

- 1** In Africa, mammals called jackals are quite common. They feed on small herbivores such as young springboks and dik-diks, hunting in packs to catch their prey. They will also eat larger herbivores such as kudu that have been killed by larger predators such as lions.

A farmer in South Africa found that a number of his sheep, while feeding on grassland, were being killed by jackals. He noted that jackals always kill sheep by attacking their necks. He designed a plastic collar for the sheep that covered their necks. None of his sheep have been killed since fitting these collars. Other farmers are now buying the collars to protect their sheep from jackal attack.

- (a)** The prey species of the jackal are usually primary consumers.

State the type of food that all primary consumers eat.

.....[1]

- (b)** Name the two carnivores identified in the text.

1.

2.[1]

- (c)** Construct a food chain for the jackal to show its relationship with sheep.

.....[2]

- (d)** Suggest a reason why jackals survive better when they hunt in packs.

.....

.....[1]

- (e)** When the farmer started to use collars on his sheep, although none of his sheep were being killed, the population of jackals did not decrease.

Suggest why the number of jackals did not decrease.

.....

.....[1]

- (f)** Name two structures, found in the neck of a sheep, that could be damaged when jackals attack it.

1.

2.[2]

- (g)** Some of the protected sheep die of old age and their remains are eaten by other animals.

Suggest and explain why the collars of the dead sheep could create an environmental problem.

.....

.....

.....[2]

[Total : 10]

2. The Ruddy duck, *Oxyura jamaicensis*, is a native of America. A flock of 20 birds was introduced into Britain from America before 1950. The original flock settled quickly in their new habitat and started breeding. Numbers now exceed 6000.
- The White-headed duck, *Oxyura leucocephala*, (a native of Spain) is a closely related species to the Ruddy duck. Female White-headed ducks are more attracted to male Ruddy ducks than to males of their own species.
- Cross-breeding between the two species produces a new variety of fertile duck. The White-headed duck is now threatened with extinction. Some conservationists are considering a plan to kill the British population of Ruddy ducks to prevent the White-headed duck becoming extinct.

Fig. 6.1 shows a male Ruddy duck.



Fig. 6.1

- (a) State two features, visible in Fig. 6.1, that distinguish birds, such as the Ruddy duck, from other vertebrate groups.

1 [2]
 2

- (b) (i) With reference to an example from the passage, describe what is meant by the term *binomial system*.

..... [2]

- (ii) State two reasons, based on information in the passage, why the Ruddy duck and White-headed duck are considered to be closely related.

1 [2]
 2

- (c) (i) Explain why Ruddy ducks would **not** become extinct, even if British conservationists carried out their plan.

..... [1]

- (ii) Suggest **one** factor, other than the breeding habits of the Ruddy duck, that could result in the extinction of a bird such as the White-headed duck.

..... [1]

- (d) The Ruddy duck feeds on seeds and insect larvae. The ducks are eaten by foxes and humans.

Explain why these feeding relationships can be displayed in a food web, but not in a food chain.

..... [2]

[Total: 10]

3. Scientists are considering the use of a genetically engineered virus to kill a population of the cane toad, *Bufo marinus*, which is growing out of control in Australia.

This virus will introduce a modified form of genetic material, responsible for hormone production. The normal hormone causes the toads to mature in a similar way to hormones causing puberty in mammals. The modified genetic material will prevent toads maturing, leading to their death.

The toad was introduced into Australia because it eats scarab beetles, a pest of sugar cane plants. Sugar cane is an important crop plant.

Animals such as crocodiles and dingos are predators of the toad, but the toad can kill them by squirting a powerful toxin.

- (a) Define the term *genetic engineering*.

.....
 [2]

- (b) State which part of the virus would carry the modified genetic material.

..... [1]

- (c) (i) Name the hormone that causes puberty in male mammals.

..... [1]

- (ii) State two characteristics that develop in a boy when this hormone is produced.

1
 2 [2]

The toad population is increasing out of control. In terms of a sigmoid growth curve, it is in the exponential phase.

- (d) (i) 1. Sketch a sigmoid growth curve using the axes below.
 2. Label the axes (units are **not** needed).
 3. Label the exponential phase of the curve.



[4]

- (ii) Suggest **one** limiting factor, other than viruses or predators, that could stop the toad population rising.

..... [1]

- (e) (i) Construct a **food web** for the organisms named in this question.

[2]

- (ii) Complete the table by writing each of the organisms you used in the food web in the correct column.

carnivore	herbivore	producer

[3]

[Total : 16]

4. The wild dog is one of the smaller African carnivorous mammals. It has disappeared from 25 of the 39 countries where it used to live. Wild dogs hunt in packs, feeding on antelopes, which are grass-eating mammals.

