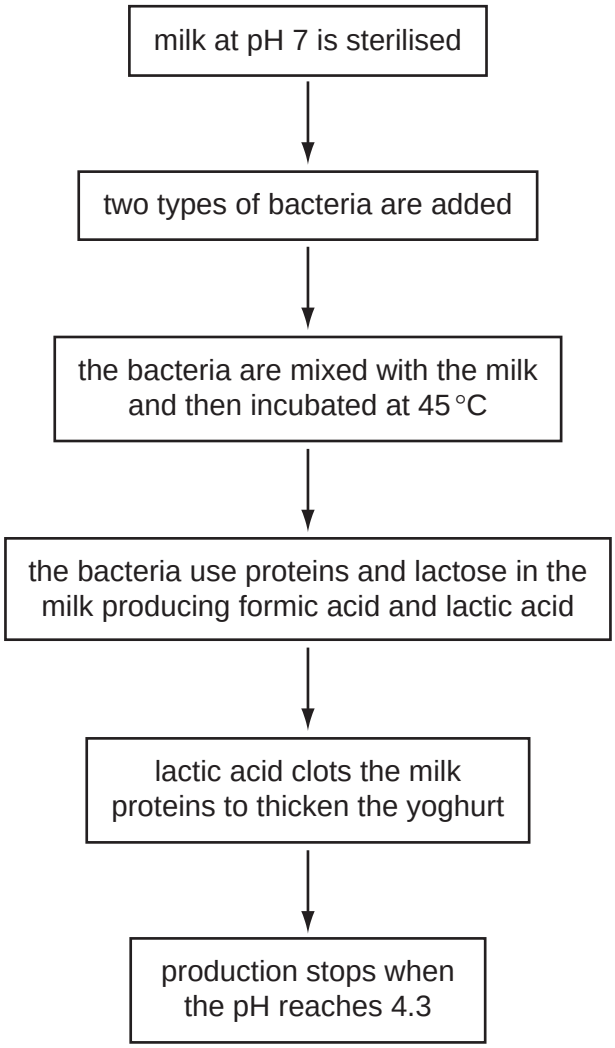

Fig. 3.1

(i) Explain why the milk is sterilised at the start of the process.

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..... [2]

(ii) Explain why the bacteria are incubated at 45 °C.

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(iii) State **and** explain what happens to the populations of the bacteria during the yoghurt-making process.

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..... [5]

(iv) Explain why yoghurt cannot be made by using only one of the types of bacteria.

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..... [2]

(b) At the end of the fermentation, food additives may be added to the yoghurt.

State **three** types of food additive that may be used in producing yoghurt.

1 .....

2 .....

3 ..... [3]

[Total: 14]

3 The Galápagos Islands in the Pacific Ocean have many species of animals and plants that live nowhere else. Iguanas are large herbivorous reptiles. Four species of iguana live on the Galápagos Islands:

- marine iguana, *Amblyrhynchus cristatus*
- land iguana, *Conolophus subcristatus*
- Santa Fe land iguana, *Conolophus pallidus*
- pink land iguana, *Conolophus rosada*

Fig. 2.1 shows a marine iguana.

Fig. 2.1

(a) Reptiles and mammals are both vertebrates.

State three features of mammals that are **not** found in reptiles.

1 .....

2 .....

3 ..... [3]

(b) The marine iguana, *A. cristatus*, feeds on seaweed and must therefore dive several metres into the cold waters that surround the Galápagos Islands. Iguanas can only stay in the water for a short length of time, until their body temperature drops too low. Mammals of an equivalent size, such as sea otters, can stay in cold water for a long time.

Explain how some mammals are able to stay in cold water for a long time.

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Land iguanas live on Isabela, the largest island in the Galápagos. In 1986, some rangers from the Galápagos National Park found a population of pink land iguanas living at the northern end of the island. These iguanas have been studied in detail and are now classified as a new species, *C. rosada*.

(c) Define the term *population.*

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..... [2]

(d) Suggest how a study of the DNA of iguanas helps to classify them.

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..... [1]

(e) The International Union for the Conservation of Nature describes these iguanas as vulnerable. This means that their populations are likely to become extinct.

Suggest two reasons why it is important to conserve individual species, such as the four species of iguana on the Galápagos Islands.

1 .....

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2 .....

..... [2]

[Total: 13]

4 Fig. 1.1 shows a goliath beetle, *Goliathus giganteus*.

Fig. 1.1

(a) State two features, **visible in Fig. 1.1**, that show that *Goliathus giganteus* is an arthropod.

1 .....

2 ..... [2]

Various arthropods are pests of date palms and cause much damage to this important crop throughout the Middle East.

Fig. 1.2 shows eight species of arthropod that are pests of date palms.

