CAMBRIDGE
International Examinations

Cambridge
IGCSE

Example Candidate Responses

(Standards Booklet)

Cambridge IGCSE®
Biology
0610

Cambridge Secondary 2

Contents

Introduction 2

Assessment at a glance 3

Paper 2 – Core theory 4

Paper 3 – Extended theory 54

Paper 5 – Practical test 119

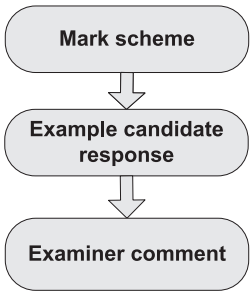
Paper 6 – Alternative to practical 151

Introduction

The main aim of this Example Candidate Responses booklet is to exemplify standards for those teaching Cambridge IGCSE Biology (0610), and to show how different levels of candidates' performance relate to the subject's curriculum and assessment objectives.

In this booklet a range of candidate responses has been chosen as far as possible to exemplify grades A, C and E. For the Core Curriculum (Paper 2) candidates are eligible for grades C to G so examples are for grades C and E. For Papers 3, 5 and 6 example candidate responses for grades A, C and E are given when available. This booklet does not cover Paper 1 and Paper 4. Paper 1 is a multiple-choice question paper. The mark scheme provides sufficient detail and the candidate answers do not require examiner commentary to expand on why the marks were given. For more information and example candidate responses for Paper 4 the *Coursework Training Handbook (Part 1): Guidance* is available from Teacher Support at http://teachers.cie.org.uk

For ease of reference the following format for each paper has been adopted:



Each question has a mark scheme which is followed by examples of marked candidate responses, each with an examiner comment on performance. Comments are given to indicate where and why marks were awarded, and how additional marks could have been obtained. In this way, it is possible to understand what candidates have done to gain their marks and what they still have to do to improve their grades.

Past papers, examiner reports and other teacher support materials are available on Teacher Support at http://teachers.cie.org.uk

Assessment at a glance

All candidates must enter for three papers.

<table>
<tr><th colspan="3">All candidates take:</th></tr>
<tr><td colspan="3">Paper 1 45 minutes
Multiple-choice question paper
Weighted at 30% of total available marks</td></tr>
<tr><th colspan="2">and either:</th><th>or</th></tr>
<tr><td colspan="2">Paper 2 1 hour 15 minutes
Core theory paper
Weighted at 50% of total available marks</td><td>Paper 3 1 hour 15 minutes
Extended theory paper
Weighted at 50% of total available marks</td></tr>
<tr><th>and either:</th><th>or:</th><th>or:</th></tr>
<tr><td>Paper 4
Coursework
Weighted at 20% of total available marks</td><td>Paper 5 1 hour 15 minutes
Practical Test
Weighted at 20% of total available marks</td><td>Paper 6
Alternative to Practical
Weighted at 20% of total available marks</td></tr>
</table>

Teachers are reminded that a full syllabus is available at www.cie.org.uk

Paper 2 – Core theory

Question 1

Mark scheme

<table>
<tr>
<td>1 (a)</td>
<td>
<table>
<tr><td>arachnids</td><td>✓;</td></tr>
<tr><td>crustaceans</td><td></td></tr>
<tr><td>insects</td><td></td></tr>
<tr><td>myriapods</td><td></td></tr>
</table>
</td>
<td>[1]</td>
<td>if more than 1 box ticked no mark</td>
</tr>
<tr>
<td>(b)</td>
<td>
<table>
<tr><td>crab</td><td>name of arthropod</td></tr>
<tr><td>A</td><td>Araneus;</td></tr>
<tr><td>B</td><td>Buthus;</td></tr>
<tr><td>C</td><td>Hydrachna;</td></tr>
<tr><td>D</td><td>Ixodes;</td></tr>
<tr><td>E</td><td>Oligolophus;</td></tr>
</table>
any four correctly named – 1 mark each
</td>
<td>[4]</td>
<td>two or more names in a line mark the first.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Total: 5]</td>
<td></td>
</tr>
</table>

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade C

1 Fig. 1.1 shows five arthropods, each with four pairs of legs.

For Examiner's Use

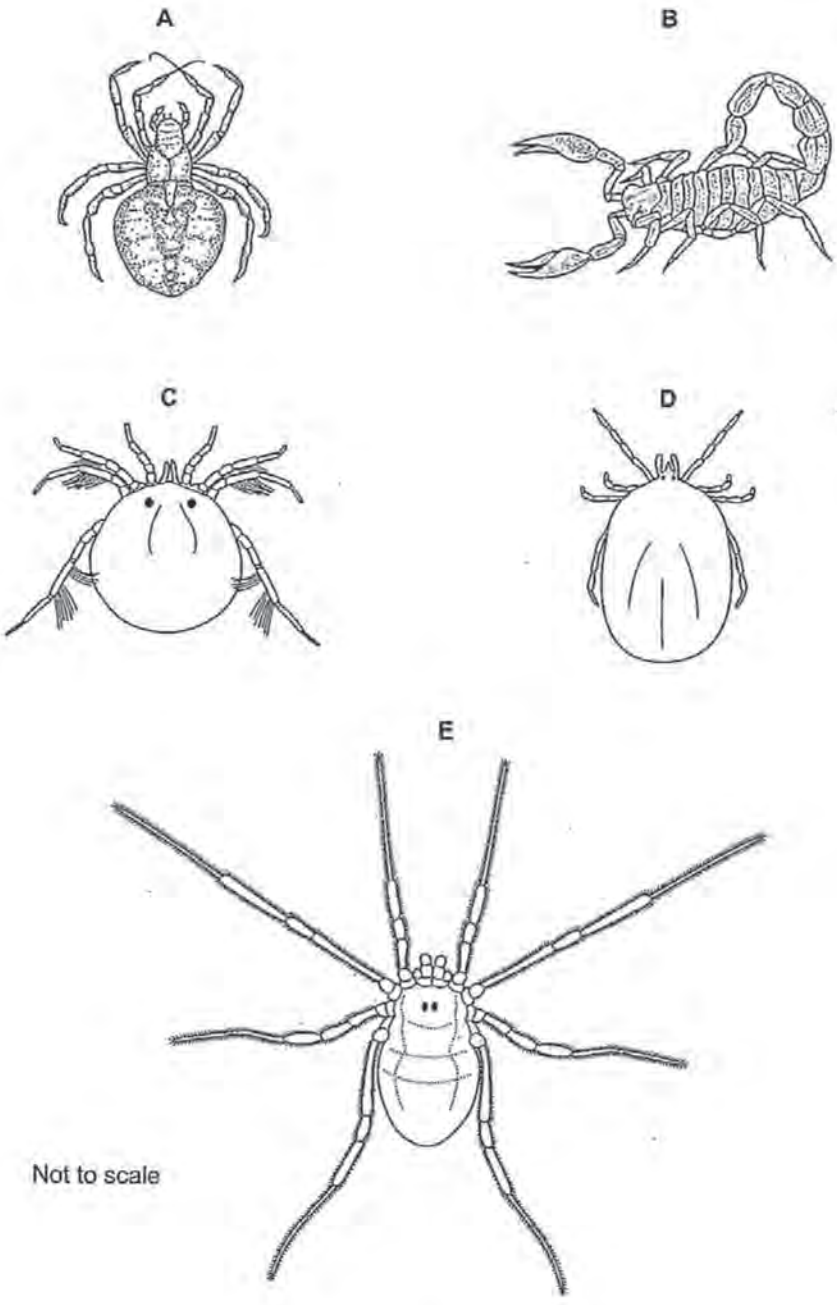


Fig. 1.1

For Examiner's Use

(a) These five arthropods all belong to the same group.

To which group of arthropods do they all belong?

Tick (✓) **one** box to show your answer.

arachnids	✓
crustaceans	
insects	
myriapods	

[1]

(b) Use the key to identify each of these arthropods.

Write the name of each animal in the correct box in Table 1.1.

Key

	name of arthropod
1 (a) legs with hairs (b) legs without hairs	go to 2 go to 3
2 (a) legs with small groups of hairs (b) legs hairy all over	*Hydrachna* *Oligolophus*
3 (a) body clearly has two main regions (b) body seems to have only one main region	go to 4 *Ixodes*
4 (a) body clearly segmented, pincers present (b) body with no segments, no pincers	*Buthus* *Araneus*

Table 1.1

animal	name of arthropod
A	Araneus
B	Buthus
C	Hydrachna
D	Ixodes
E	Oligolophus

[4]

Examiner comment – grade C

The candidate has identified the group to which the illustrated arthropods belong in **(a)** and also all specimens using the key in **(b)**.

Mark awarded = 5 out of 5

Example candidate response – grade E

1 Fig. 1.1 shows five arthropods, each with four pairs of legs.

For Examiner's Use

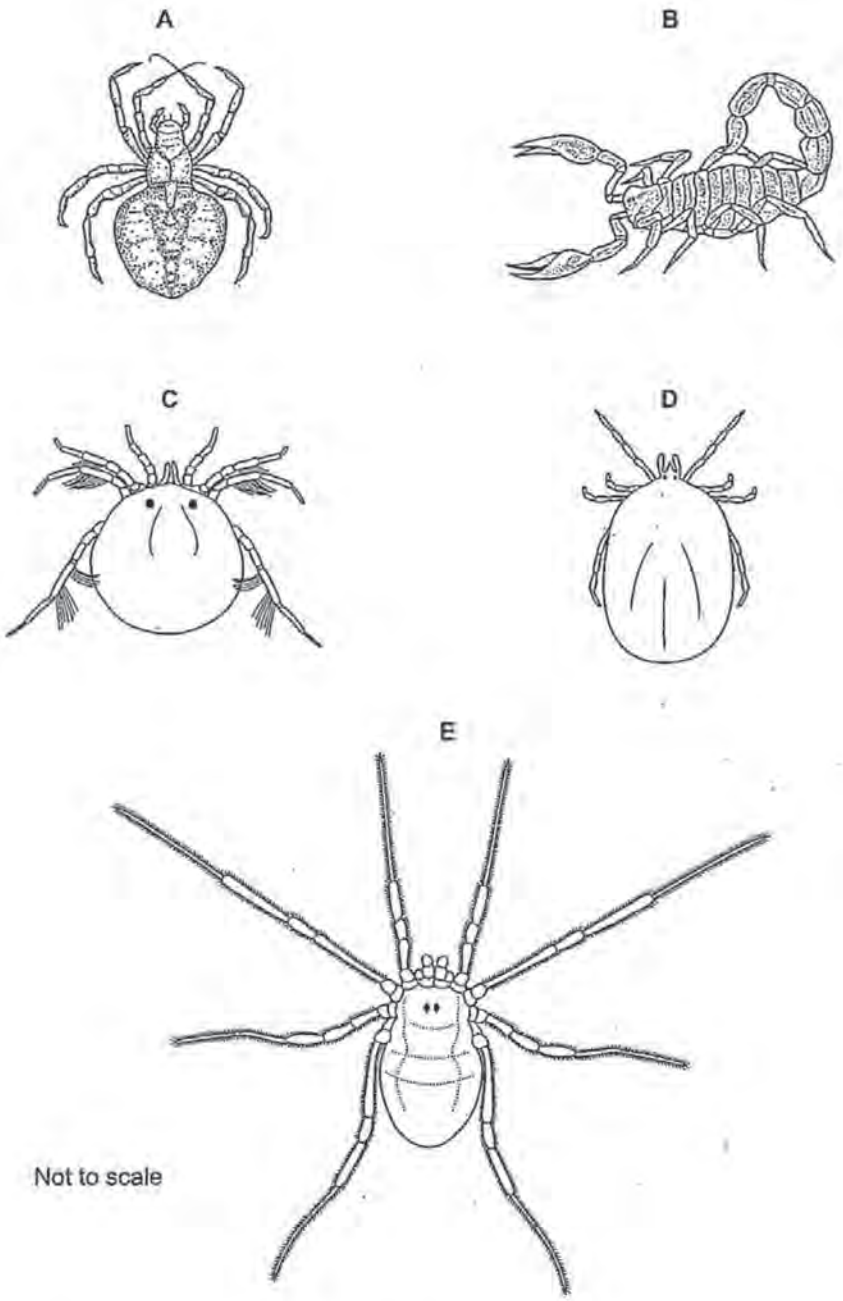


Fig. 1.1

(a) These five arthropods all belong to the same group.

