Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Characteristics and classification of living organisms

Time allowed: 1 hour 30 minutes

Subject code **0610**

Biology

Questions from Paper 3, Paper 4 and Paper 6

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 89

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 89 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

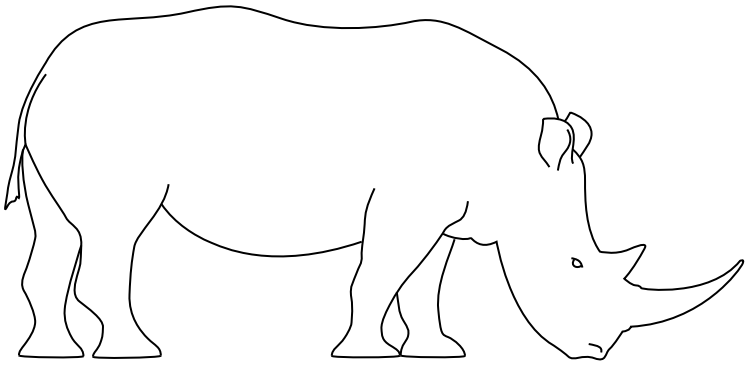
Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

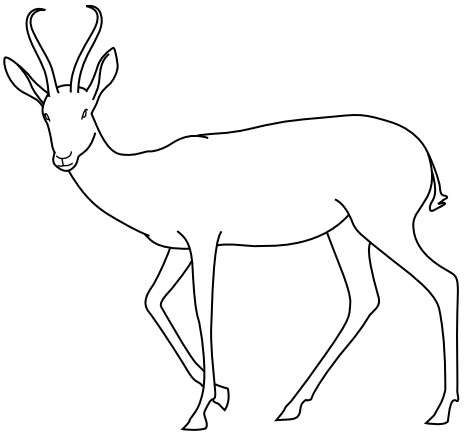
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Print at 100% (Actual size) so diagrams keep their real measurements.

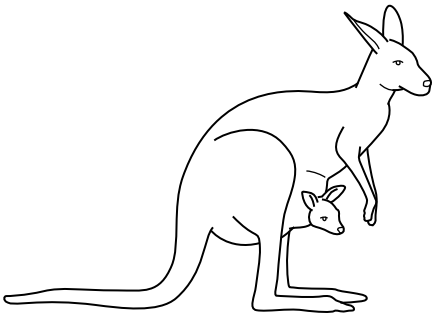
1 Fig. 1.1 shows five different mammals.



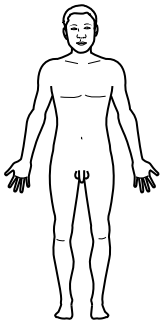
A



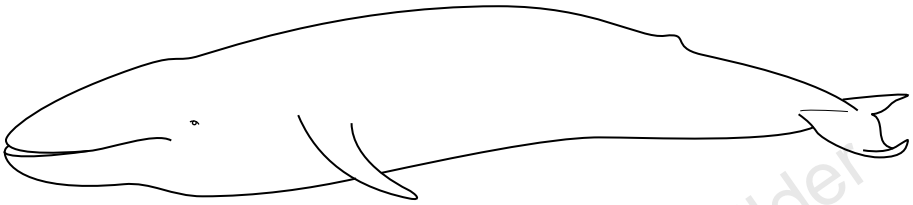
B



C



D



E

not drawn to scale

Fig. 1.1

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Use the key to identify the mammals shown in Fig. 1.1.

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

key

				letter
1	(a)	has visible external ears	go to 2	
	(b)	does not have visible external ears	*Eschrichtius robustus*	
2	(a)	stands on four legs	go to 3	
	(b)	stands on two legs	go to 4	
3	(a)	has two horns between its ears	*Antidorcas marsupialis*	
	(b)	has two horns in front of its ears	*Diceros bicornis*	
4	(a)	has ears placed on top of head	*Macropus rufus*	
	(b)	has ears placed at the side of head	*Homo sapiens*	

[4]

[Total: 4]

Classification, species and dichotomous keys Click for more variations

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1	**E** *E. robustus ;* **B** *A. marsupialis ;* **A** *D. bicornis ;* **C** *M. rufus ;* **D** *H. sapiens ;*	max [4]	4 or 5 correct = 4 marks 3 correct = 3 marks 2 correct = 2 marks 1 correct = 1 mark
		[Total: 4]	

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2 **(a)** State the name of the large group of organisms that includes insects, arachnids, crustaceans and myriapods.

..... [1]

(b) Fig. 1.1 shows a key that identifies nine genera of invertebrates that have jointed legs.

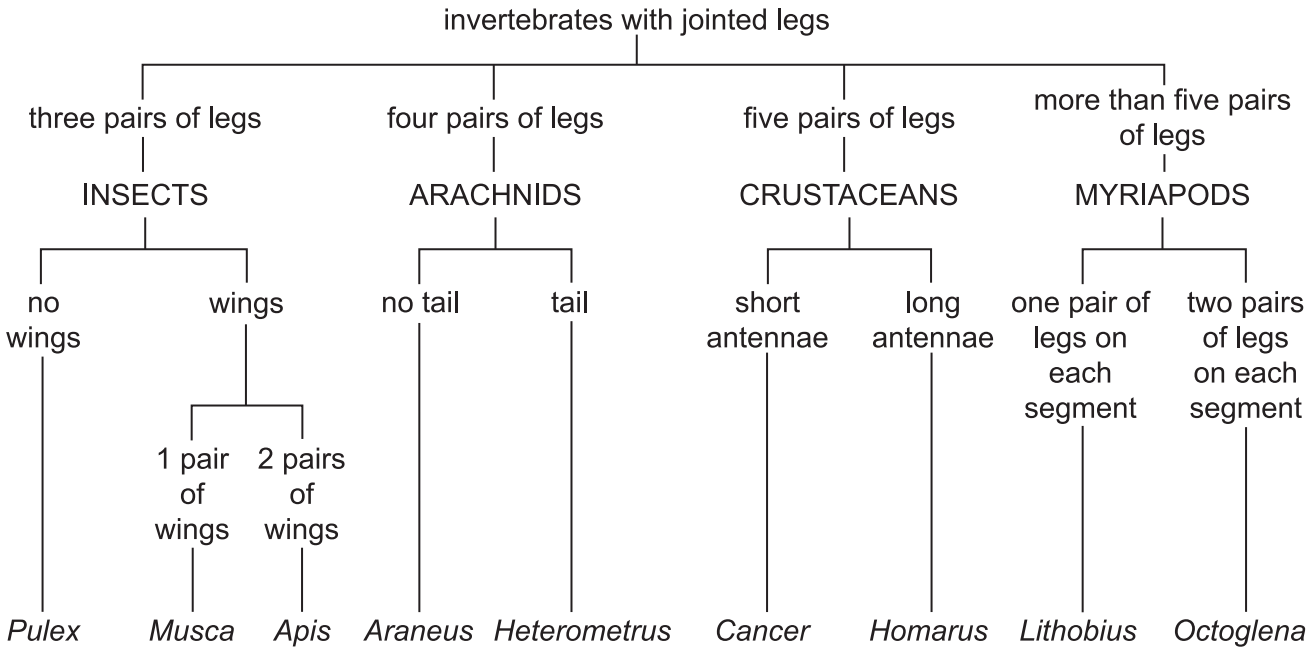


Fig. 1.1

(i) Use the information in Fig. 1.1 to describe **two** features of *Musca*.