A conservation programme has been started to increase the wild dog population in South Africa. Farmers are worried about numbers getting out of control because wild dogs breed at a very fast rate. However, conservationists are not concerned because the lion is a natural predator of the dogs.

(a) Wild dogs are carnivorous mammals.

(i) Define the term *carnivore*.

..... [1]

(ii) State **one** external feature which distinguishes mammals from other vertebrates.

..... [1]

(b) (i) Suggest two reasons why numbers of African wild dogs are decreasing.

1.

2. [2]

(ii) Suggest what could happen to the species if numbers continue to decrease.

.....

..... [1]

(c) Using the information in the passage above, construct a food chain for a wild dog, including its predator.

Label each organism with its trophic level.

[4]

(d) It is important that the wild dog species is conserved.

(i) Explain the meaning of the term *conservation*.

.....
.....
..... [2]

(ii) Outline the measures that could be taken to conserve a mammal, such as the wild dog.

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

(e) When wild dogs die, nitrogen compounds in their bodies may become available for plants. Outline the processes that occur to make these nitrogen compounds in the bodies of dead animals available for plants to absorb.

.....
.....
.....
.....
.....
..... [5]

[Total: 19]

5. Fig. 4.1 shows three species of zebra.

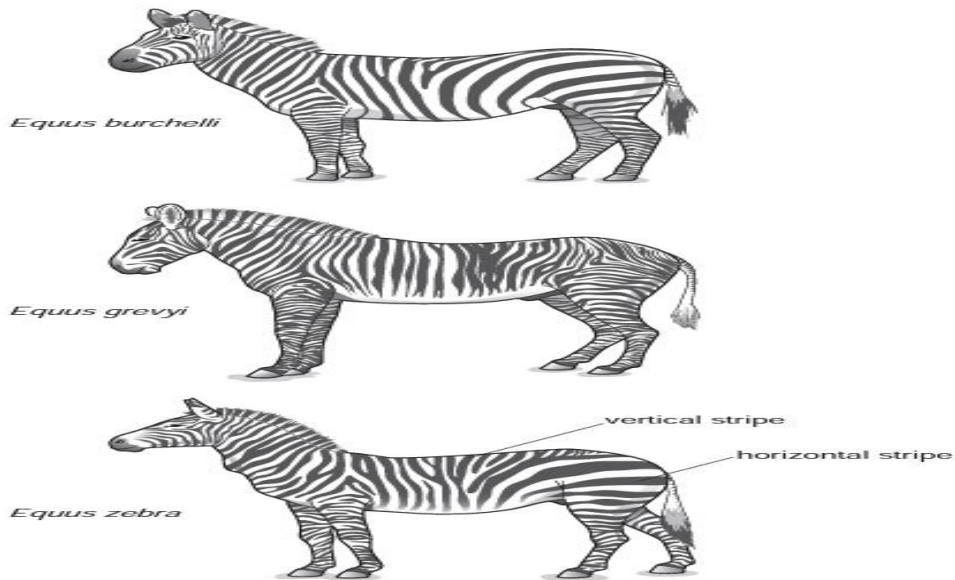


Fig. 4.1

- (a) Describe **one** method a scientist could use to show that the zebras shown in Fig. 4.1 are different species.
 [1]
- (b) Studies have shown that the hotter the environment, the more stripes zebras have.
- (i) State the type of variation which would result in different numbers of stripes.
 [1]
- (ii) Study Fig. 4.1. Suggest which species of zebra lives in the hottest environment.
 [1]
- (c) Occasionally, zebras are born that are almost completely black. The change in appearance is the result of mutation.
- (i) State the term that is used to describe the appearance of an organism.
 [1]
- (ii) Define the term *mutation*.
 [2]
- (d) Tsetse flies attack animals with short fur, sucking their blood and spreading diseases. Fig. 4.2 shows a tsetse fly. This fly is an insect, belonging to the arthropod group.



Fig. 4.2

- (i) State **one** feature, **visible in Fig. 4.2**, which is common to all arthropods.
 [1]
- (ii) State two features, **visible in Fig. 4.2**, which distinguish insects from other arthropod groups.
- [1]
 - [2]
- (e) Scientists have discovered that zebras with more horizontal stripes attract fewer tsetse flies.
- (i) Suggest why the stripes on the head and neck of the zebra would be an advantage when it feeds on grass on the ground.
 [2]
- (ii) Describe how a species of zebra could gradually develop more horizontal stripes.
 [3]

6. Fig. 2.1 shows *Salvinia molesta*, which is an Australian freshwater plant, introduced to the wetlands of Namibia as a source of animal food. However, in Namibia the plant reproduces much more quickly than in Australia. It quickly covers the surface of the water.