To which group of arthropods do they all belong?

Tick (✓) **one** box to show your answer.

arachnids	✓
crustaceans	
insects	
myriapods	

[1]

For Examiner's Use

(b) Use the key to identify each of these arthropods.

Write the name of each animal in the correct box in Table 1.1.

Key

	name of arthropod
1 (a) legs with hairs	go to 2
(b) legs without hairs	go to 3
2 (a) legs with small groups of hairs	*Hydrachna*
(b) legs hairy all over	*Oligolophus*
3 (a) body clearly has two main regions	go to 4
(b) body seems to have only one main region	*Ixodes*
4 (a) body clearly segmented, pincers present	*Buthus*
(b) body with no segments, no pincers	*Araneus*

Table 1.1

animal	name of arthropod
A	~~Hydrachna~~ Buthus.
B	~~Oligolophus~~ Ixodes
C	Hydrachna
D	Araneus
E	Oligolophus

[4]

[Total: 5]

Examiner comment – grade E

The candidate identified the group to which the illustrated arthropods belong in **(a)**, but although the specimens with hair on their legs have been correctly identified using the key in **(b)**, those without (specimens A, B and D) have been confused when using the key.

Mark awarded = 3 out of 5

2	(a)	**M** – trachea; **N** – bronchus; **O** – bronchioles;	[3]	A – cartilage, windpipe A – bronchi, I – ref to position left/right A – alveolus / alveoli
	(b)	observe rise and fall of chest / OWTTE; count number of inhalations in known period of time;	[2]	A – ref to breathing monitors A – 15 s to 5 mins
	(c)	**(i)** male 1; **(ii)** female 2; **(iii)** 1 breathing rate rises with exercise; 2 the rise in breathing rate varies from person to person; 3 (on average) males have higher breathing rates, before running / resting / after running than females/ OWTTE / ORA; any two – 1 mark each	[1] [1] [2]	
	(d)	1 exercise needs (extra) energy; 2 energy released by respiration; 3 in muscles; 4 (more) oxygen needed; 5 (more) carbon dioxide to be removed; 6 increased breathing rate to provide the oxygen / remove the carbon dioxide; any four – 1 mark each	[4]	more required at least once in the logical progression – penalise once for complete absence I – refs to anaerobic respiration
			[Total: 13]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade C

2 Fig. 2.1 shows a section through the human chest (thorax).

For Examiner's Use

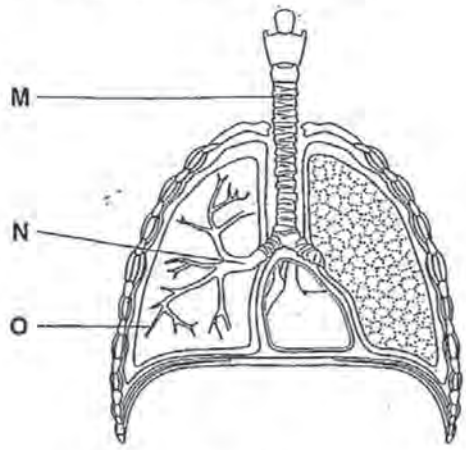


Fig. 2.1

(a) Name the structures labelled **M**, **N** and **O**.

M Trachea

N Bronchi

O Bronchiole [3]

(b) The breathing rates of some students were measured before they started running.

Describe how you could measure the breathing rates.

Measure the number of times someone breathes in a minute, before the exercise ~~rate~~. Then measure this again after the exercise, and compare both results.

[2]

(c) Fig. 2.2 shows the results of an investigation into the breathing rates of some students before and immediately after running.

For Examiner's Use

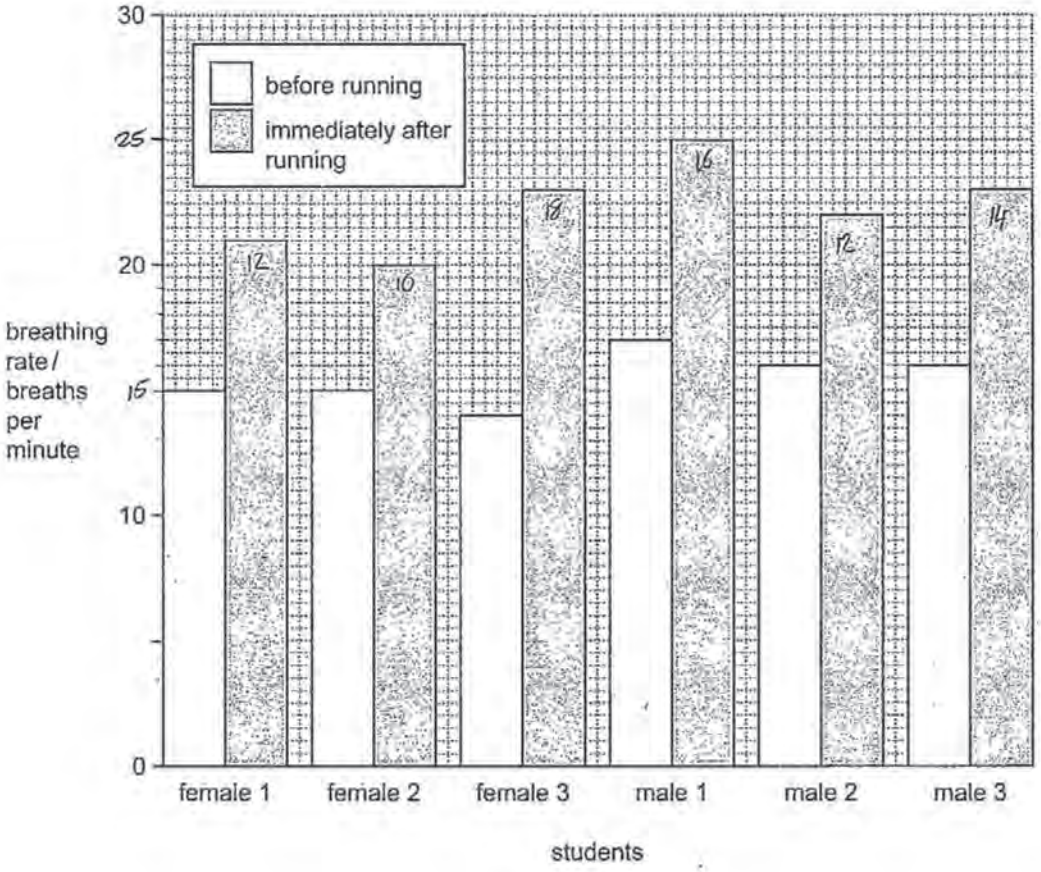


Fig. 2.2

(i) State which student has the highest breathing rate before running.

male 1 [1]

(ii) State which student has the smallest change in breathing rate from before to immediately after running.

female 2 [1]

(iii) Describe any patterns shown by the results.

The results after running in breathing rates are higher than before running. After running, all the results are either 20 p/min or above, yet before running they are all below 17 p/min. [2]

(d) Explain why breathing rate changes during exercise.

For Examiner's Use

During exercise the heart needs more oxygen to supply the body with. This then increases breathing rate as the body has to breathe in as much oxygen as possible during the period of exercise. Whereas, before the period of exercise, the breathing rate does not change as drastically, as the heart would not need as much oxygen to be transported to the heart. [4]

[Total: 13]

Examiner comment – grade C

The candidate typically gained full credit in **(a)** by identifying all three labelled structures. In **(b)** the candidate also stated the need to relate the number of breaths to a sensible time period, but there was no indication as to how the breathing would be detected e.g. observing the rise and fall of the chest or the use of a breathing monitor.

In **(c)** the candidate selected the right information from the data and identified the increase of breathing rate after running as a pattern. However there were other patterns that could have been recognised such as the higher breathing rates of males compared to females before and after running or the fact that the increases of breathing rates vary from individual to individual.

In **(d)** the candidate has recognised that during exercise more oxygen is needed in the body and that an increased breathing rate provides this, but did not extend the response to link this to the increased respiration necessary to release the extra energy needed in the muscles.

Mark awarded = 9 out of 13

Example candidate response – grade E

2 Fig. 2.1 shows a section through the human chest (thorax).

For Examiner's Use

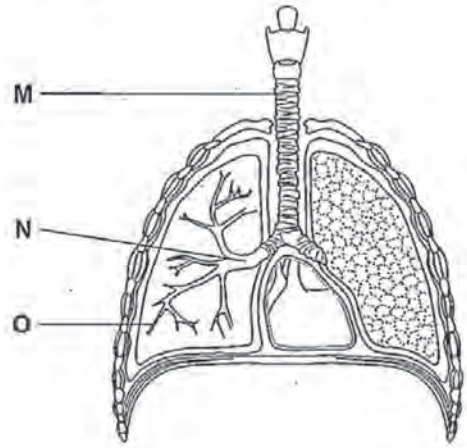


Fig. 2.1

(a) Name the structures labelled M, N and O.

M trachea

N oesophagus

O Lung [3]

(b) The breathing rates of some students were measured before they started running.

Describe how you could measure the breathing rates.

A breathing rate machine is used to calculate the number of breathing rates per minute; or visibly you can count the number of breaths rates. [2]

(c) Fig. 2.2 shows the results of an investigation into the breathing rates of some students before and immediately after running.