1 .....

.....

2 .....

.....

[2]

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(ii) Fig. 1.2 shows one of the animals described in the key.

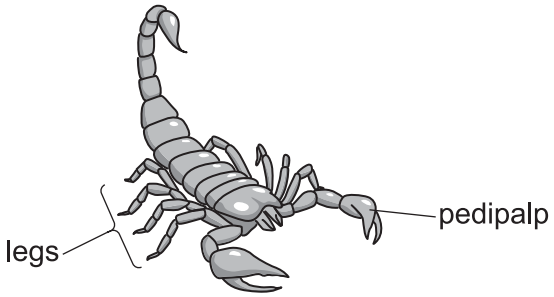


Fig. 1.2

Use the key in Fig. 1.1 to identify this animal.

..... [1]

[Total: 4]

Features of organisms: kingdoms and groups Click for more variations

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2(a)	arthropods ;	1	
2(b)(i)	*any 2 from:* does not have a backbone ; 3 pairs of legs / 6 legs ; has (1 pair of) wings ; has jointed legs ;	2	
2(b)(ii)	*Heterometrus* ;	1	

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3 Arachnids, crustaceans, insects and myriapods are all classified as arthropods.

Scorpions, such as *Heterometrus swammerdami* shown in Fig. 1.1, are arachnids.

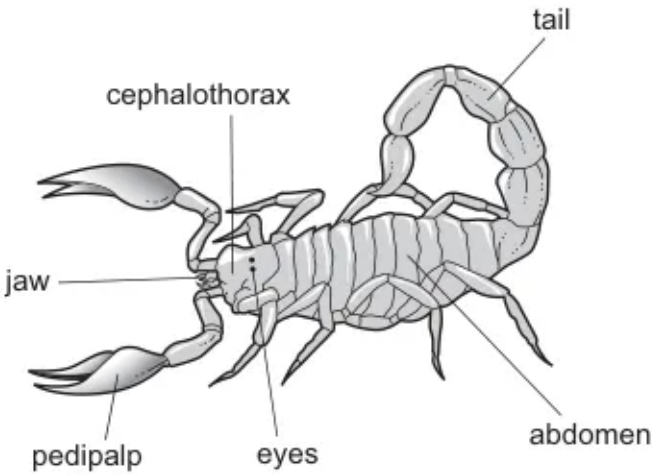


Fig. 1.1

(a) State **three** features, shown by *H. swammerdami* and **visible** in Fig. 1.1, that arachnids share with other arthropods.

1 .....

2 .....

3 ..... [3]

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(b) Fig. 1.2 shows seven species of arachnid.

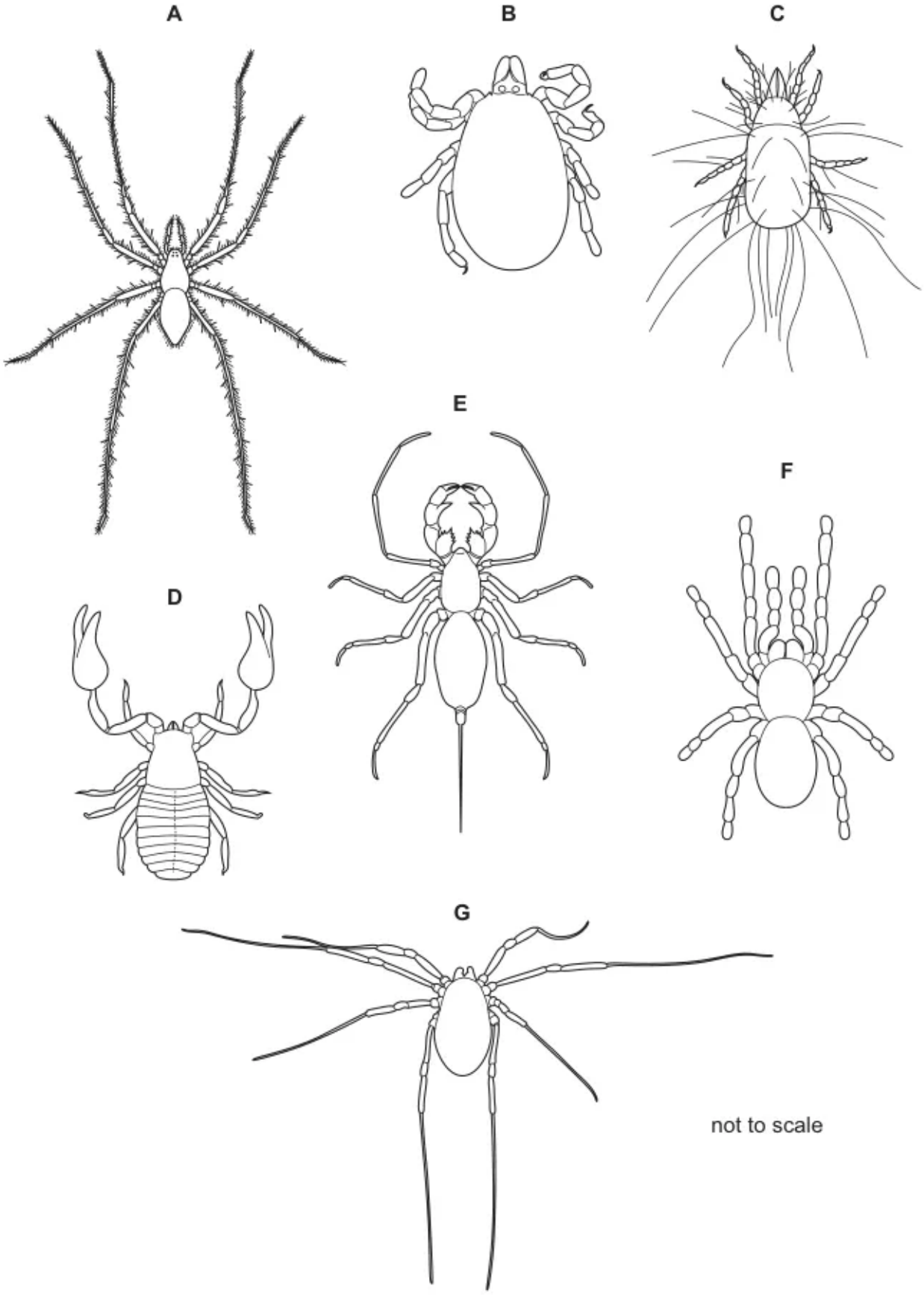


Fig. 1.2

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)	Abdomen with a tail	*Abaliella dicranotarsalis*	**E**
(b)	Abdomen without a tail	go to 2	
2 (a)	Legs much longer than abdomen and cephalothorax	go to 3	
(b)	Legs not much longer than abdomen and cephalothorax	go to 4	
3 (a)	Hairs on the legs	*Tegenaria domestica*	
(b)	No hairs on the legs	*Odielus spinosus*	
4 (a)	Cephalothorax or abdomen segmented	*Chelifer tuberculatus*	
(b)	Cephalothorax and abdomen not segmented	go to 5	
5 (a)	Abdomen and cephalothorax about the same size	*Poecilotheria regalis*	
(b)	Abdomen larger than cephalothorax	go to 6	
6 (a)	Body covered in long hairs	*Tyroglyphus longior*	
(b)	Body not covered in hairs	*Ixodes hexagonus*	