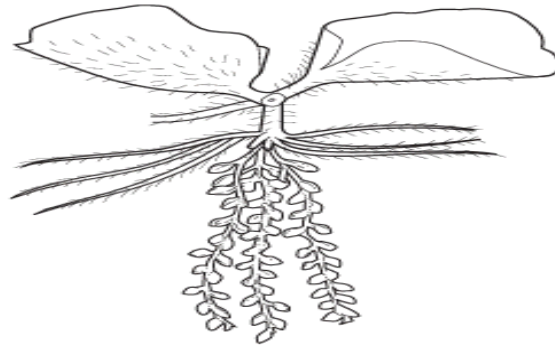


Fig. 2.1

- (a) Scientists are concerned about the environmental damage caused by *S. molesta* to the aquatic habitats in the ecosystem of the Namibian wetlands.

(i) Define the term *ecosystem*.

.....
 [2]

(ii) Outline how *S. molesta* could damage the aquatic habitats of the wetland ecosystem.

.....

 [4]

- (b) *S. molesta* is being controlled using an Australian beetle, *Cyrtobagous salinae*. The beetle eats the growing points of the plant.

Suggest and explain why

(i) it is better to use a natural consumer of the plant than to apply herbicides in the water to kill it,

.....
 [2]

(ii) it could be dangerous to the wetland ecosystem to introduce Australian beetles.

.....
 [2]

- (c) The growth of *S. molesta* is now under control.

Its population growth has followed the pattern of a sigmoid curve.

(i) Using the axes below, sketch a sigmoid growth curve for *S. molesta*. [1]

(ii) Label the phases of the sigmoid growth curve. [3]



(iii) Using the information given in this question (pages 3 and 4), state **one** factor that is limiting the growth of *S. molesta*. [1]

(iv) Explain how two other named factors could also limit the growth of *S. molesta*.

1.

 [4]

7. Fig. 6.1 shows three different insects.



Vespula flavopilosa
insect 1



Vespula rufa
insect 2



Callicera rufa
insect 3

Fig. 6.1

(a) Insects 1 and 2 are more closely related to each other than to insect 3.

(i) Explain how the binomial names indicate that insects 1 and 2 are more closely related.

.....
.....
..... [2]

(ii) Explain how the appearance of the three insects suggests that insects 1 and 2 are more closely related.

.....
.....
..... [2]

Vespula flavopilosa gives a painful sting. The insect shown in Fig. 6.2 is very similar in appearance to *Vespula flavopilosa* but does not give a sting.



Chrysotoxum cautum

Fig. 6.2

(b) *Chrysotoxum cautum* is very similar in appearance to *Vespula flavopilosa*. Explain how this is an advantage.

.....
.....
..... [2]

(c) It is thought that *Chrysotoxum cautum* evolved from an insect that did not have any stripes.

Suggest how these insects became striped.

.....
.....
.....
.....
.....
.....
.....
.....
..... [5]

8. 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.