For Examiner's Use

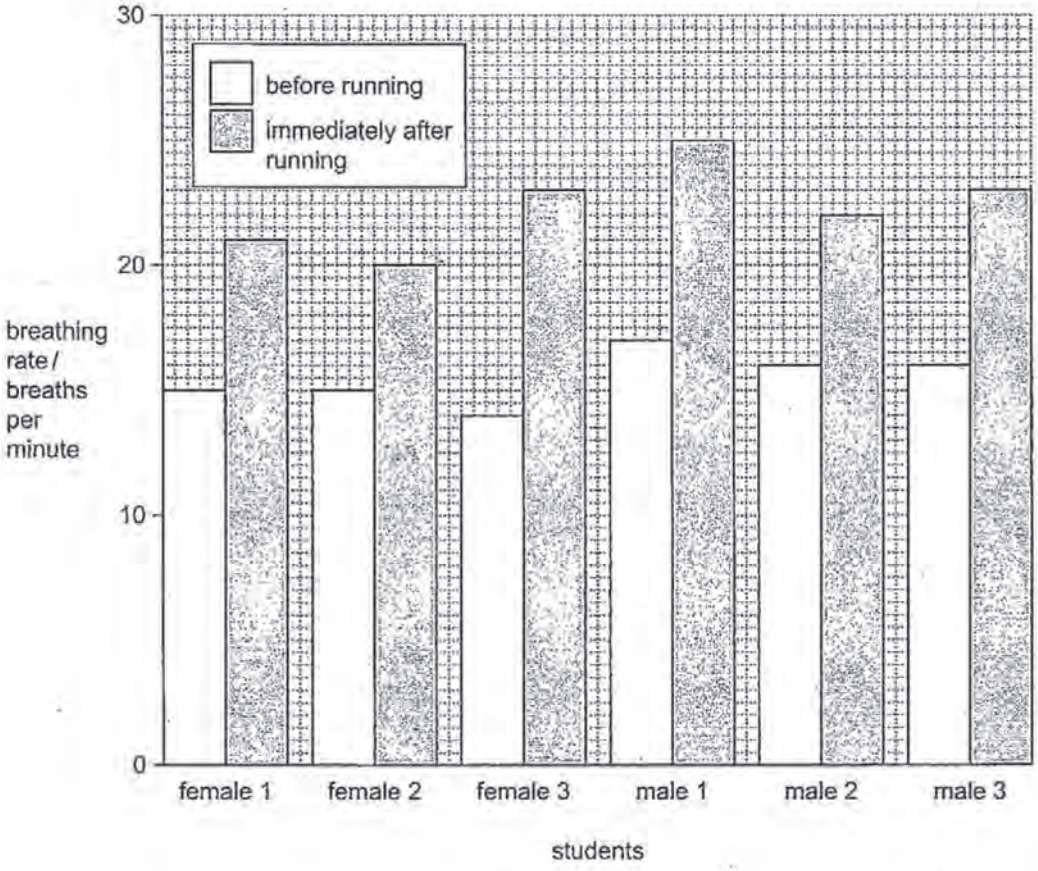


Fig. 2.2

(i) State which student has the highest breathing rate before running.

female male 1 [1]

(ii) State which student has the smallest change in breathing rate from before to immediately after running.

female 2 [1]

(iii) Describe any patterns shown by the results.

from female 1 the pattern increases from the before running bar to the after running bar then it decreases to the before running bar of the female 2 and increases again to bar [2]

(d) Explain why breathing rate changes during exercise.

For Examiner's Use

During exercise the breathing rate changes, because ~~it~~ for example if you are jogging or running the breathing rate increases because you are using the oxygen which is inside your body to do these exercises. After the exercise you take in oxygen to replace the one used.

[4]

[Total: 13]

Examiner comment – grade E

In **(a)** the candidate gained credit for only one correct identification (label M). A more careful examination of the diagram should have suggested that label O was labelling a structure within the lung rather than the lung itself. For the latter the line would have terminated at the outer surface of the lung.

In **(b)** the candidate refers to the use of a breathing monitor and also the need to gather the data over a set period of time for full credit.

The responses in **(c)** show the ability to extract relevant data from the bar charts but not to be able to pick out patterns such as the increase of breathing rate after running, the higher breathing rates of males compared to females before and after running or the fact that the increases of breathing rates vary from individual to individual.

In **(d)** although the candidate refers to the use of oxygen, this alone gains no credit. To do so there should have been a reference to the need for increased amounts of oxygen. Also references to the demand for more energy released by respiration and for the increased activity of the muscles would have gained further credit.

Mark awarded = 5 out of 13

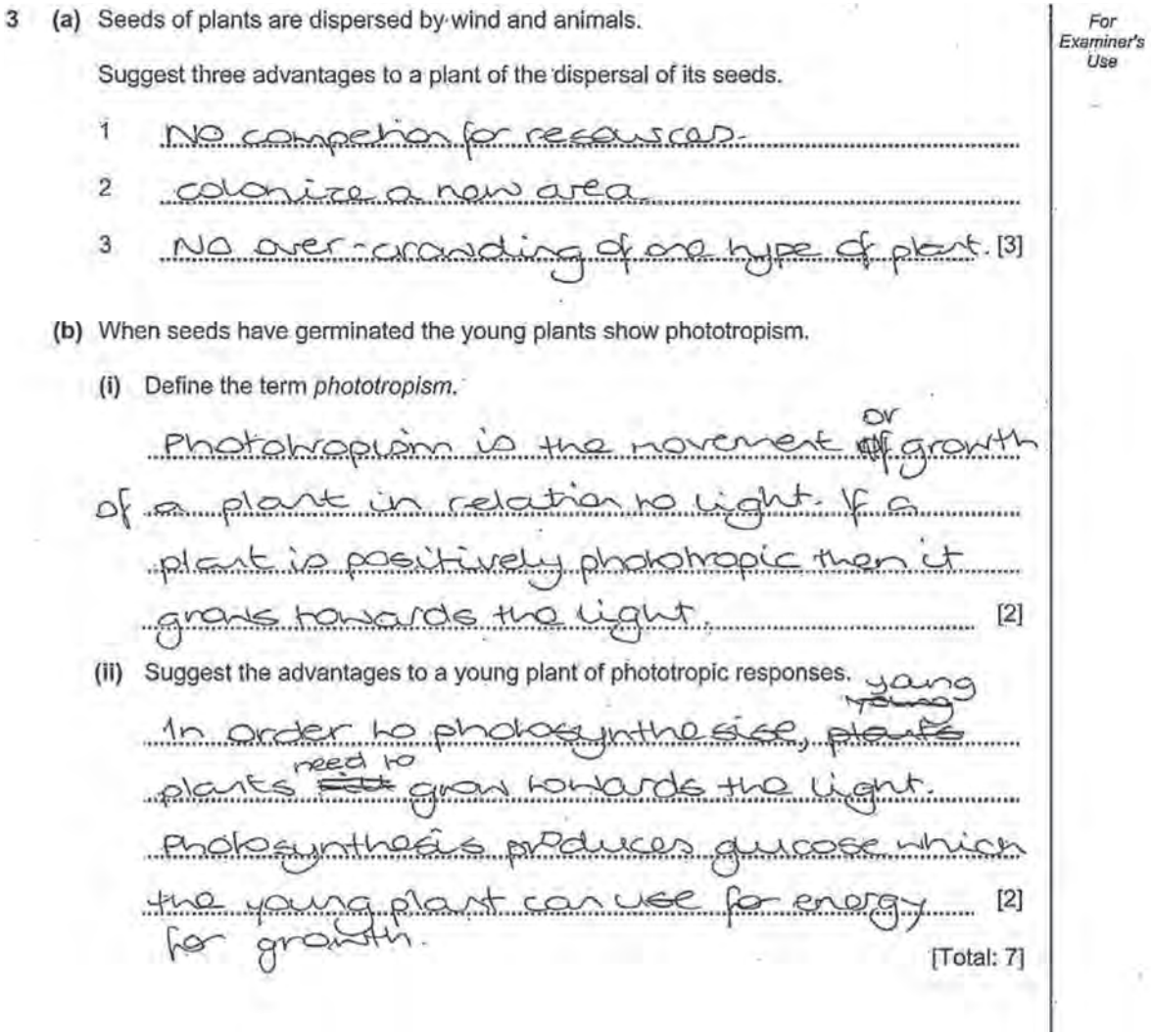
Question 3

Mark scheme

3	(a)	1 less competition for (rooting) space; 2 less competition for light; 3 less competition for minerals / salts; 4 less competition for water; 5 less risk of all destroyed by disease / disaster; 6 colonisation of new places; any three – 1 mark each	[3]	all points in context of either parent-seedling or seedling-seedling competition MP3 A – ions / named examples I – ref to nutrients MP1–5 A – less competition unqualified for 1 mark if no specific examples given A – ref to fires
	(b)	(i) growth of stem; towards light; **OR** growth of root; away from light; **OR** growth of plant; towards or away from light; (ii) shoot / plumule / stem grows towards light; gets (more) light for photosynthesis; **OR** root / radicle grows away from light / into soil (if root exposed); improves anchorage / reaches water / minerals; any two – 1 mark each	[2] [2]	A – refs to chlorophyll formation
			[Total: 7]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade C



3 (a) Seeds of plants are dispersed by wind and animals.

Suggest three advantages to a plant of the dispersal of its seeds.

1 No competion for resources.

2 colonize a new area.

3 No over-crowding of one type of plant. [3]

For Examiner's Use

(b) When seeds have germinated the young plants show phototropism.

(i) Define the term *phototropism*.

Photowropism is the movement or growth of a plant in relation to light. If a plant is positively phototropic then it grows towards the light. [2]

(ii) Suggest the advantages to a young plant of phototropic responses.

In order to photosynthesise, young plants need to grow towards the light. Photosynthesis produces glucose which the young plant can use for energy for growth. [2]

[Total: 7]

Examiner comment – grade C

The candidate in **(a)** has realised that the dispersal of seeds reduced competition for resources and allows colonisation of new habitats. Full marks could have been gained if another specific resource had been named in answer space 1.

In both **(bi)** and **(bii)** the candidate's response could have been extended to gain full credit. In both cases the basic concept that trophic responses are by growth has been recognised but in **(bi)** the candidate has not pinpointed the direction a part of the plant grows in, i.e. stems towards light or roots away from light and in **(bii)** that it is the stem or shoot that needs to grow towards light as this is where photosynthesis occurs.

Mark awarded = 4 out of 7

Example candidate response – grade E

3 (a) Seeds of plants are dispersed by wind and animals.

Suggest three advantages to a plant of the dispersal of its seeds.

1 Stable population

2 less competition for water & space

3 offspring will not be the same as parent [3]

For Examiner's Use

(b) When seeds have germinated the young plants show phototropism.

(i) Define the term *phototropism*.

* This is when a leave or stem is to response due to a stimulus of light in a certain direction [2]

(ii) Suggest the advantages to a young plant of phototropic responses.

* plant can have alot of Concentration of auxin and also they will have the chance in choosing the direction of response towards light or away from light [2]

[Total: 7]

Examiner comment – grade E

The candidate has recognised the concept of reduced competition in **(a)** but has unfortunately combined two resources for which there is less competition in a single response. If this had been presented as two separate responses the candidate would have doubled the mark awarded.

In **(bi)** the response deals with the stimulus but fails to link it to a growth response and thus only gains part of the available credit. Unfortunately the response in **(bii)** suggests that plants can choose the direction of the response and also does not suggest what advantage the direction of growth confers on the plant.