[4]

[Total: 7]

Classification, species and dichotomous keys Click for more variations

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3	**(a)**	segmented body / segmentation ; jointed, limbs / legs ; exoskeleton / outer skeleton ;	3	
	(b)	*5 / 6 RIGHT = 4* *4 RIGHT = 3* *3 RIGHT = 2* *1 / 2 RIGHT =1* *0 RIGHT = 0*	4	
		[Total: 7]		

Abaliella dicranotarsalis	**E**
go to 2	
go to 3	
go to 4	
Tegenaria domestica	**A**
Odielus spinosus	**G**
Chelifer tuberculatus	**D**
go to 5	
Poecilotheria regalis	**F**
go to 6	
Tyroglyphus longior	**C**
Ixodes hexagonus	**B**

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4 Fig. 1.1 shows four different reptiles.

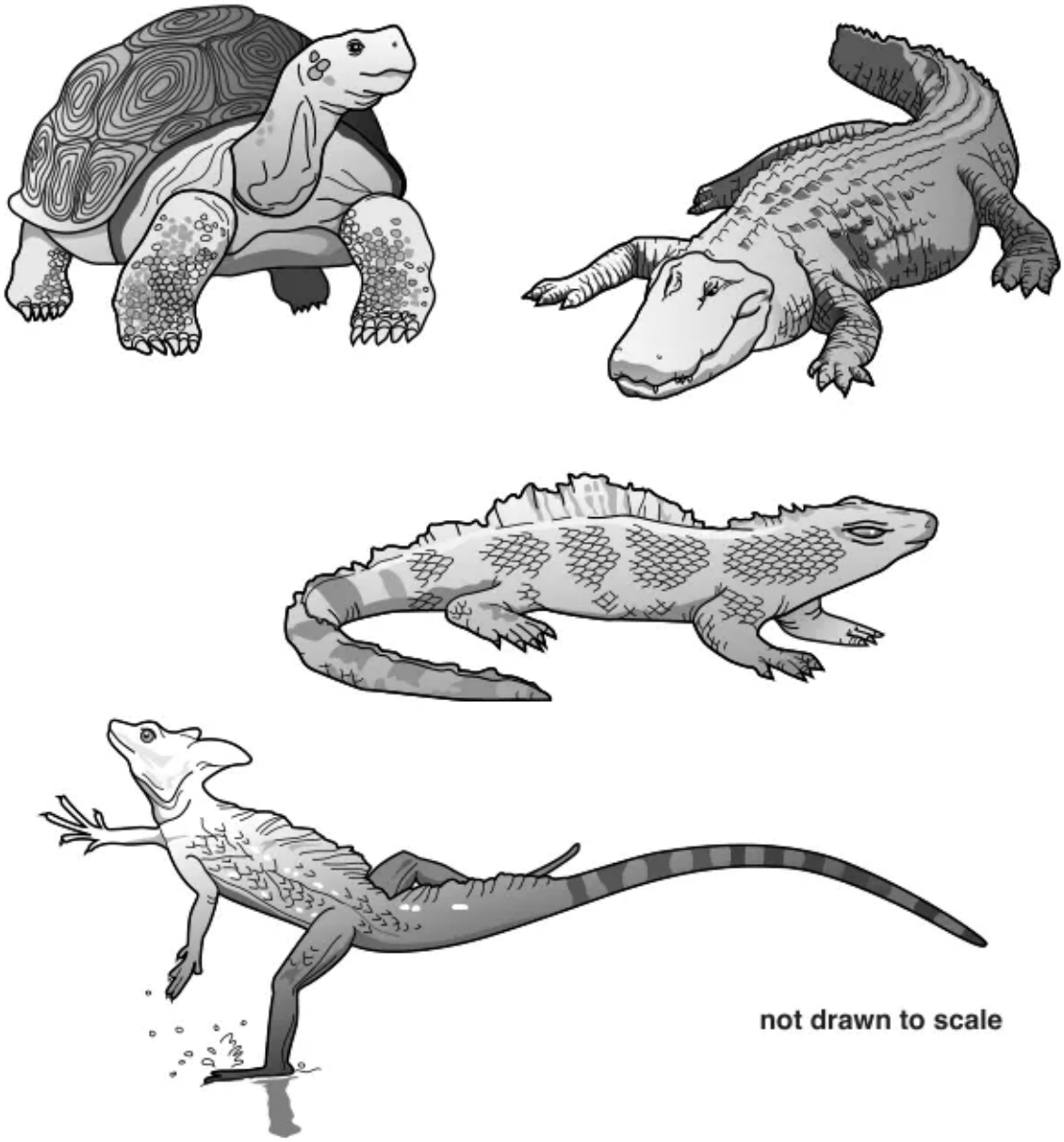


Fig. 1.1

(a) (i) Reptiles are vertebrates.

State **one** feature which all vertebrates have in common.

.....

.....[1]

STEM

(ii) State **two** features which can be used to identify the animals in Fig. 1.1 as reptiles.

1 .....

.....

2 .....

.....

[2]

(iii) Fig. 1.2 shows a snake.

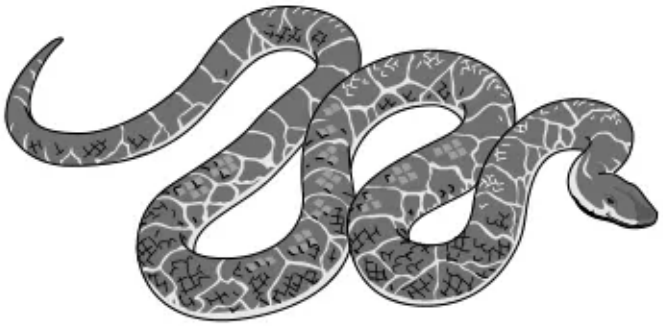


Fig. 1.2

Snakes are also reptiles. State **one** way, **visible** in Fig. 1.2, in which snakes are different from the reptiles shown in Fig. 1.1.

.....

.....[1]

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Fig. 1.3 shows a newt, which looks similar to some reptiles, but belongs to a different vertebrate group.