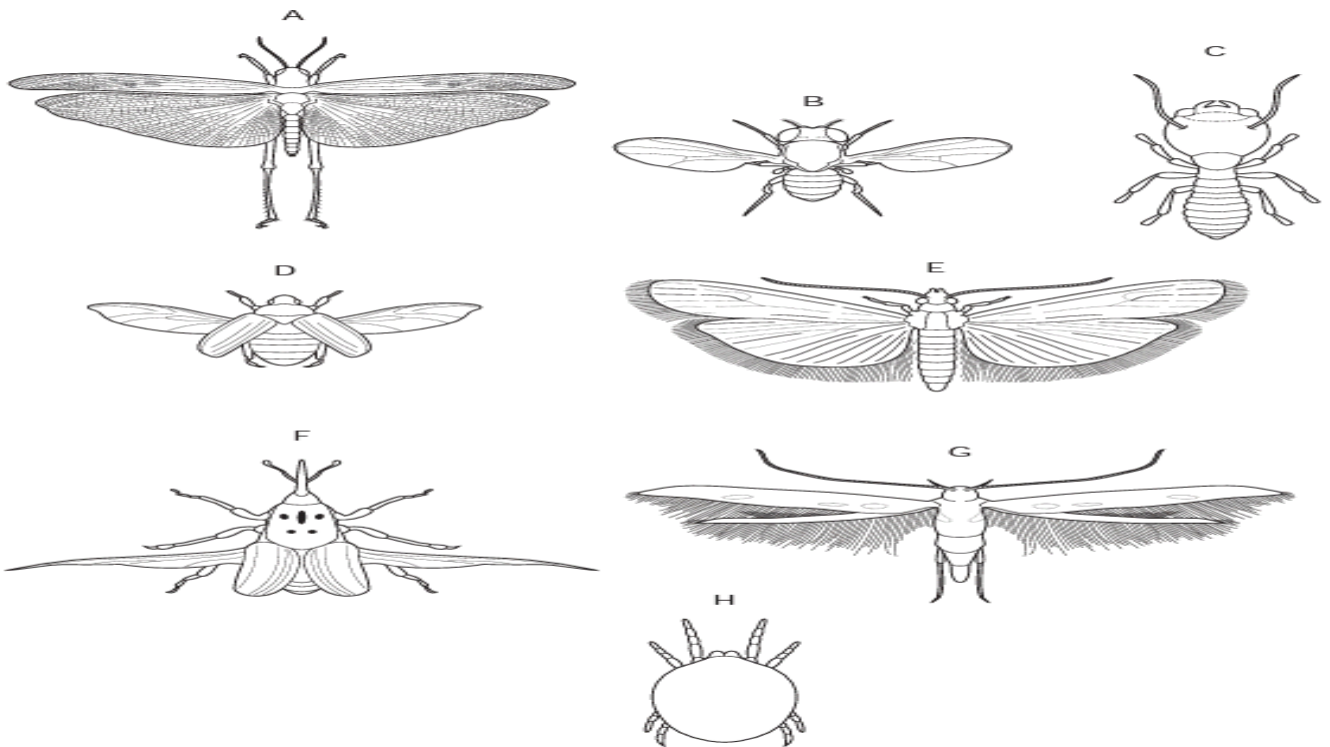


Fig. 1.2

(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	<i>Schistocerca gregaria</i>	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	<i>Drosophila melanogaster</i>
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	<i>Ephestia cautella</i>
(b)	Hairs on back wings shorter than width of back wing	<i>Batrachedra amydraula</i>
6 (a)	Thorax with spots	<i>Rhynchophorus ferrugineus</i>
(b)	Thorax with no spots	<i>Oryctes agamemnon</i>
7 (a)	Three pairs of legs	<i>Microcerotermes diversus</i>
(b)	Four pairs of legs	<i>Oligonychus afrasiaticus</i>

9. Fig. 1.1 shows three annelid species and *Ascaris lumbricoides*, a species of nematode.

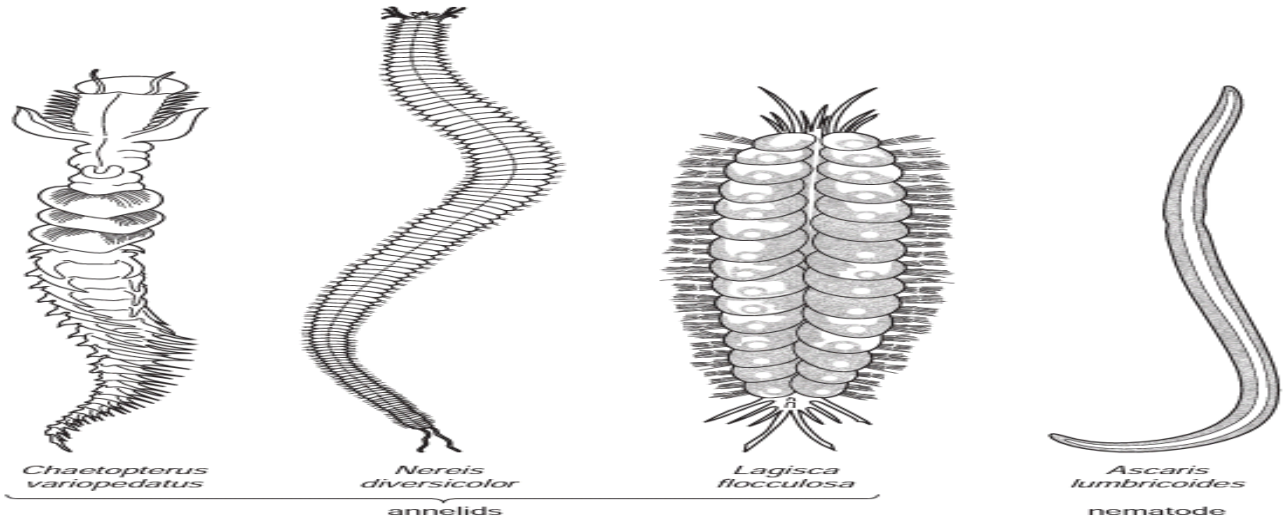


Fig. 1.1

(a) State **three** features shown by the three annelid species that are **not** shown by the nematode species.

- 1
- 2
- 3 [3]

(b) Organisms are given two names, e.g. *Nereis diversicolor*. State what is meant by the first name.