Mark awarded = 2 out of 7

4	(a)	**(i)** 1 by diffusion; 2 through root hairs; 3 from soil water / in solution in soil water; 4 down concentration gradient; Any two – 1 mark each	[2]	MP1 A – ref to active transport MP4 A – against the concentration gradient (linked to active transport)
		(ii) fungi / bacteria;	[1]	A – decomposers
	(b)	**(i)** to allow them to be absorbed / carried in plasma;	[1]	
		(ii) bone / tooth / muscle;	[1]	A – ref to enamel or dentine
	(c)	1 minerals in dung / faeces; 2 a concentrated / rich source of phosphates; 3 excreta broken down / minerals released into soil; 4 replaces phosphates removed by plants / crops; 5 thus new plants / crops grow well / no deficiency; 6 thus minerals recycled; any three – 1 mark each	[3]	
			[Total: 8]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade C

4 Fig. 4.1 shows the cycling of phosphate ions in living organisms and the environment.

For Examiner's Use

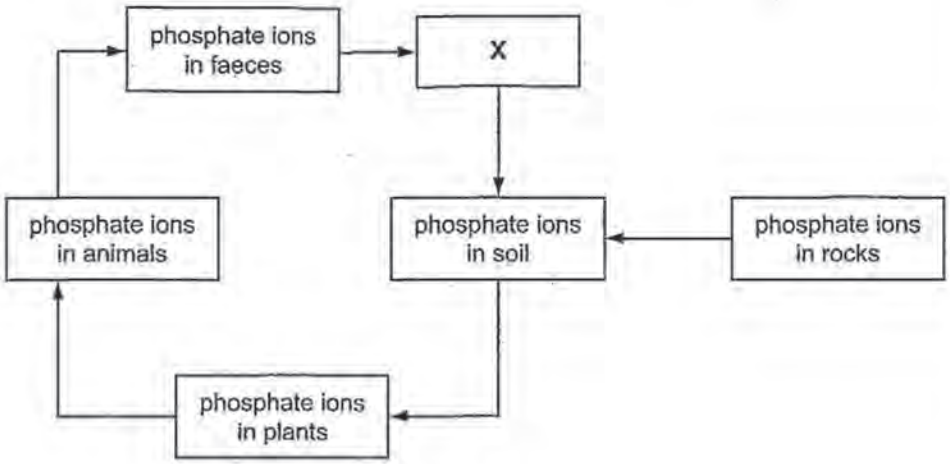


Fig. 4.1

(a) Phosphate ions are often in limited supply in the soil but are needed by all living organisms.

(i) Describe how plants might obtain phosphate ions from the soil.

These phosphate ions may be absorbed through the roots of the plant from the soil. This would occur through the process of osmosis.

[2]

(ii) Name **one** group of organisms represented by box **X**.

decomposer [1]

(b) In humans, phosphate ions may be used in a similar way to calcium ions.

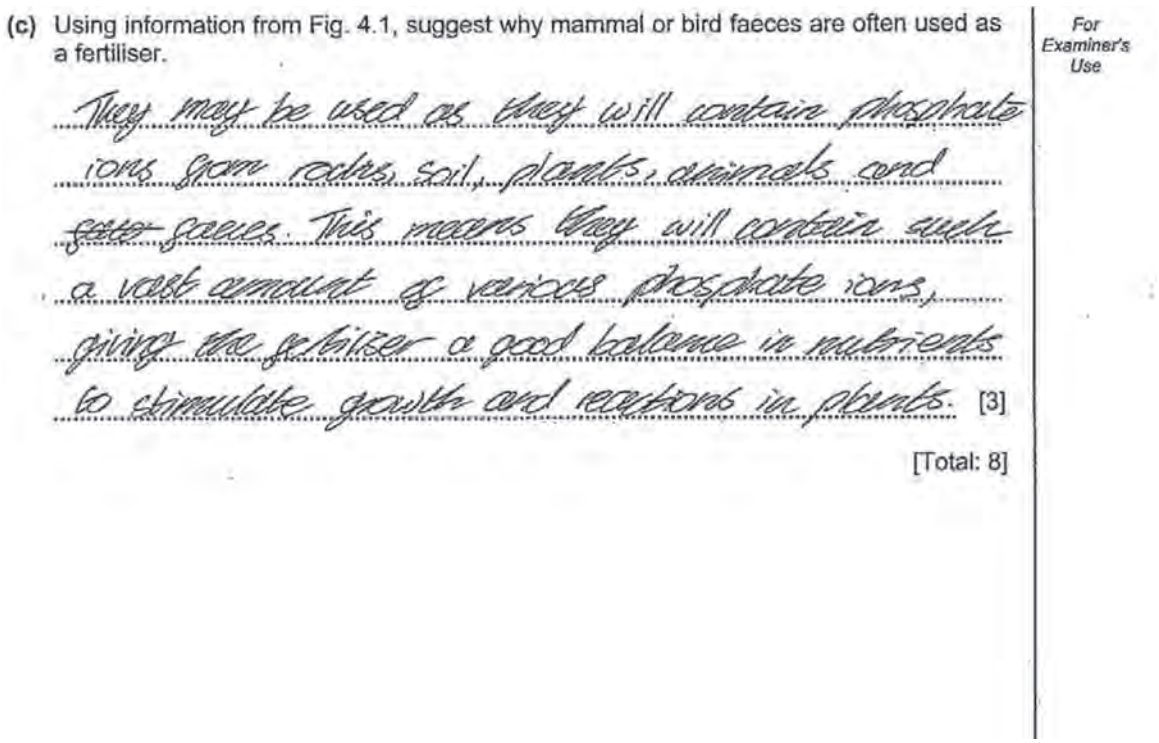
(i) Phosphates may be present in the diet as soluble phosphate ions.

Suggest why only the soluble phosphates in food enter the bloodstream of a human.

They have to be soluble so they can diffuse into the bloodstream [1]

(ii) Name **one** human tissue that is likely to contain phosphates.

Bone marrow in bones [1]



(c) Using information from Fig. 4.1, suggest why mammal or bird faeces are often used as a fertiliser.

For Examiner's Use

They may be used as they will contain phosphate ions from rotten soil, plants, animals and ~~eate~~ faeces. This means they will contain such a vast amount of various phosphate ions, giving the fertilizer a good balance in nutrients to stimulate growth and reactions in plants. [3]

[Total: 8]

Examiner comment – grade C

Unfortunately the candidate confused the uptake of water into roots by osmosis with the diffusion of phosphate ions into roots and gained no credit in **(ai)**. A good response would have identified that this occurs via the root hairs and depends on a concentration gradient between the soil water and cells in the root. In **(aii)** the candidate identified decomposers as organisms represented by box X. The response could have been slightly more specific and named either bacteria or fungi.

The responses in **(b)** were both correct and **(bi)** was a particularly perceptive answer linking to the idea of the need for solubility to allow entry into the blood by diffusion.

In **(c)**, the candidate recognised that faeces contain minerals and that they will be a rich source of phosphates. More credit could have been gained if the response had linked in the role of the decomposers or the idea that the value of the fertiliser is to replace phosphates removed by earlier crops.

Mark awarded = 5 out of 8

Example candidate response – grade E

4 Fig. 4.1 shows the cycling of phosphate ions in living organisms and the environment.

For Examiner's Use

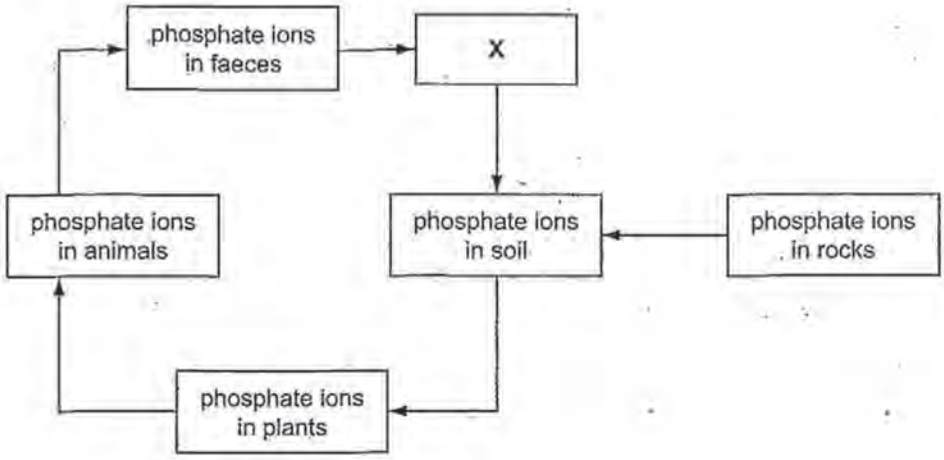


Fig. 4.1

(a) Phosphate ions are often in limited supply in the soil but are needed by all living organisms.

(i) Describe how plants might obtain phosphate ions from the soil.

They would obtain phosphate ions from soil through absorption of mineral salts from the roots to the plant.

[2]

(ii) Name **one** group of organisms represented by box **X**.

Bacteria.

[1]

(b) In humans, phosphate ions may be used in a similar way to calcium ions.

(i) Phosphates may be present in the diet as soluble phosphate ions.

Suggest why only the soluble phosphates in food enter the bloodstream of a human.

Because it is able to be absorbed in the blood that is why it enters the blood stream.

[1]

(ii) Name **one** human tissue that is likely to contain phosphates.

egg tissue Red blood cell.

[1]

(c) Using information from Fig. 4.1, suggest why mammal or bird faeces are often used as a fertiliser.

For Examiner's Use

& Inorder to provide minerals to the plant so as to make
it enable the growth of a plant.
They are also used so as to provide or make the soil fertile
so as to enable growth of plant.
Moreover, it is beneficial to the root as it helps to trap
mineral salts and water from the ground. [3]

[Total: 8]

Examiner comment – grade E

In **(ai)** although there are no errors the answer is rather generalised. A better response would have made reference to the root hair cells, diffusion of the phosphate ions and the need for a concentration gradient between the soil water and the root cells. In **(aii)** the candidate correctly identified bacteria as organisms represented by box X.

In **(bi)** the response correctly linked the need for solubility to the process of absorption in the digestive system. However, although all cells contain some phosphate ions – it was expected in **(bii)** that a candidate would select an example in which these ions are especially important – such as bone, tooth enamel or dentine.

In **(c)** the candidate realised that faeces contain supplies of minerals such as nitrates. However a stronger answer would have would have developed this to relate to decomposers such as the bacteria mentioned in **(aii)** and the fact that these sources of minerals replace those lost from the soil in earlier crops.

Mark awarded = 3 out of 8

Question 5

Mark scheme

<table>
<tr>
<td>5 (a)</td>
<td>
<table>
<tr><th>substance</th><th>enters the blood</th><th>leaves the blood</th></tr>
<tr><td></td><td>lungs;</td><td></td></tr>
<tr><td></td><td></td><td>liver;</td></tr>
<tr><td></td><td></td><td>kidney;</td></tr>
</table>
</td>
<td>[3]</td>
<td>A – alveoli
A – Bowman's capsule / glomerulus</td>
</tr>
<tr>
<td>(b)</td>
<td>prevents / reduces risk of microorganisms entering blood / tissues;
stops / reduces loss of blood;</td>
<td>[2]</td>
<td>A – ref to bacteria / viruses
I – ref to germs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Total: 5]</td>
<td></td>
</tr>
</table>

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade C

5 **(a)** One function of the blood is to transport substances around the body.