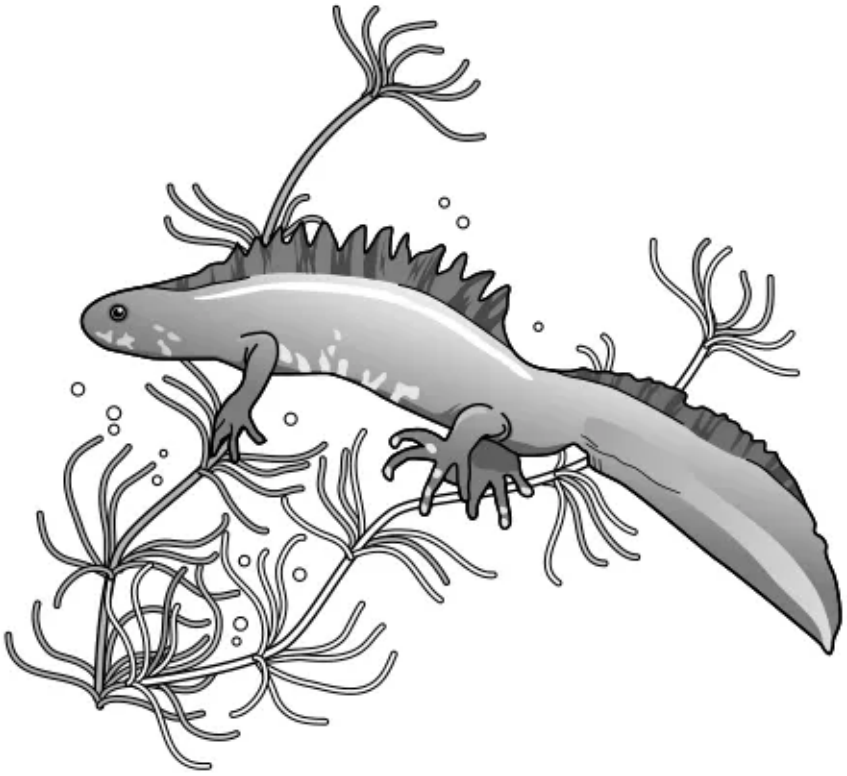


Fig. 1.3

(b) (i) State the vertebrate group to which the newt belongs.

Choose from this list and **circle** your answer.

amphibian **bird** **fish** **mammal**

[1]

(ii) State **two** features of this group which distinguish it from other vertebrate groups.

1 .....

.....

2 .....

.....

[2]

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(c) In some species of reptile, the female keeps the fertilised eggs in her body until they are ready to hatch. Suggest **two** advantages of having this adaptive feature.

1 .....

.....

2 .....

.....

[2]

[Total: 9]

Features of organisms: kingdoms and groups Click for more variations

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4 **(a) (i)**	ref. to vertebral column / backbone ; skull ;	[max. 1]	
(ii)	dry skin ; ref. to scales ; eggs with, dry shell / leathery shell ;	[max. 2]	
(iii)	no limbs / legs ;	[1]	
(b) (i)	amphibian ;	[1]	
(ii)	smooth skin / no scales ; gas exchange using skin ; spend part of life (cycle) in water and land/ AW ; ref. to metamorphic life cycle / AW ;	[max. 2]	

(c)	better survival of egg ; fewer eggs need to be produced ; less risk of predation ; maintains suitable temperature ; reduces risk of disease AW ; protected from external environment ;	[max. 2]	
		[Total: 9]	

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5 Fig. 3.1 shows three animals **A**, **B** and **C** which belong to the same group of arthropods.

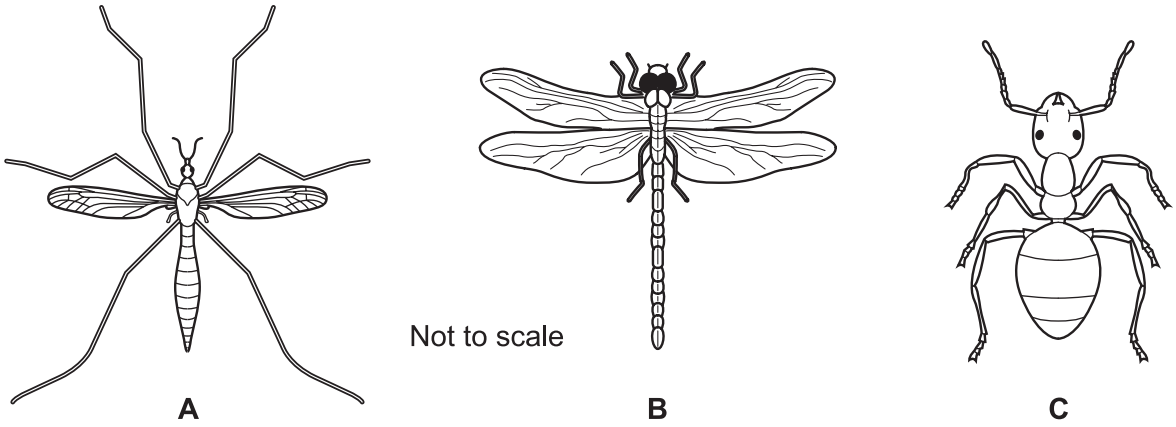


Fig. 3.1

(a) (i) List three visible features, other than size, which are used to classify them all in the same group of arthropods.

1 .....

2 .....

3 ..... [3]

(ii) Give one visible difference, other than size, between animal,

A and **B** .....

A and **C** ..... [2]

(iii) Name the group of arthropods to which these three animals belong.

..... [1]

(b) Name one other group of arthropods and describe how this group differs from the one you have named in **(a)(iii)**.

group of arthropods .....

difference 1 .....

difference 2 ..... [3]

[Total: 9]

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5 (a) (i)	**3** body parts / head + thorax + abdomen; **Two or one pair** of **antennae**; **six legs / three pairs** of (jointed) legs; **one pair / two** (compound) eyes;	**Max[3]**	Ignore segmented body, segmentation of the abdomen, 3 body segments, exoskeleton. Ignore antennae alone, 'things on head, feelers. Ignore 'same number of legs'. Need number to be qualified.
(ii)	**A** and **B –** one pair v two pairs of wings / length of abdomen / thickness of legs / AW; **A** and **C –** wings v no wings / C has no wings [alone] / A has wings [alone]	**Max[2]**	A. if only half of the answer is given e.g. B has 2 pairs of wings this implies that A doesn't. A. if mention number of wings. Ignore wings alone. Ignore different size but allow the shape of abdomen. Ignore length of leg comparison.
(iii)	Insects / Insecta ;	**[1]**	

(b)	Crustacean / Crustaceae; two pairs of antennae / claws, clamp or chelopeds / more than 6 legs or more than 3 pairs / hard or calcareous exoskeleton, hard covering or hard shell / tough covering AW;; **or** Arachnids / Arachnida; 4 pairs or 8 legs / simple eyes / pedipalp / cephalothorax and abdomen or 2 body parts / AW;; **or** Myriapods / Myriapoda; one or two pairs of legs per segment; elongate body;	**[3]**	If named an example e.g. crab instead of crustacean then no group name mark but accept up to 2 differences. Accept more than 3 pairs of legs, more than 1 pair of antennae. Ignore no wings / many legs / compound eyes / not one pair of antennae / body not divided into three parts. If named an example e.g. spider, scorpion, mites instead of arachnids then no group name mark but accept up to 2 differences. Ignore more than 3 pairs of legs. [need to know how many more. Ignore negative features e.g. no wings / no compound eyes / no antennae. Ignore no separate thorax and abdomen / no wings / many legs. If incorrect group given e.g. molluscs. No mark for group name but allow only **one** difference with insects but it must be a positive feature e.g. hard shell present in mollusc. Name of group = one mark. 2 marks for two correct differences in positive features. These three groups are the only ones listed in the syllabus.
		[Total:9]	

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6 The classification of giant pandas, *Ailuropoda melanoleuca*, is debated by many scientists.