..... [1]

(c) *N. diversicolor* is a filter feeder. It filters plankton from sea water. Annelids like *N. diversicolor* form an important part of the ecosystems of estuaries. Fish feed on annelids when the sea covers the mud in the estuary. When the tide is out wading birds are the main predators of annelids. Birds of prey are the main predators of the wading birds.

(i) Explain the term *ecosystem*.

.....

 [3]

(ii) Use the space below to draw a food chain for the estuary ecosystem **when the tide is out**.

.....

 [2]

(iii) Describe the advantages of drawing a food web rather than a food chain for an ecosystem.

.....

 [2]

(d) The palolo worm is a species of annelid that lives on coral reefs in the Pacific Ocean. At certain times of the year, all the worms in an area leave their burrows to swim to the surface. They all release their gametes into the water at the same time. This is known as mass spawning. Suggest the advantages of having mass spawning occurring only at certain times of the year and not all year round.

.....

 [3]

(e) Meiosis is involved in producing gametes in palolo worms. Describe how meiosis differs from mitosis **and** explain why meiosis is important for the production of gametes.

.....

 [4]

[Total: 18]

10. Fig. 5.1 shows the nematode, *Caenorhabditis elegans*.



Fig. 5.1

(a) (i) State the genus of this nematode.[1]

(ii) State two structural features of nematodes.
 1
 2 [2]

(b) Nematodes feed on dead and decaying material. Explain why this gives nematodes an important role in ecosystems.

 [3]

(c) Fig. 5.2 shows the life cycle of *C. elegans*. The diploid number of this species is 12.

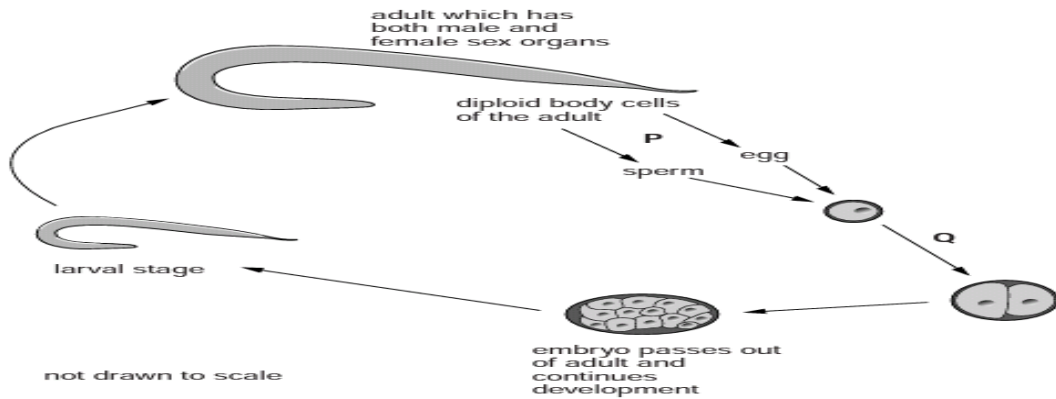


Fig. 5.2

(i) Suggest why there is very little genetic variation in the offspring of the adult nematode shown in Fig. 5.2.

 [2]

(ii) State the haploid number of *C. elegans*. [1]

(iii) Explain why **meiosis** occurs at **P** and **mitosis** occurs at **Q**.
 meiosis at P

 mitosis at Q [3]

(d) *C. elegans* was one of the first organisms to have its genome sequenced.
 An organism's genome is the sum of all its genetic material. Gene sequencing identifies all the component parts of the DNA that makes up the genome.
 State where DNA is located in a cell.
 [2]

11. Myriapods are a group of arthropods that are commonly found in soil habitats in many parts of the world. Many myriapods are very small and not easy to identify.

Fig. 6.1 shows four species of myriapod, not drawn to the same scale.

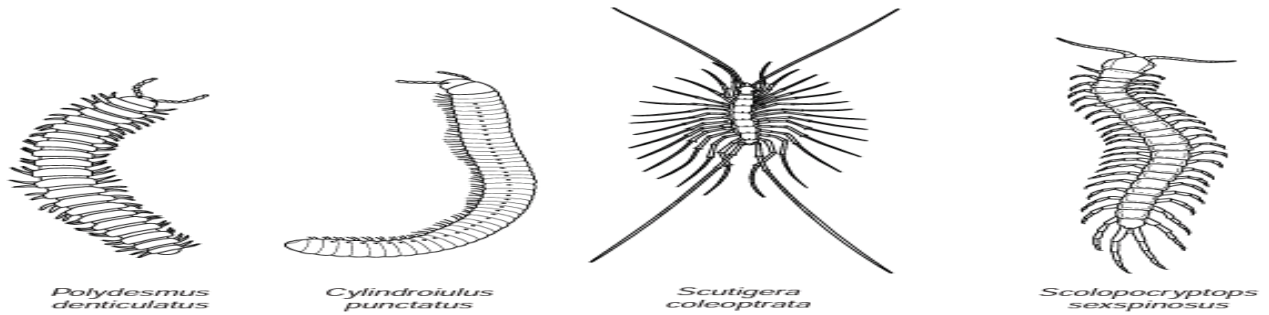


Fig. 6.1

(a) State **three** features of **all** myriapods that are visible in Fig. 6.1.