Complete Table 5.1 to show where some substances may enter and leave the blood.

For Examiner's Use

Table 5.1

substance	enters the blood	leaves the blood
oxygen	lungs	muscle cells
insulin	pancreas	liver
urea	liver	kidneys

[3]

(b) Another function of the blood is to form a clot if the skin is cut.

State two advantages to the body of the blood clotting at a cut in the skin.

1 It prevent the cost of blood

2 It prevent the bacterial from entering into the body [2]

[Total: 5]

Examiner comment – grade C

In **(a)** the candidate clearly understood the entry into and exit from the blood of the oxygen and insulin it carries but did not realise that the kidney removes urea from the blood.

In **(b)** the response was fully correct as the candidate identified both reducing blood loss and preventing the entry of pathogens as advantages of clotting at a cut; also the term bacteria was used rather than vague terms such as germs or infection.

Mark awarded = 4 out of 5

Example candidate response – grade E

5 (a) One function of the blood is to transport substances around the body.

Complete Table 5.1 to show where some substances may enter and leave the blood.

For Examiner's Use

Table 5.1

substance	enters the blood	leaves the blood
oxygen	lungs	muscle cells
insulin	pancreas	Kidneys
urea	liver	bladder

[3]

(b) Another function of the blood is to form a clot if the skin is cut.

State two advantages to the body of the blood clotting at a cut in the skin.

1 Prevents further blood loss

2 Prevents infections from occurring

[2]

[Total: 5]

Examiner comment – grade E

The candidate had knowledge of the entry into the blood of oxygen but was confused in **(a)** about the exit from the blood of both insulin (via the liver) and urea (via the kidney).

In **(b)** the candidate recognised that clotting reduces blood loss but did not gain credit for the statement about preventing infections. Clotting reduces the risk of entry of pathogens but is no guarantee of preventing infections.

Mark awarded = 2 out of 5

6	(a)	(i) (tropic level) 1 / producers; (ii) cheetah / hyena / lion;	[1] [1]	I – ref to primary
	(b)	(i) (animal / consumer / organism) that eats plants / vegetation; it eats only plants / does not eat meat / other consumers; (ii) because of its size it is basically free of predators;	[2] [1]	A – ref to animal that gets energy from plants
	(c)	(i) bacteria / fungi / (fly) maggots; (ii) 1 various mineral / ions removed from soil by plants; 2 need to be replaced; 3 or plant regrowth is restricted; 4 decomposers release minerals from dead remains; 5 without this action get build up of dead material; 6 also soil becomes less fertile; any three – 1 mark each	[1] [3]	A – named example A – MP1, 3 and 4 in terms of carbon dioxide
	(d)	grass, zebra / impala, cheetah, hyena OR acacia, impala, cheetah, hyena chain of four organisms from food web; shown in correct order; arrows showing direction of energy flow;	[3]	**NO MARK**
			[Total: 12]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade C

6 Fig. 6.1 shows a food web from the African savannah (grassland).

For Examiner's Use

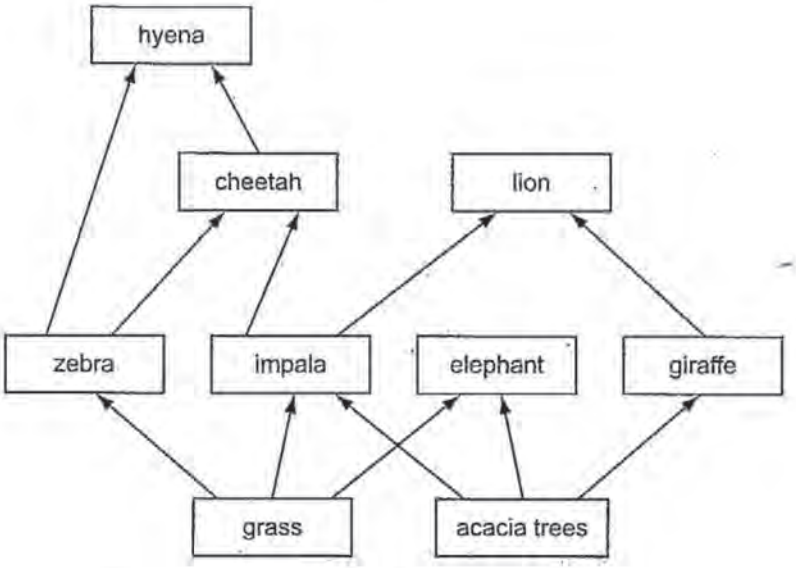


Fig. 6.1

(a) (i) State the trophic level that the acacia trees occupy.

1st trophic level [1]

(ii) Name **one** secondary consumer in Fig. 6.1.

lion [1]

(b) Elephants are herbivores.

(i) Explain what is meant by the term *herbivore*.

A herbivore animal is one that obtains its energy by eating plants

[2]

(ii) Suggest why elephants are not linked to any of the predators in the food web.

elephants are not linked to any predators because the are enourmously large and [1]
are usually is not eaten because the y can defend themselves.

(c) Decomposers are found on the dead bodies of plants and animals.

For Examiner's Use

(i) Name **one** type of decomposer in such a food web.

Bacteria [1]

(ii) Explain why decomposers are very important in the savannah ecosystem.

Decomposers are very important because they release carbon dioxide back into the atmosphere. They bring nutrients for and minerals to the soil, making soil fertile

[3]

(d) Draw a food chain of **four** organisms using information from Fig. 6.1.

grass → zebra → cheetah → hyena.

GRASS → ZEBRA → CHEETAH → HYENA [3]

[Total: 12]

Examiner comment – grade C

In **(a)** the candidate identified the trophic level of the acacia trees and also a secondary consumer (lion), gaining full credit.

In **(bi)** the response recognises that herbivores eat plants but does not make the point that they only eat plants or that they do not eat animal tissue, and thus does not gain full credit. Also, in **(bii)**, the candidate has realised that because of their size most elephants are not normally the prey of the three secondary consumers in the food web (although it is true that lions hunting as a group may occasionally kill a young or weak elephant).

The response for **(ci)** is totally correct but in **(cii)** the candidate has only touched upon the importance of bacteria in the savannah ecosystem in relation to their decomposition action releasing carbon dioxide back into the environment. A stronger response would have linked their activity to the need to recycle not only carbon dioxide but also minerals from dead animal and plant remains to replace minerals removed by plants and passed along the food web. Without this recycling process this ecosystem would become less fertile with time.

In **(d)** the candidate has constructed a suitable food chain based on the food web and has correctly shown the flow of energy by a series of arrows, gaining full credit.

Mark awarded = 9 out of 12

Example candidate response – grade E

6 Fig. 6.1 shows a food web from the African savannah (grassland).

For Examiner's Use

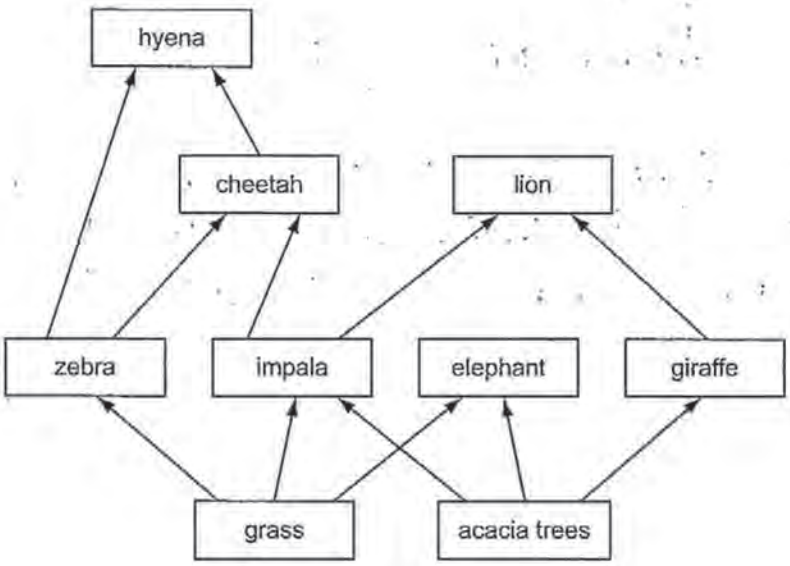


Fig. 6.1

(a) (i) State the trophic level that the acacia trees occupy.

lion [1]

(ii) Name **one** secondary consumer in Fig. 6.1.

impala [1]

(b) Elephants are herbivores.

(i) Explain what is meant by the term *herbivore*.

Herbivore means the animals which only eat plants and don't animals they are know herbivore. for eg :- Elephants etc. [2]

(ii) Suggest why elephants are not linked to any of the predators in the food web.

Because it is a huge animal and ~~none~~ none can attack this animal. [1]

(c) Decomposers are found on the dead bodies of plants and animals.

For Examiner's Use

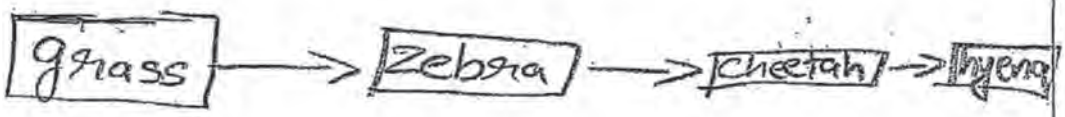
(i) Name **one** type of decomposer in such a food web.

~~Hyena~~ Micro organisms [1]

(ii) Explain why decomposers are very important in the savannah ecosystem.

so that the dead bodies are not left theis in Savannah which could dirty the place. [3]

(d) Draw a food chain of **four** organisms using information from Fig. 6.1.



[3]

[Total: 12]

Examiner comment – grade E

In **(a)** the candidate did not seem familiar with either of the terms trophic level or secondary consumer and thus gained no credit.

In **(bi)** the candidate understood that herbivores only eat plants and not any animals, and also in **(bii)** recognised that the great size of elephants generally protects them from attacks by the carnivores in this food web.

In **(ci)** the response was not adequate as it was not specific enough. This is because there are many types of microorganisms that are not decomposers. The response was also rather vague in **(cii)**. A stronger response would have linked the action of the decomposers to recycling minerals from the material for reuse by plants in this ecosystem and that the soil would not become continually less fertile as a resort.

The candidate constructed a correct food chain showing the flow of energy by a series of linking arrows in **(d)**, gaining full credit.