Fig. 2.1 shows a giant panda eating bamboo plants.



Fig. 2.1

Fig. 2.2 shows a red panda, *Ailurus fulgens*, and a polar bear, *Ursus maritimus*.



red panda eating bamboo plants



polar bear eating fish

Fig. 2.2

(a) State **one** dietary component that is more likely to be found in bamboo plants than in fish.

..... [1]

(b) **(i)** State **two** features, visible in Fig. 2.1 and Fig. 2.2, that identify the three animals as all belonging to the same vertebrate group.

1 .....

2 .....

[2]

(ii) DNA can also be used to classify species.

Molecular biologists compared the DNA base sequences of eight species from the same vertebrate group. They used the differences to draw a classification diagram.

Fig. 2.3 shows the classification diagram for these eight species. The shorter the horizontal distance from two species to the branching point that they share, the more similar their DNA sequences are and the more closely the two species are related.

The scale on Fig. 2.3 shows the time at which the molecular biologists estimate that each branching point occurred.

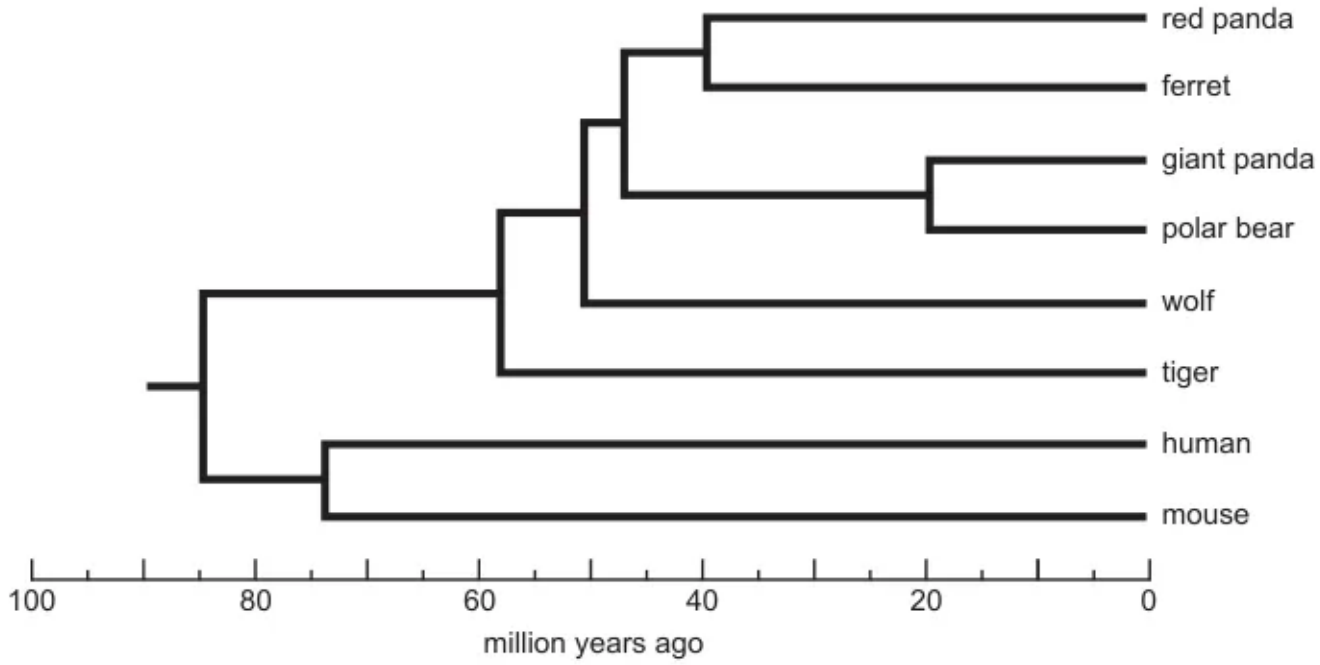


Fig. 2.3

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Morphology can also be used to classify species. Some scientists think that morphology suggests that the giant panda is more closely related to the red panda than it is to the polar bear.

Discuss the evidence for **and** against the giant panda being more closely related to the red panda than it is to the polar bear. Use the information in Fig. 2.1, Fig. 2.2 and Fig. 2.3 in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(iii) State one **other** type of evidence that is used to classify species.

..... [1]

[Total: 9]

Classification, species and dichotomous keys Click for more variations

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6(a)	(dietary) fibre **/** carbohydrate / starch / (named) sugar / vitamin C **;**	**1**	
6(b)(i)	external ears / pinnae **;** fur **;**	**2**	
6(b)(ii)	*any five from:* *for (giant panda closer to red panda):* same diet / herbivores / AW **;** terrestrial / similar, ecosystems / habitats **;** fur markings described **;** ear position **;** *against:* shorter (branch) distance between giant panda and polar bear (than to red panda) **;** fewer, DNA (base sequence) / gene, differences between giant panda and polar bear (than to red panda) **;** (red panda) first appeared, 40±3 million rather than 20±3 million, years ago (giant and polar) **;** more time for, mutations / evolution (for red panda) **;** common, ancestor / branch / relationship, 20±3 million, (giant and polar), than 47±3 million years ago (red) **;** DNA data is likely to be more, accurate / quantitative / not subjective **;**	**5**	
6(b)(iii)	anatomy **/** ability to produce fertile offspring **/** AVP **;**	**1**	

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7 Scientists use classification systems to study relationships between different groups of organisms.

(a) State the **two** parts of a scientific name used in the binomial system.