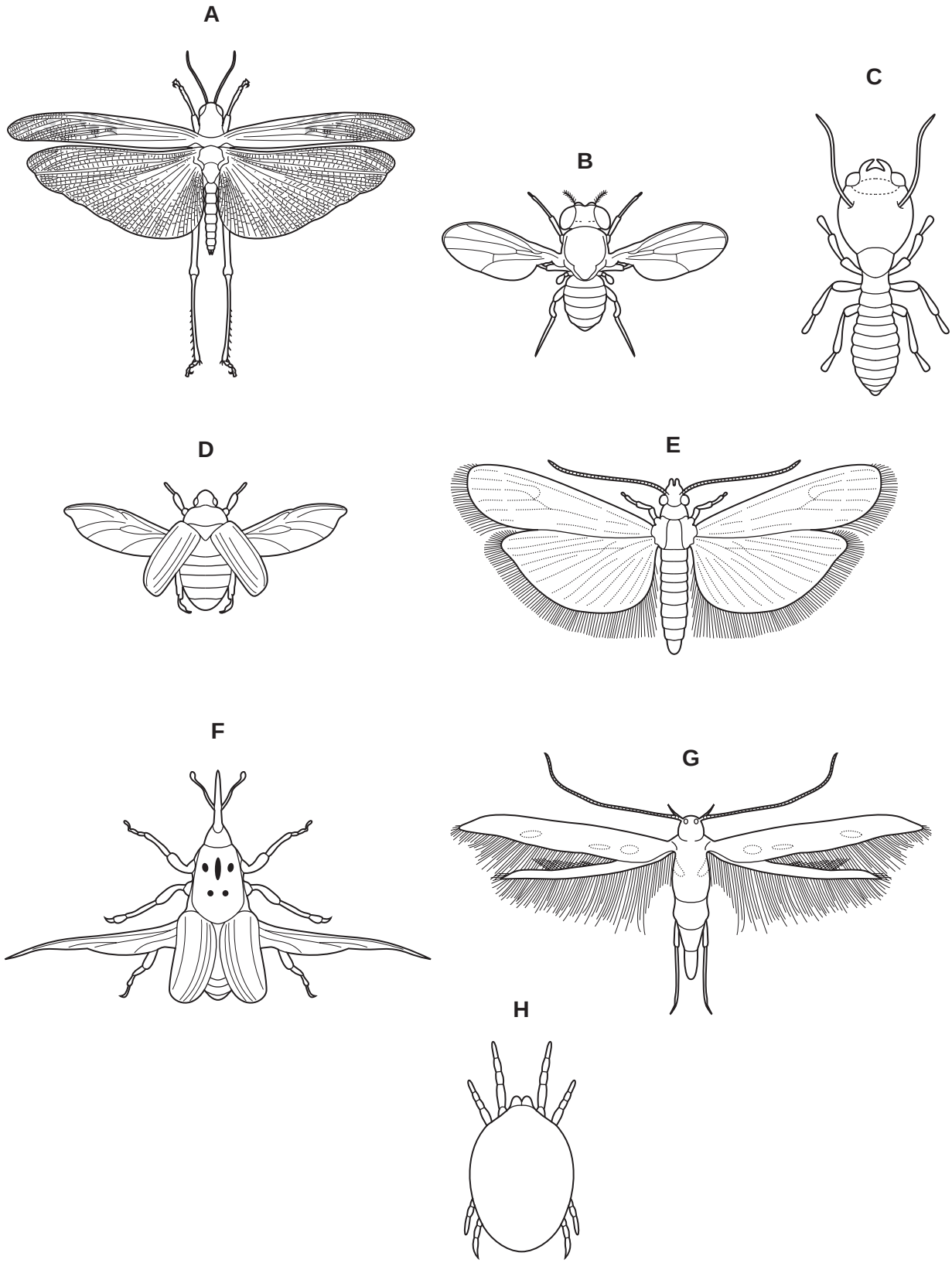

Fig. 1.2

(b) Use the key to identify each species. Write the letter of each species, **B** to **H**, in the correct box in the key. One, **A**, has been done for you.

Key

1 (a)	Wings present	go to 2	
(b)	Wings absent	go to 7	
2 (a)	Back legs adapted for jumping	*Schistocerca gregaria*	**A**
(b)	Back legs not adapted for jumping	go to 3	
3 (a)	Two pairs of wings	go to 4	
(b)	One pair of wings	*Drosophila melanogaster*	.....
4 (a)	Wings with hairs	go to 5	
(b)	Wings with no hairs	go to 6	
5 (a)	Hairs on back wings longer than width of back wing	*Ephestia cautella*	.....
(b)	Hairs on back wings shorter than width of back wing	*Batrachedra amydraula*	.....
6 (a)	Thorax with spots	*Rhynchophorus ferrugineus*	.....
(b)	Thorax with no spots	*Oryctes agamemnon*	.....
7 (a)	Three pairs of legs	*Microcerotermes diversus*	.....
(b)	Four pairs of legs	*Oligonychus afrasiaticus*	.....