Mark awarded = 6 out of 12

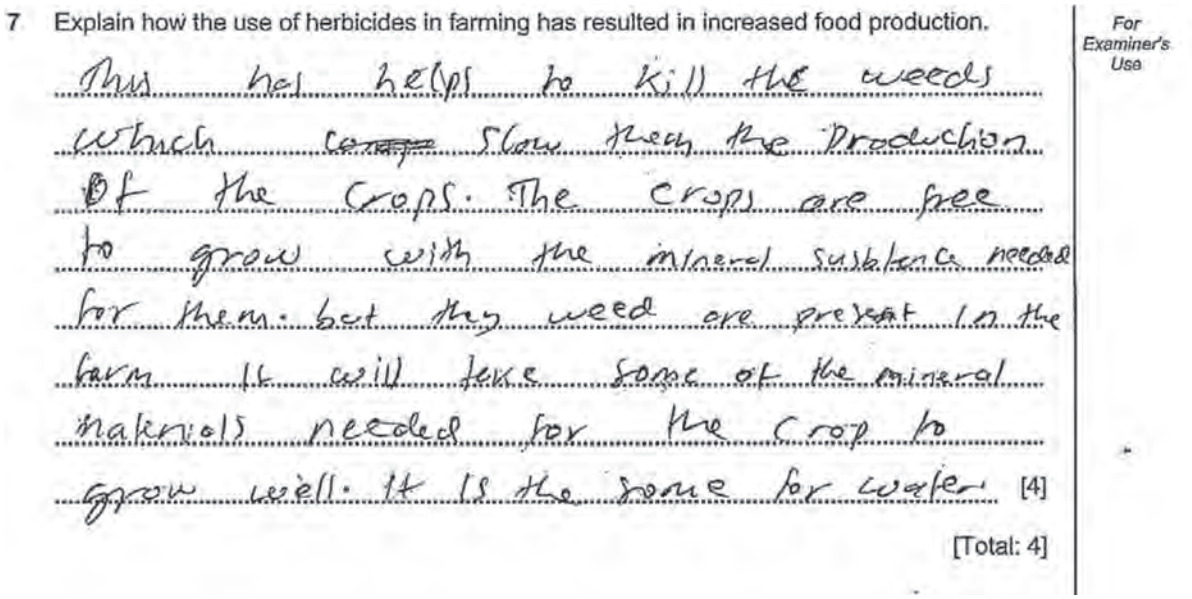
Question 7

Mark scheme

7	1 herbicides kill competing species / weeds; 2 reduces competition for minerals / ions; 3 reduces competition for light / removes shading of crop; 4 reduces competition for water; 5 reduces competition for space 6 some weeds have antagonistic effect of crop plants; 7 crop grows faster / process bigger yield; 8 weeds can harbour harmful bacteria / fungi / insects; any four – 1 mark each	[4]	A – named example, I – ref to nutrients MP2–5 A – less competition unqualified for 1 mark if no specific examples given MP8 A – in context of harm to crop plant, A – pests
		[Total: 4]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade C



7 Explain how the use of herbicides in farming has resulted in increased food production.

For Examiner's Use

This has helps to kill the weeds which ~~comp~~ slow down the production of the crops. The crops are free to grow with the mineral substance needed for them. but the weed are present in the farm it will take some of the mineral materials needed for the crop to grow well. It is the same for water. [4]

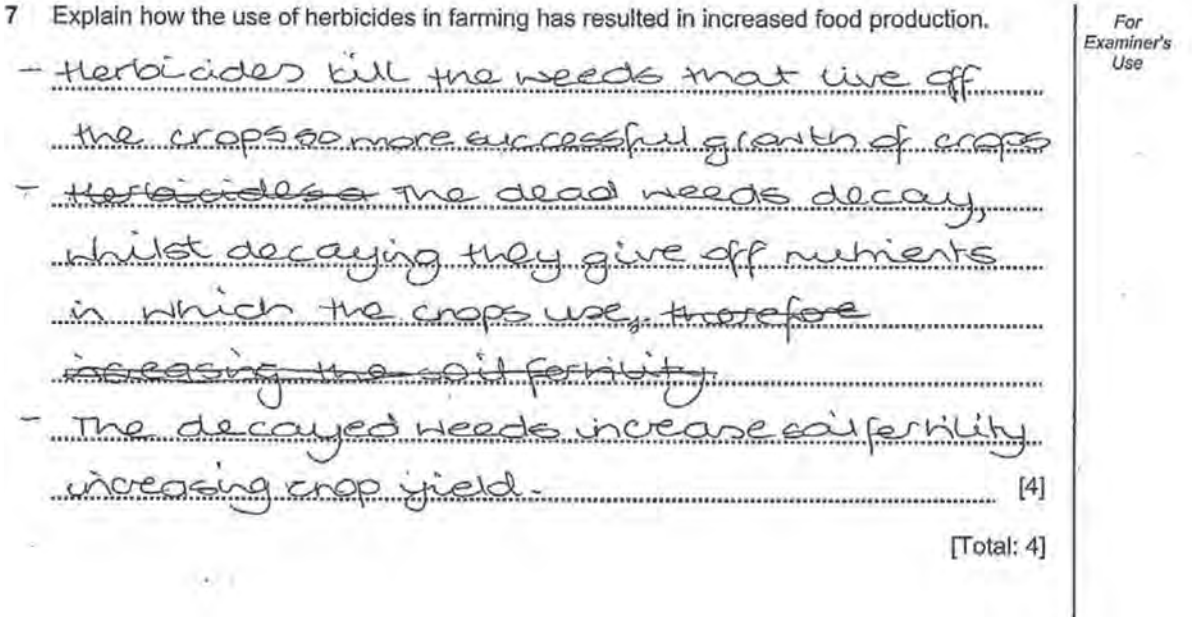
[Total: 4]

Examiner comment – grade C

The candidate identifies that herbicides kill weeds and then expands the response to explain how the weeds would have taken both minerals and water needed by the crop plant for maximum growth. This could be further expanded by reference to less competition for light or for rooting space.

Mark awarded = 3 out of 4

Example candidate response – grade E



7 Explain how the use of herbicides in farming has resulted in increased food production.

For Examiner's Use

- herbicides kill the weeds that live off the crops so more successful growth of crops
- ~~herbicides a~~ The dead weeds decay, whilst decaying they give off nutrients in which the crops use, ~~therefore increasing the soil fertility.~~
- The decayed weeds increase soil fertility increasing crop yield. [4]

[Total: 4]

Examiner comment – grade E

The candidate makes the point that herbicides kill weeds. However the response does not expand on this by stating the advantages this confers on crop growth in removing competition, which would be expected for a better response. This response gains minimal credit.

Mark awarded = 1 out of 4

8	(a)	1 growth / germination needs energy; 2 seed respires; 3 using food reserves / named example; 4 no photosynthesis happening; any three – 1 mark each	[3]	A – carbohydrate, starch, sugar, glucose, fat
	(b)	1 shoot above ground; 2 leaves are green; 3 exposed to light; 4 photosynthesis starts; 5 new materials formed / named example; 6 more formed than reserves used up; any three – 1 mark each	[3]	
	(c)	13 days;	[1]	A – 12.8 to 13.2 days
			[Total: 7]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade C

8 Fig. 8.1 shows changes in the dry mass of pea seeds as they germinate and grow into seedlings.

For Examiner's Use

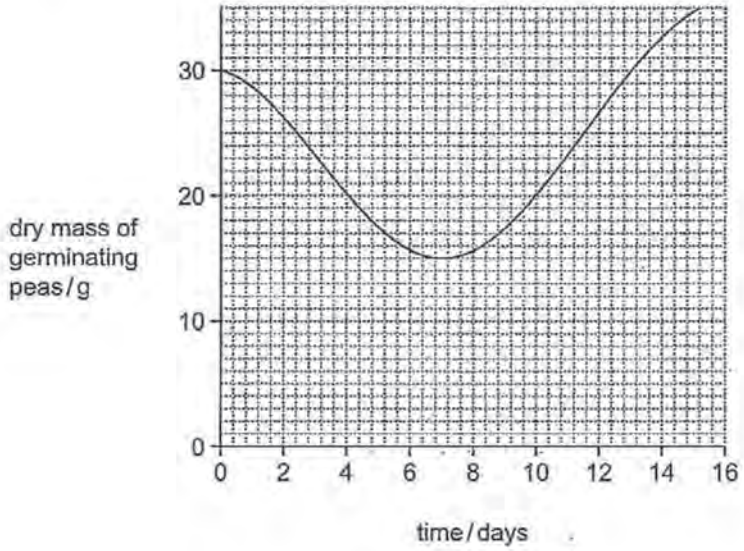


Fig. 8.1

(a) Explain why the germinating peas lost dry mass during the first days of the investigation.

the enzymes are activated also they consumes the by water and oxygen nutrients at their disposition in order to grow so that dry mass falls, this energy will be used to grow the shoot of the plant out of the soil and to start photosintesis. to

[3]

(b) Suggest why the pea seedlings increased in dry mass after day 7.

the shoot is now out of the ground soil and now it can start carrying out photosintesis and create glucose for own use, so the plant will start to grow.

[3]

(c) State how long after the start of the investigation it took for the seedlings to regain their original dry mass.

14 days

[1]

[Total: 7]

Examiner comment – grade C

The candidate has recognised in **(a)** that the seed is using nutrients within the seed and this leads to making energy available for germination, although there is no reference to respiration, which causes the fall in dry mass.

In **(b)** the candidate carries on the theme from **(a)** that the shoot is out of the soil and can carry out photosynthesis to manufacture glucose, gaining full credit.

The answer in **(c)** the candidate has wrongly selected four days from the graph. The graph should be interpreted at the point on the graph where the mass returns to its original 30g i.e. 13 days. No marks were awarded.

Mark awarded = 4 out of 7

Example candidate response – grade E

8 Fig. 8.1 shows changes in the dry mass of pea seeds as they germinate and grow into seedlings.

For Examiner's Use

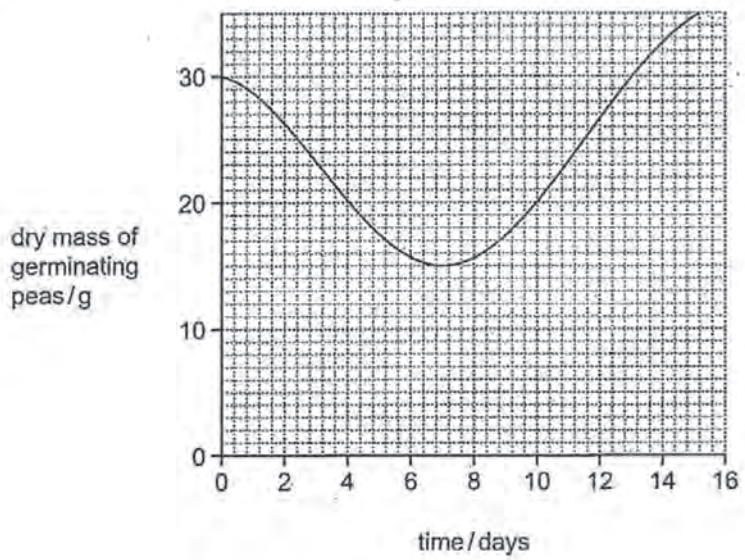


Fig. 8.1

(a) Explain why the germinating peas lost dry mass during the first days of the investigation.

The germinating peas lost dry mass because during these first days the food stored in the embryo are used up in aiding the seed to germinate. Also the seed coast ~~had~~ was wearing off so the embryo ~~peas~~ gave up most of what it was containing to prevent dormancy. [3]

(b) Suggest why the pea seedlings increased in dry mass after day 7.

after these 7 days the embryo cotyledon has started absorbtion of nutrients from the soil so this makes photosynthesis and the eating the cotyledon begins to dry up and soon it falls off. [3]

(c) State how long after the start of the investigation it took for the seedlings to regain their original dry mass.