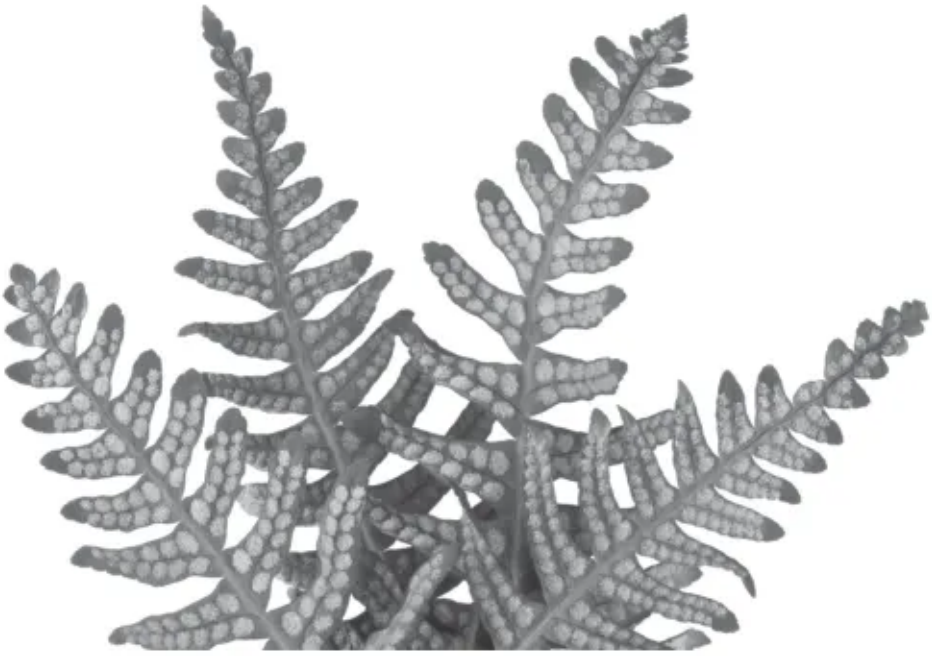
..... [1]

(b) Scientists discover a new species. It is multicellular, and has cell walls that are **not** made of cellulose. This new species feeds by releasing digestive enzymes into its surroundings and then absorbing the digested nutrients.

Identify the kingdom that the new species belongs to.

..... [1]

(c) Fig. 1.1 shows photographs of two different species, **X** and **Y**.



species **X**



species **Y**

Fig. 1.1

(i) Species **X** and **Y** belong to the plant kingdom.

State **two** structures found in cells from species **X** and **Y** that are **not** found in animal cells.

1 .....

2 .....

[2]

(ii) Using features visible in Fig. 1.1, identify the group in the plant kingdom that species **X** and **Y** belong to.

Explain your answer.

species **X** .....

.....

.....

.....

species **Y**.....

.....

.....

.....

.....

[4]

(iii) Understanding evolutionary relationships between crop plants can help scientists and farmers improve agriculture.

Explain how a scientist could determine if different crop plant species share a recent ancestor (are closely related).

.....

.....

.....

.....

..... [2]

[Total: 10]

Features of organisms: kingdoms and groups Click for more variations

7(a)	genus **AND** species ;	**1**	
7(b)	fungus / fungi ;	**1**	
7(c)(i)	*any two from:* **1** chloroplast ; **2** cell wall ; **3** (large permanent) vacuole ; **4** AVP ;	**2**	e.g. starch grains
7(c)(ii)	*any four from:* *species **X*** **1** fern ; **2** spores ; **3** fronds ; *species **Y*** **4** monocotyledon ; **5** narrow / long / AW, leaves ; **6** parallel veins ;	**4**	
7(c)(iii)	*any two from:* **1** use, base / amino acid / nucleotide / gene, sequences **OR** sequence, DNA / RNA / AW ; **2** (crops with) recent ancestors / closely related species, will have more, sequences / genes / alleles in common / will have similar, sequences / genes / alleles ; **3** **AVP** ;	**2**	

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8 **(a)** Describe the meaning of the term species.

.....

.....

..... [2]

(b) Fig. 1.1 is a photograph of *Lithobius forficatus*, a species of myriapod.



Fig. 1.1

(i) State the genus of the organism shown in Fig. 1.1.

..... [1]

(ii) State **one** feature **visible** in Fig. 1.1 that identifies the organism as:

a myriapod .....

an arthropod. .....
[2]

(iii) State the names of **two** groups of arthropods, other than myriapods.

1 .....

2 .....
[2]

(iv) State **two** features of plant cells that would be **absent** in the cells of the organism shown in Fig. 1.1.

1 .....

2 .....
[2]

(c) Adaptive features enable organisms to survive in their environment.

Fig. 1.2 is a photograph of another species of arthropod. Some of its adaptive features are visible in Fig. 1.2.



Fig. 1.2

(i) State **one** adaptive feature visible in Fig. 1.2 that reduces water loss when the organism is on land.

..... [1]

(ii) State the name of the kingdom that the organism in Fig. 1.2 belongs to.

..... [1]

[Total: 11]

Features of organisms: kingdoms and groups Click for more variations

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8(a)	a group of organisms that can reproduce ; to produce fertile offspring ;	**2**	
8(b)(i)	*Lithobius* ;	**1**	
8(b)(ii)	*myriapod:any one from:* many pairs of legs / more than 16 legs / more than 8 pairs of legs ; one or two pairs of legs on each segment ; *arthropod: any one from:* segmented body ; exoskeleton ; jointed legs ;	**2**	
8(b)(iii)	*any two from:* insects ; arachnids ; crustaceans ;	**2**	
8(b)(iv)	*any two from:* chloroplasts / chlorophyll ; cell wall / cellulose ; (permanent) vacuole ; AVP ; e.g. starch, grain / granule	**2**	
8(c)(i)	(hard) shell / exoskeleton / carapace ;	**1**	
8(c)(ii)	animal ;	**1**	

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9 **(a)** Table 2.1 shows the names of three groups of arthropods and some of their characteristics.

Place ticks (✓) in the boxes to show the characteristics present in each group.

Table 2.1

characteristic	arthropod group		
	arachnids	crustaceans	myriapods
four pairs of legs			
one pair of antennae			
body divided into two main parts			

[3]

(b) All living organisms show the same seven characteristics.

State **four** of the characteristics of living organisms.

1 .....

2 .....

3 .....

4 .....

[4]

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(c) Fig. 2.1 shows the apparatus used by some students during an investigation.

The apparatus is drawn as seen from above.