- 1
- 2
- 3 [3]

(b) Describe **three** features of myriapods that could be used to make a dichotomous key to distinguish between the four species in Fig. 6.1.

- 1
- 2
- 3 [3]

(c) Mitochondria are cell structures that contain a small quantity of DNA.

Scientists are sequencing the DNA of one particular gene in mitochondria to help identify different species of many animals including myriapods. The sequences that they find are called 'barcodes'.

(i) State the part of the cell that contains most of the DNA. [1]

(ii) Suggest how DNA barcoding might be useful in the conservation of animals, such as myriapods. [2]

(iii) State the function of DNA in cells. [2]

(d) A student found the following information about the feeding relationships between some organisms in a soil habitat.

Dead organic matter, such as leaves, provides food for bacteria and soil fungi.

Earthworms eat dead leaves.

Many millipedes feed on dead plant matter and also on soil fungi.

Nematodes feed on bacteria and are eaten by springtails.

Centipedes are predators that feed on earthworms, millipedes and springtails.

(i) Draw a food web to show the feeding relationships described above.

(ii) Describe the roles of the soil organisms in the **carbon** cycle. [4]

12. (a) Fig. 1.1 shows five species of mollusc.

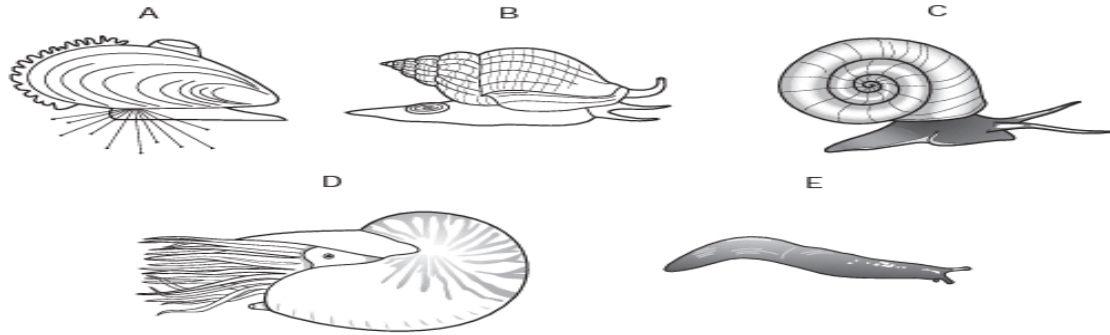


Fig. 1.1

Use the key to identify each species. Write the letter of each species (A to E) in the correct box beside the key.

Key

1 (a)	body is completely or partly covered in a shell	go to 2	
(b)	body is not completely covered or partly covered in a shell	<i>Limax flavus</i>	
2 (a)	shell is attached to rocks by thin threads	<i>Mytilus edulis</i>	
(b)	shell is not attached to rocks by thin threads	go to 3	
3 (a)	shell is a spire that comes to a point	<i>Buccinum undatum</i>	
(b)	shell is not a spire that comes to a point	go to 4	
4 (a)	animal has tentacles	<i>Nautilus pompilius</i>	
(b)	animal has 2 tentacles	<i>Planorbis planorbis</i>	

[3]

(b) State two features that are shown by all molluscs.

- 1
- 2

[2]

[Total: 5]