It took the seedlings 13 days to regain their original dry mass [1]

[Total: 7]

Examiner comment – grade E

In **(a)** the candidate recognised that the loss of dry mass was linked to the usage of stored food within the seed and gained one mark for this. However, this was not developed to cover points such as the need for energy to be released from the stored materials by respiration for germination and the fact that no photosynthesis was occurring.

Unfortunately in **(b)** the candidate did not relate the rise in dry mass to the start of the process of photosynthesis, which produces new materials for the growth of the seedling, as the shoot was now above ground. No marks were given for this answer.

The candidate extracted the relevant data from the graph for the response to **(c)** and gained one mark.

Mark awarded = 2 out of 7

Question 9

Mark scheme

<table>
<tr>
<td>9 (a)</td>
<td>(i) A – sperm cell;
B – white blood cell / phagocyte / leucocyte;

(ii) fusing with ovum / egg (cell) / fertilisation / forming zygote;
has tail to swim to reach ovum;

(iii) to surround / engulf / digest / destroy microorganisms / phagocytosis;</td>
<td>[2]

[2]

[1]</td>
<td>A – lymphocyte

I – ovule
A – is haploid, streamlined, has acrosome, mitochondria,

A – produce antibodies</td>
</tr>
<tr>
<td>(b)</td>
<td>
<table>
<tr><th>type of cell</th><th>number of chromosomes</th></tr>
<tr><td>nerve cell C</td><td>46</td></tr>
<tr><td>cell A</td><td>23;</td></tr>
<tr><td>cell B</td><td>46;</td></tr>
<tr><td>red blood cell D</td><td>0;</td></tr>
</table>
</td>
<td>[3]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Total: 8]</td>
<td></td>
</tr>
</table>

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade C

9 Fig. 9.1 shows four animal cells.

For Examiner's Use

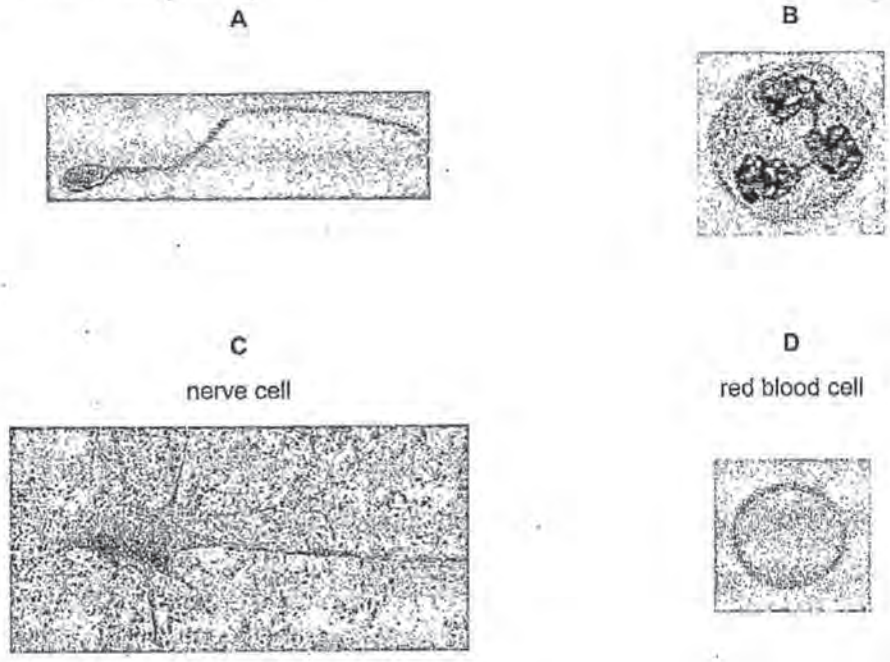


Fig. 9.1

(a) (i) Identify the cells labelled A and B.

A sperm

B white blood cell [2]

(ii) State the function of cell A and describe how it is adapted to this function.

A sperm is a cell with a genetic information it has a nucleus that carries the information from the male's body to the female's body (by ejaculation) this the two gametes meet and fertilised then form a new individual [2]

(iii) State **one** function of cell B.

engulf the bacteria and forms antibodies

[1]

(b) The cells in Fig. 9.1 are all from the human body.

Complete Table 9.1 to show the number of chromosomes in these cells. One has been completed for you.

For Examiner's Use

Table 9.1

type of cell	number of chromosomes
cell **A**	23
cell **B**	0
nerve cell **C**	46
red blood cell **D**	0

[3]

[Total: 8]

Examiner comment – grade C

In **(ai)** the candidate correctly identified cells A and B. However in **(aii)** the candidate only partially answered the question because the function of cell A (a sperm cell) was described but there was no indication as to how it was adapted for this function – a tail for swimming to the ovum would have been a good answer. A function of cell B was correctly stated in **(aiii)**.

In **(b)** the candidate did not overlook the fact that red blood cells have no nucleus, a feature of many weaker answers. The candidates also stated that there were no chromosomes in this cell but unfortunately this seemed to be erroneously applied to cell B – which would have the full number of 46 chromosomes in its nucleus.

Mark awarded = 6 out of 8

Example candidate response – grade E

9 Fig. 9.1 shows four animal cells.

For Examiner's Use

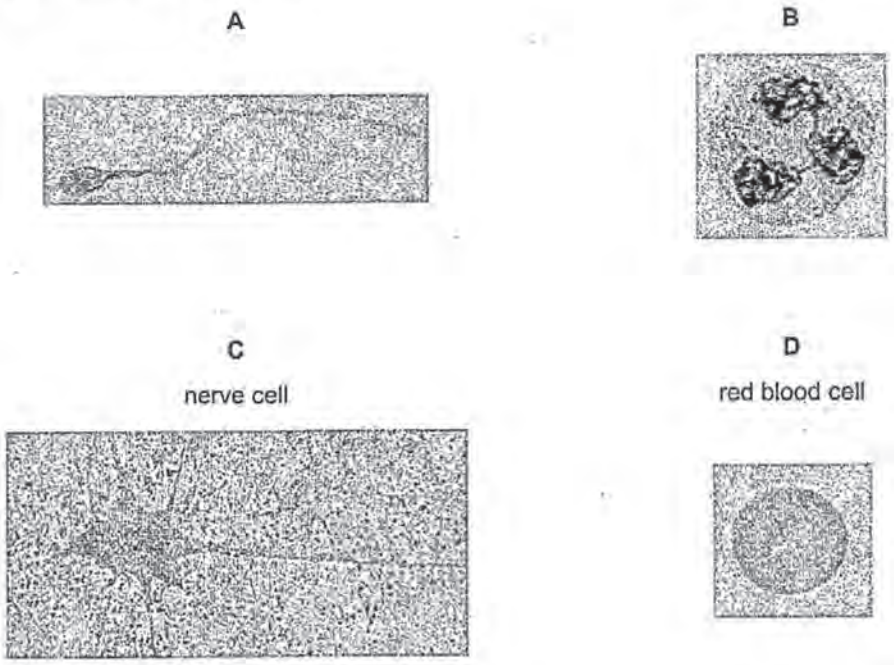


Fig. 9.1

(a) (i) Identify the cells labelled **A** and **B**.

A sperm cell

B Egg cell (ovary) [2]

(ii) State the function of cell **A** and describe how it is adapted to this function.

The function of cell A is to fertilize the female egg cell. It is adapted to this function, it swims all the way into the vagina to the direction of the ovary. [2]

(iii) State **one** function of cell **B**.

it consists of the XX chromosomes it combines with a male sex cell to form a zygot. [1]

(b) The cells in Fig. 9.1 are all from the human body.

Complete Table 9.1 to show the number of chromosomes in these cells. One has been completed for you.

For Examiner's Use

Table 9.1

type of cell	number of chromosomes
cell A	23
cell B	23
nerve cell C	46
red blood cell D	46

[3]

[Total: 8]

Examiner comment – grade E

In **(ai)** the candidate correctly identified cell A but not cell B. Weaker responses often contain this misunderstanding that cell B was an egg cell as well as thinking that an egg cell was the ovary itself.

In **(aii)** the candidate has identified the function of the sperm cell but has not attempted to comment on an adaptation for this function. This could be the result of not reading the question fully. The response to **(aiii)** was unfortunately linked to the misidentification of cell B and so gained no credit.

In **(b)** the candidate correctly linked cell A to the haploid number of chromosomes but also did this for cell B, again linked to the initial misidentification. The fact that red blood cells have no nucleus was overlooked.

Mark awarded = 3 out of 8

10 (a)	(i) when both of a pair of alleles are identical / same;	[1]	A – genes for alleles
	(ii) (thalassaemia allele is) recessive; present in both parents but not affecting them / OWTTE;	[2]	
	(iii) TT **and** Tt;	[1]	
(b)	1 parent genotypes Tt and Tt; 2 gametes T t T t ; 3 offspring genotypes TT Tt Tt tt; 4 phenotypes not affected not affected not affected affected;	[4]	apply ECF for lines following from an erroneous line NB – MP4 must have at least one affected offspring to answer question
(c)	(i) iron;	[1]	
	(ii) have insufficient / malformed haemoglobin; therefore cannot carry enough oxygen; thus cannot release sufficient energy by respiration; any two – 1 mark each	[2]	
		[Total: 11]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade C

10 Thalassaemia is an inherited condition in which the haemoglobin does not work properly.

People who have thalassaemia have inherited an allele that causes the condition from both parents. This can happen even if neither parent has the condition.

(a) (i) State what is meant by the term *homozygous*.

it is a condition where Both The alleles are of same type [1]

(ii) State and explain whether the allele that causes thalassaemia is dominant or recessive.

Thalassaemia is a condition caused when a person inherits an allele from Both The parents (causing disease). Hence, it is a recessive condition [2]

(iii) Using the symbols **T** (dominant) and **t** (recessive) to represent the two alleles, state the possible genotypes for a person who does **not** show symptoms of this condition.

tt [1]

(b) Complete the genetic diagram to explain how two parents who do not show symptoms of the condition can have a child who does have thalassaemia.

For Examiner's Use

	parent 1		parent 2
parental phenotypes	no thalassaemia	×	no thalassaemia
parental genotypes	Tt	×	Tt
gametes	T t	+	T t

♀ / ♂	T	t
T	TT	Tt
t	tT	tt

offspring genotypes	TT	Tt	tT	tt
offspring phenotypes	diseased		Not affected	
	Not affecte		Not affected	

[4]

(c) (i) Thalassaemia has symptoms very like those of anaemia. A deficiency of a mineral in the diet causes anaemia.

Name this mineral.

Iron [1]

(ii) Suggest why people who have thalassaemia find any physical activity very difficult.

With haemoglobin Not working properly O_2 transfer will be affected Therefore, tissues would not receive O_2 required Less energy would be produced Causing fatigue [2]

[Total: 11]

Examiner comment – grade C

In **(ai)** the response identifies the relevant point that both alleles of a pair are the same. In **(aii)** the candidate has recognised that the allele for thalassaemia is recessive as the offspring has inherited the alleles from each parent. However, the candidate has not made the point that although each parent has the allele, neither of them need show the condition. This is the key point of a good explanation.