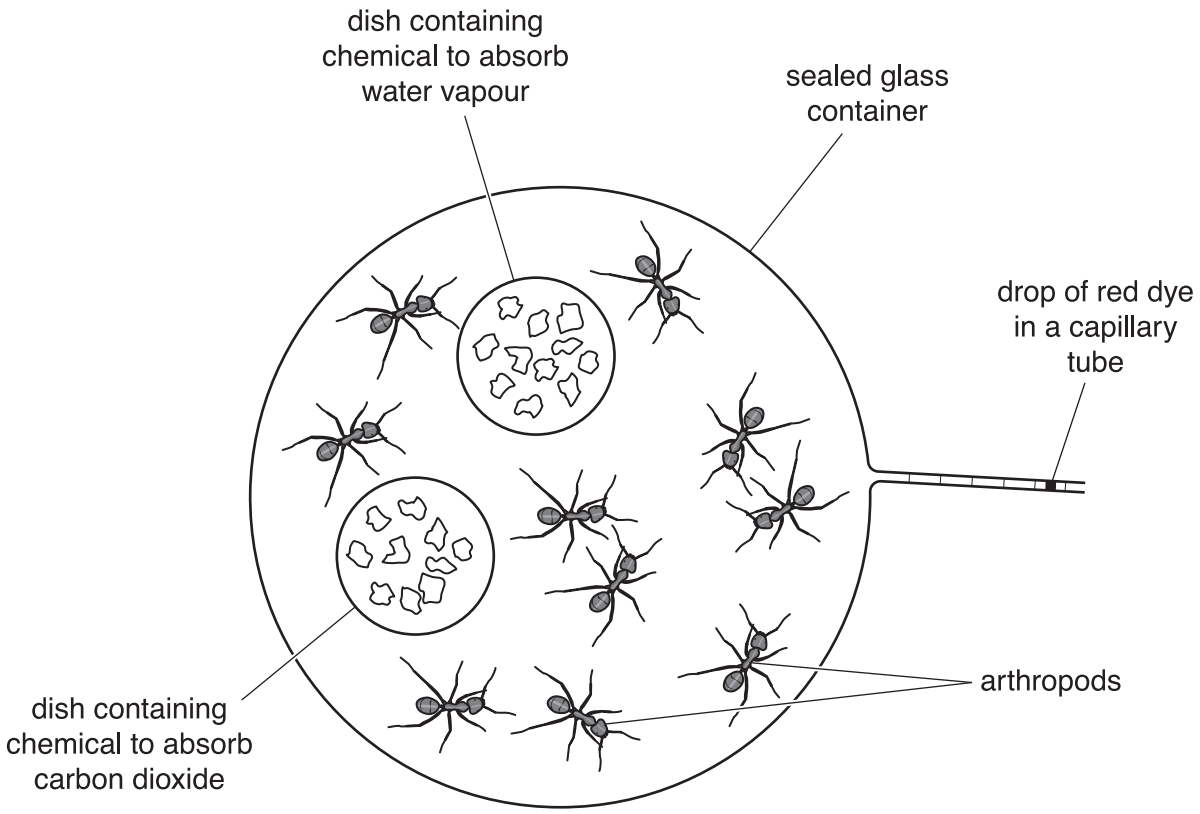


Fig. 2.1

Some arthropods were placed in the container.

A drop of red dye was inserted into the capillary tube.

The drop of red dye in the capillary tube gradually moved towards the arthropods.

(i) Explain why the drop of red dye moved towards the arthropods.

.....

.....

.....

.....

.....

..... [3]

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The investigation shown in Fig. 2.1 was repeated at different temperatures.

Fig. 2.2 shows the results.

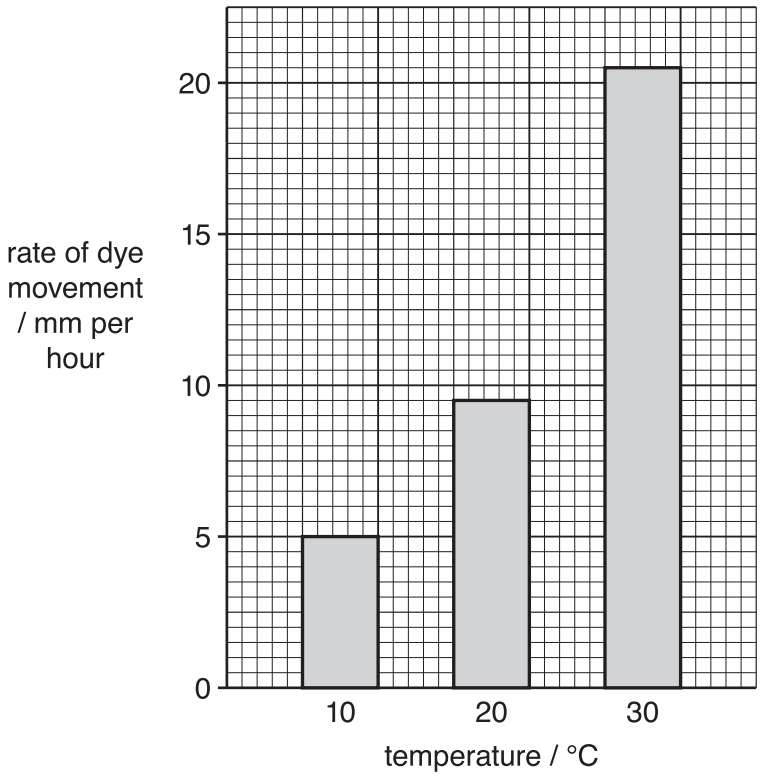


Fig. 2.2

(ii) State the trend shown in Fig. 2.2.

.....

..... [1]

(iii) Calculate the percentage increase in the rate of dye movement between 10 °C and 20 °C.

Show your working.

.....%
[2]

[Total: 13]

Characteristics of living organisms Click for more variations

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9(a)	<table><tr><td rowspan="2">characteristic</td><td colspan="3">arthropod group</td></tr><tr><td>arachnids</td><td>crustaceans</td><td>myriapods</td></tr><tr><td>four pairs legs</td><td>✓</td><td></td><td></td></tr><tr><td>one pair antennae</td><td></td><td></td><td>✓</td></tr><tr><td>two main body parts</td><td>✓</td><td></td><td></td></tr></table> ;;;	**3**	one mark for each correct row
9(b)	movement ; respiration ; sensitivity ; growth ; reproduction ; excretion ; nutrition ;	**4**	
9(c)(i)	oxygen used by arthropods ; correct reference to (aerobic) respiration ; carbon dioxide / water (vapour), is given out / released ; carbon dioxide / water (vapour), is absorbed ; (so) volume of air (in the container) decreases / pressure in the container decreases ;	**3**	
9(c)(ii)	as the temperature increases the (rate of) dye movement increases / AW ;	**1**	
9(c)(iii)	90(%) ;;	**2**	

10 **(a)** Complete the statements about classification.

Organisms are classified into groups by the ..... that they share.

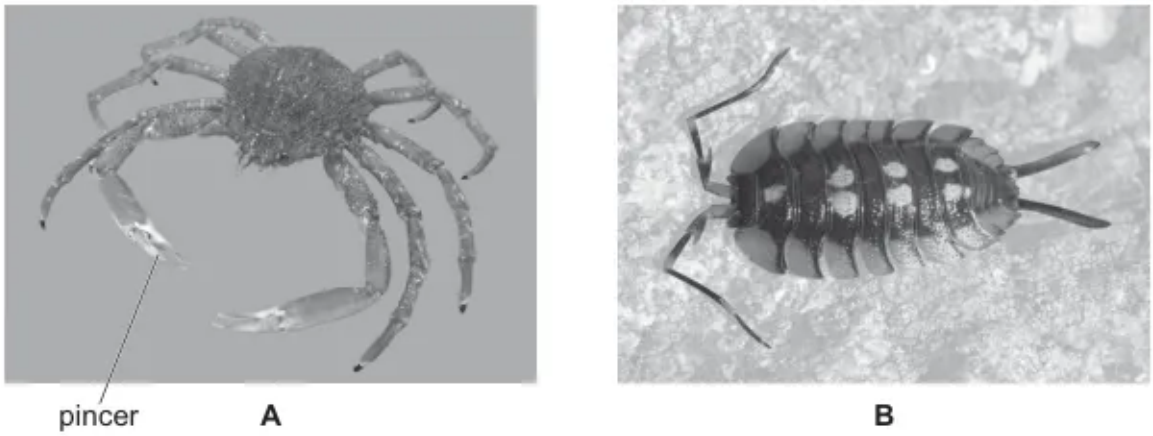
The internationally agreed system for naming species is the ..... system.