1 Fig. 1.1 shows seven different species of amphibian.

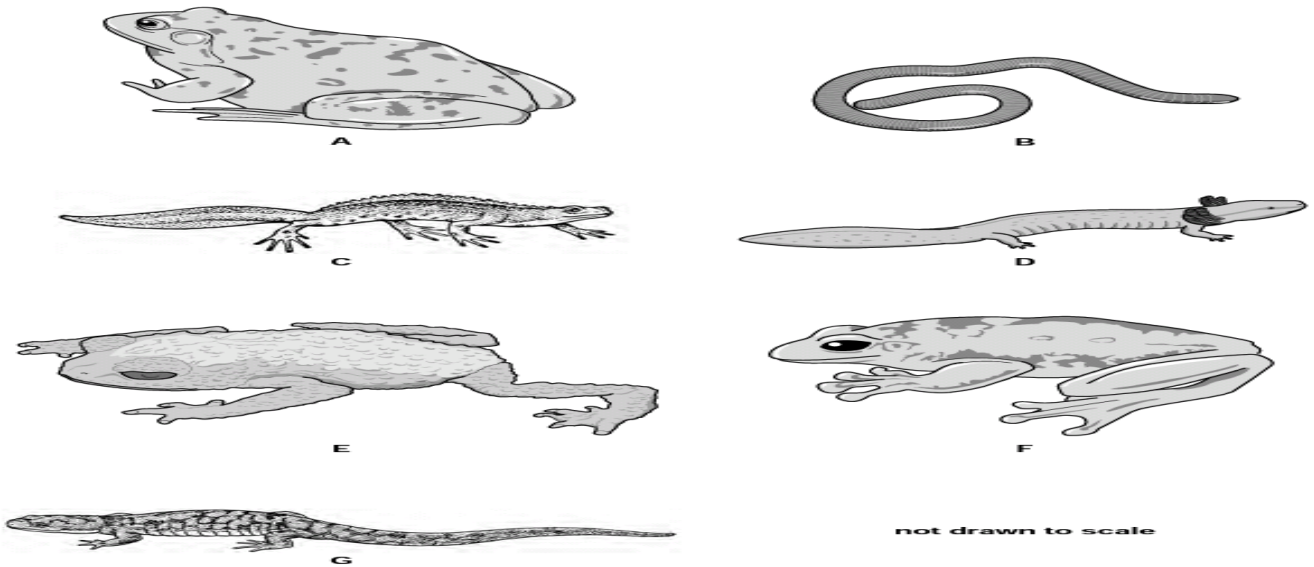


Fig. 1.1

(a) Use the key to identify each species. Write the letter of each species (A to G) in the correct box beside the key. One has been done for you.

Key

1 (a)	long, narrow body, with or without legs	go to 2	
(b)	body not long and narrow, back legs are larger than the front legs	go to 5	
2 (a)	body without legs	<i>Gymnopsis multiplicata</i>	B
(b)	body with legs which are all of the same size	go to 3	
3 (a)	raised crest along the back of the body	<i>Triturus cristatus</i>	
(b)	no crest along the back of the body	go to 4	
4 (a)	gills present	<i>Necturus maculosus</i>	
(b)	no gills present	<i>Ambystoma tigrinum</i>	
5 (a)	skin is smooth	go to 6	
(b)	skin is not smooth	<i>Oreophrynella quelchii</i>	
6 (a)	digits end in swellings	<i>Polypedates leucomystax</i>	
(b)	digits do not end in round swellings	<i>Rana temporaria</i>	

[3]

6 Fig. 6.1 shows a lizard.



Fig. 6.1

The lizard is observed over a period of two hours.

(a) State two observations, other than movement, you could make about the lizard to show that it is a living organism.

- 1.
- 2. [2]

13.

Fig. 6.2 shows the relationship between external and internal temperatures for a lizard and a mammal, such as a cat.

14.

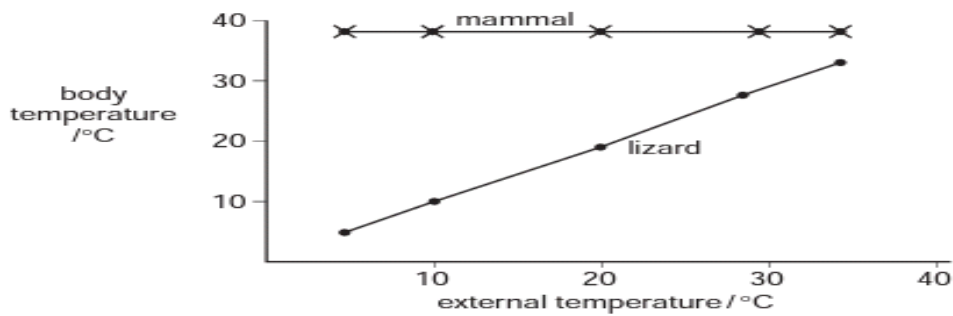


Fig. 6.2

(b) Describe what happens to the body temperature of the lizard as the external temperature drops from 20 °C to 10 °C.

-
-
- [2]

(c) Describe and explain two mechanisms that help to keep the body temperature of the mammal constant when the external temperature drops from 20 °C to 10 °C.

- 1.
-
-
-
-
- [6]

(d) Suggest why the movement of the lizard becomes slower when the external temperature drops from 20 °C to 10 °C.