[4]

Pesticides can be sprayed onto date palms to kill pests. This can damage the environment.

(c) Outline the damage to the environment that may be done by spraying pesticides.

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An alternative to using pesticides is biological control.

The Senegalese grasshopper is a serious pest in West Africa. A fungal parasite of grasshoppers is used as a means of biological control. Spores of the fungus are sprayed onto populations of grasshoppers.

An investigation was carried out to compare this biological control with a pesticide.

Three fields were treated as follows:

- sprayed with fungal spores
- sprayed with pesticide
- not sprayed

(d) Explain why one field was not sprayed.

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..... [1]

The population density of grasshoppers was recorded for 22 days after spraying. The results are shown in Fig. 1.3.

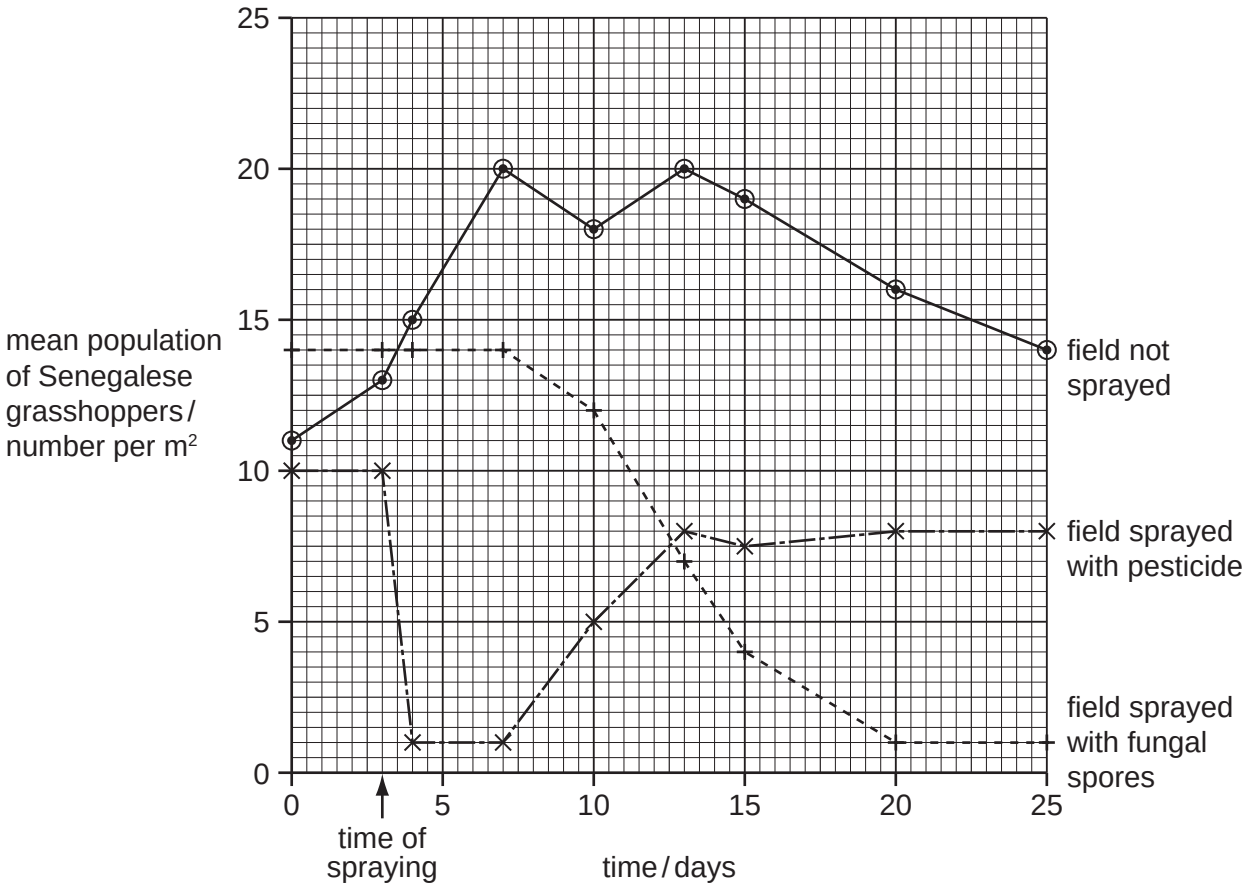

Fig. 1.3

(e) (i) Describe the effects of the two sprays on the populations of grasshoppers. You will gain credit if you use data from Fig. 1.3 to support your answer.

pesticide .....

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fungal spores .....

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..... [5]

(ii) Explain the differences between the effects of the pesticide and the fungal spores on the grasshoppers, as shown in Fig. 1.3.

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..... [4]

[Total: 20]