The scientific name of an organism is made up of the ..... name and the ..... name.

[4]

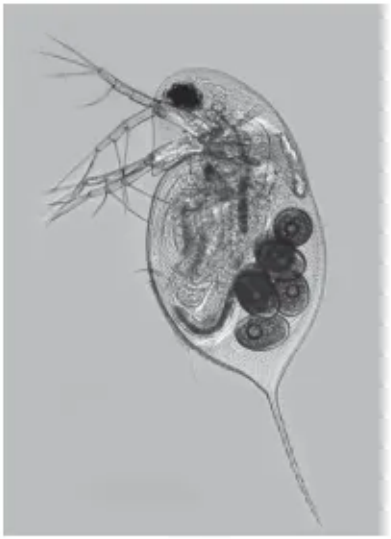
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(b) Fig. 1.1 shows six species of crustacean.



A

B



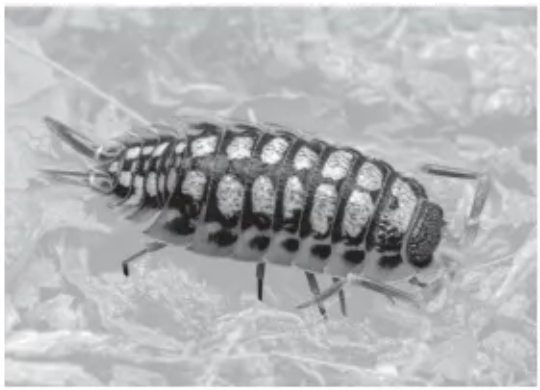
C



D



E



F

NOT TO SCALE

Fig. 1.1

Use the key to identify each species shown in Fig. 1.1.

Write the letter of each species (**A** to **F**) in the correct box in the key.

Key

1	(a)	pincers visible	*go to 2*	
	(b)	pincers **not** visible	*go to 4*	
2	(a)	pincers are the same size	*go to 3*	
	(b)	pincers are different sizes	*Minuca pugnax*	
3	(a)	body is nearly round	*Maja brachydactyla*	
	(b)	body is long	*Astacus leptodactylus*	
4	(a)	body has visible segments	*go to 5*	
	(b)	body has **no** visible segments	*Daphnia pulex*	
5	(a)	fewer than eight spots are visible on the body	*Porcellio expansus*	
	(b)	more than eight spots are visible on the body	*Porcellio haasi*	

[5]

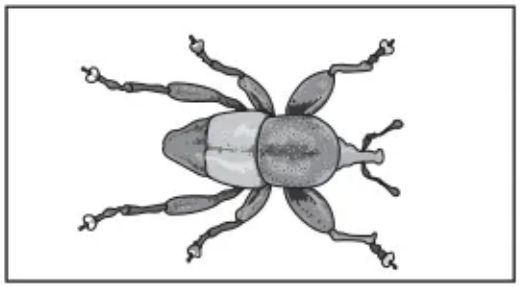
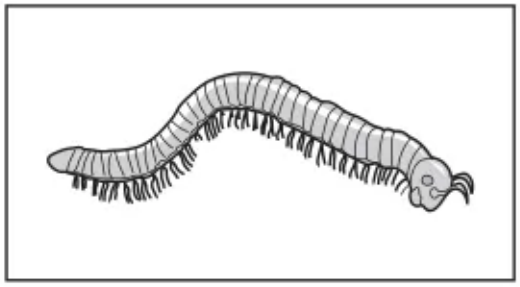
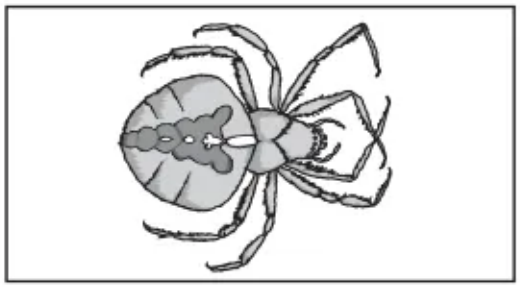
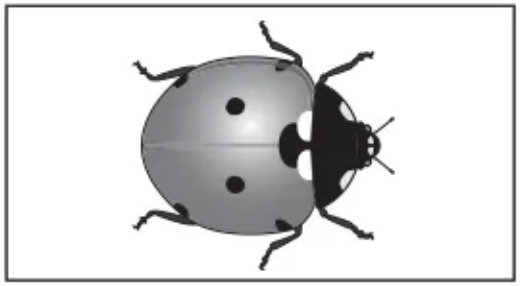
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(c) The boxes on the left show some images of arthropods.

The boxes on the right show some names of arthropod groups.

Draw a line from each box on the left to the box showing the correct arthropod group for the image.

Draw a total of **four** lines.

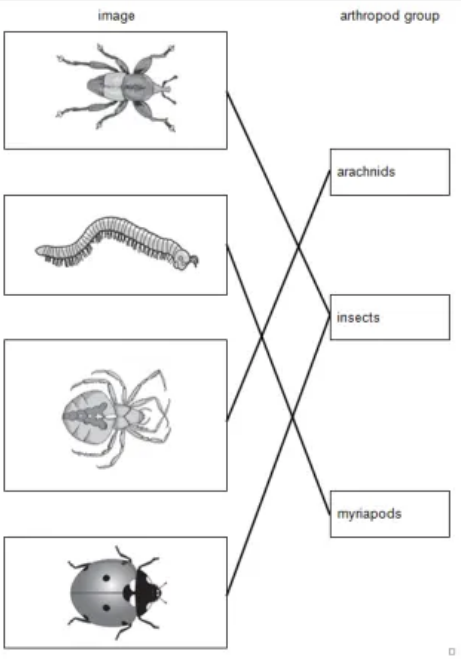
image	**arthropod group**
	arachnids
	insects
	myriapods
	

NOT TO SCALE

[4]

[Total: 13]

Classification, species and dichotomous keys Click for more variations

10(a)	features / AW ; binomial ; genus ; species ;	**4**	MP3 and MP4 **A** either order
10(b)	*Minuca pugnax* **E** *Maja brachydactyla* **A** *Astacus leptodactylus* **D** *go to 5* *Daphnia pulex* **C** *Porcellio expansus* **B** *Porcellio haasi* **F** ;;;;;	**5**	6 correct = 5 marks 4 or 5 correct = 4 marks 3 correct = 3 marks 2 correct = 2 marks 1 correct = 1 mark
10(c)	 ;;;;	**4**	one mark for each correct line from the image box **R** each additional line

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