-
-
- [2]

[Total: 12]

15. Fig. 1.1 shows five mammals.

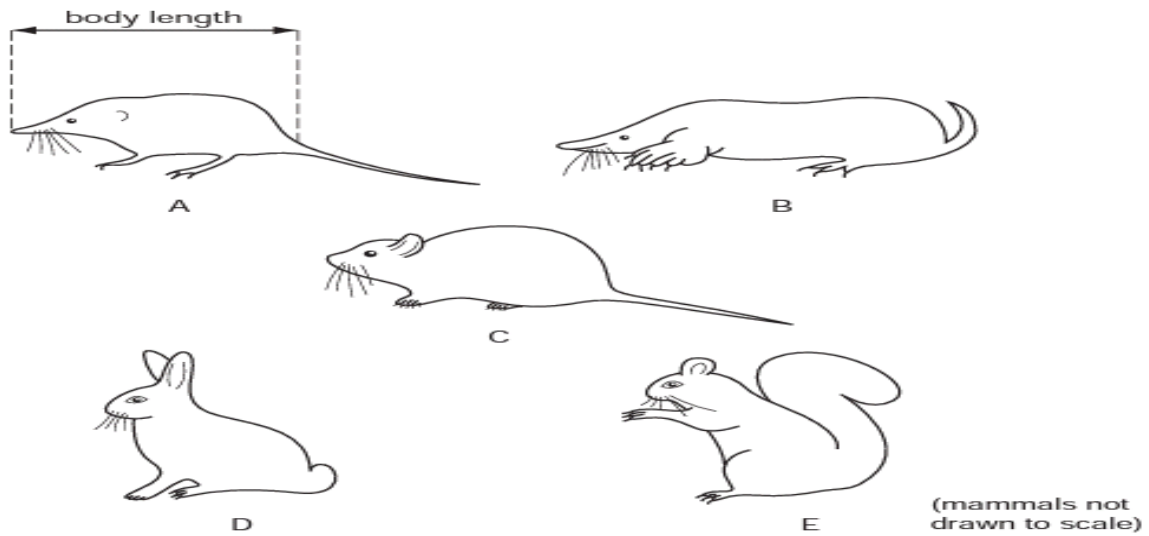


Fig. 1.1

(a) Use the key to identify each of these mammals. Write the letter for each mammal in Table 1.1.

- | | |
|---------------------------------------------------|--------------------------------|
| 1 tail more than half that of body length | go to 2 |
| tail less than half that of body length | go to 4 |
| 2 ears at top of head, with thick tail | <i>Sciurus caroliniensis</i> |
| ears at side of head, with thin tail | go to 3 |
| 3 nose pointed, nose length longer than its depth | <i>Sorex araneus</i> |
| nose blunt, nose length shorter than its depth | <i>Clethrionomys glareolus</i> |
| 4 front legs as wide or wider than long | <i>Talpa europaea</i> |
| front legs longer than wide | <i>Oryctolagus cuniculus</i> |

Table 1.1

name of mammal	letter
<i>Clethrionomys glareolus</i>
<i>Oryctolagus cuniculus</i>
<i>Sciurus caroliniensis</i>
<i>Sorex araneus</i>
<i>Talpa europaea</i>

[4]

(b) Fig. 1.2 shows a young deer feeding from its mother.



Fig. 1.2

State two features of the deer, visible in Fig. 1.2, that distinguish mammals from other vertebrates.

- 1
- 2 [2]

[Total: 6]

16. The seaweed, *Caulerpa taxifolia*, lives in tropical oceans but is now also found in the Mediterranean sea, where it grows at twice the rate of local seaweeds. As a result, the local seaweeds are becoming rare.

Although not poisonous, *Caulerpa* produces a chemical in its cells that makes it inedible to Mediterranean herbivores, such as sea urchins. They do not feed on it and their numbers are decreasing. Carnivorous fish populations have also decreased by up to 50 %.

Marine conservationists are very concerned. At first they used chlorine to kill *Caulerpa* but are now considering the introduction of tropical sea slugs (herbivorous molluscs). *Caulerpa* is part of their natural diet.

- (a) The seaweed, *Caulerpa taxifolia*, is named using the binomial system.

Explain the term *binomial system*.

.....
.....
.....[2]

- (b) (i) Suggest why the local seaweeds are becoming rare.

.....
.....[2]

- (ii) Sea urchins are herbivores. Define the term *herbivore*.

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

- (iii) Suggest why the populations of carnivorous fish have decreased by up to 50%.

.....
.....
.....[2]

- (c) Suggest why using chlorine to kill *Caulerpa* might **not** be a good idea.

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

- (d) (i) Suggest why conservationists are concerned about the effects of *Caulerpa* on other organisms in the Mediterranean.

.....
.....
.....[2]

- (ii) Explain how the introduction of herbivorous sea slugs from the tropics could be effective in re-establishing a balanced ecosystem.

.....
.....
.....[2]

- (iii) Outline the possible dangers of introducing tropical sea slugs.

.....
.....
.....[2]

[Total : 14]