The question in **(aiii)** asks for the 'genotypes' (plural) of people who do not show the condition, but the candidate has only offered a single genotype and that would be for a person who does show the condition.

In **(b)** the candidate completed a clear genetic diagram except for the fact that the offspring phenotypes were not clearly linked to the relevant genotypes – this is vital to gain full credit.

The candidate identified iron as the mineral whose lack would lead to simple anaemia in **(ci)** and although in **(cii)** the symptom of thalassaemia was linked to reduced levels of oxygen in the body, this response should have been further expanded – a reference to reduced respiration in muscles, for example.

Mark awarded = 7 out of 11

Example candidate response – grade E

10 Thalassaemia is an inherited condition in which the haemoglobin does not work properly.

People who have thalassaemia have inherited an allele that causes the condition from both parents. This can happen even if neither parent has the condition.

(a) (i) State what is meant by the term *homozygous*.

This is the dominant allele

[1]

(ii) State and explain whether the allele that causes thalassaemia is dominant or recessive.

This allele is recessive. ~~Because~~ This is because it seems that in both parents it was not presented but only in the egg spacing which shows that the parents were carriers. [2]

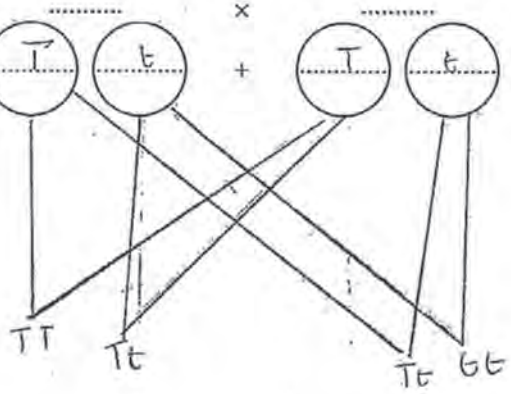
(iii) Using the symbols **T** (dominant) and **t** (recessive) to represent the two alleles, state the possible genotypes for a person who does **not** show symptoms of this condition.

Tt [1]

(b) Complete the genetic diagram to explain how two parents who do not show symptoms of the condition can have a child who does have thalassaemia.

For Examiner's Use

	parent 1		parent 2
parental phenotypes	no thalassaemia	×	no thalassaemia
parental genotypes	.....	×	.....
gametes	T t	+	T t



offspring genotypes	.....	.....	.....	.....
offspring phenotypes	.....	.....	.....	.....
	.....	.....	.....	.....

[4]

(c) **(i)** Thalassaemia has symptoms very like those of anaemia. A deficiency of a mineral in the diet causes anaemia.

Name this mineral.

Amanda [1]

(ii) Suggest why people who have thalassaemia find any physical activity very difficult.

This is because they lack ca
energy to exercise there body [2]

[Total: 11]

Examiner comment – grade E

The candidate clearly did not understand the term homozygous in the response to **(ai)**. In **(aii)** the response shows that the candidate appreciates that the allele is recessive as the parents show no symptoms but can transmit the condition to the offspring, and the candidate confirms this by reference to the parents being carriers. The question in **(aiii)** asks for the 'genotypes' (plural) of people who do not show the condition, but the candidate has only offered a single correct genotype.

In **(b)** the candidate correctly identifies the alleles present in the gametes and uses these to produce the genotypes of the offspring. This response would have gained further credit if the candidate had stated the genotypes of the two parents and also the phenotypes of the offspring.

Although the candidate was unaware of the link between iron and simple anaemia in **(ci)** and offered ammonia as the response, in **(cii)** their response was directed along the right lines but was not developed sufficiently to gain credit. If the lack of energy had been related to a deficiency of oxygen and reduced respiration, full credit would have been gained.

Mark awarded = 4 out of 11

Paper 3 – Extended theory

Question 1

Mark scheme

1	(a)	**A** **B** **C** **D**	left atrium ; mitral / bicuspid / atrioventricular, valve ; semi-lunar valve / pocket valve / aortic valve ; right ventricle ;	[4]	*reject if correct and incorrect answers given for each* **A** atria **A** auricle **A** 'oracle' / 'oricle' **A** if given the plural **A** if given the plural, **A** 'half-moon' valve
	(b)	**E** **F**	(superior / anterior) vena cava ; aorta ;	[2]	
	(c)		coronary ;	[1]	**R** cardiac **A** phonetic spellings *ignore incorrect name for MP1–4*
		1	fatty deposit in (wall of) artery ;		**A** atheroma / plaque **A** cholesterol / LDL / fatty acids **A** arteriosclerosis / described
		2	blocks, artery / restricts, blood flow ;		**A** 'narrows' artery
		3	restricts, oxygen / nutrient, supply ;		**R** if 'to body' ***ignore*** high blood pressure
		4	blood clotting occurs ;	[max 2]	
	(d)		heart not pumping blood / keeps blood circulating ; blood is oxygenated ; carbon dioxide is removed from blood ;	[max 2]	**A** blood not pumped to the lungs **A** exchange of oxygen and carbon dioxide for two marks ***ignore*** 'to keep patient alive' / 'supply heart with blood'
	(e)	1 2 3 4 5 6 7 8 9	ref. to (cardiac) muscle ; ref. to myogenic / heart has own pacemaker ; septum (divides heart into two) ; two (separate) ventricles / AW ; ventricle(s), contract / pump ; increase blood pressure ; right ventricle has thin(er) wall / left ventricle has thick(er) wall ; so low(er) pressure / higher pressure ; (in context) to lungs / to rest of body ; (in context)	[max 4]	**R** 'push' **A** bigger , **R** tougher **A** muscle **A** 'to whole body' for LV if blood to lungs described
				[Total: 15]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade A

1 Heart surgeons may stop the heart beating during operations. While this happens blood is pumped through a heart-lung machine that oxygenates the blood.

For Examiner's Use

Fig. 1.1 is a diagram showing a heart-lung machine in use.

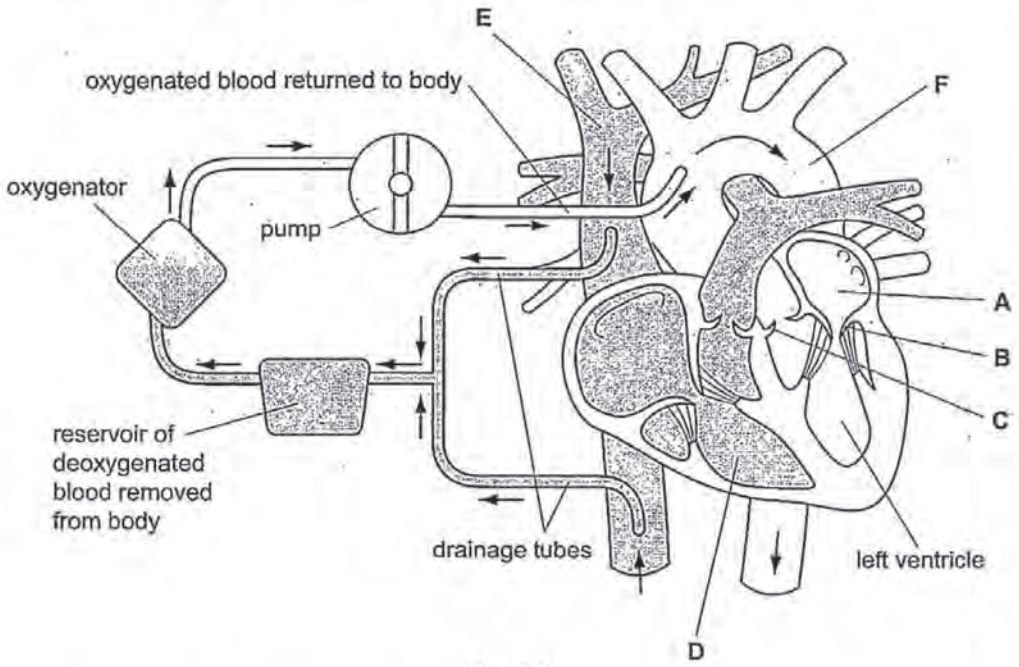


Fig. 1.1

(a) Name the structures labelled **A** to **D**.

A upper chamber

B ~~b valve~~ bicuspid valve

C Tricuspid valve

D lower chamber [4]

(b) Name the blood vessels **E** and **F**.

E vena cava

F Aorta [2]

(c) The heart-lung machine is used so that surgeons can operate on the arteries supplying heart muscle. These arteries may be diseased.

Name these arteries and explain how they may become diseased.

name of arteries coronary ~~Coronary~~ arteries

explanation These ~~artery~~ ~~arteir~~ arteries may have ~~ch~~ of coronaries heart disease in which the blood supply is ~~spa~~ stoped by fatty deposits called thrombus. And sometime blood clotting may occur. This disease is ~~en~~ caused by ~~eating~~ having large ~~am~~ amount of ~~an~~ animal fats and even caused by smoking. [3]

For Examiner's Use

(d) Suggest why a patient is put on a heart-lung machine during such an operation.

To continue the ~~&~~ blood circulation around the body or ~~ele~~ else the human will die.

[2]

Humans have a double circulation system. There is a low pressure circulation and a high pressure circulation.

(e) Explain how the structure of the heart enables it to pump blood into two circulations at different pressures.

As the blood is pumped through out the body ~~heart~~ by heard heart the ~~p~~ blood pressure is more when ~~in~~ it comes out from heart and goes to lungs ~~and~~ as it return back to heart the blood pressure is ~~de~~ decreased and it enters the heart and get pumped again ~~th~~ out to pass through out the body. while the blood comes to heart back it has a very low pressure and again the heart ~~p~~ increases the blood pressure [4]

[Total: 15]

Examiner comment – grade A

1(a) Of these answers, only **B** – bicuspid valve – is correct. 'Upper and lower chambers' are not the correct terms for left atrium and right ventricle. Structure **C** is a different type of valve to the bicuspid valve. This type of valve is a semi-lunar or pocket valve.

1(b) The two blood vessels are named correctly.

1(c) Coronary is named in the answer and coronary artery disease is mentioned in the explanation. The explanation for how the arteries become diseased refers to fatty deposits and blood clotting. The term thrombus is used in the wrong context as it is the blood clot that should be so described. However, the way in which the coronary arteries become diseased is correct and full marks were awarded.

1(d) People undergoing the operation described in the question are put on heart-lung machines to 'continue circulating blood around the body'. This deals with the action of the machine in replacing the heart during the operation. To gain a second mark, the candidate should also refer to the gas exchange that occurs in the lungs – a function that is also replaced by the heart-lung machine.

1(e) The candidate has described changes in blood pressure as blood flows through the circulation system. Unfortunately, nothing in the answer deals with the question about the structure of the heart. The answer should deal with the difference between the thickness of the left and right ventricles so that blood is pumped at a higher pressure into the systemic circulation and at a lower pressure into the pulmonary circulation.

Mark awarded = 7 out of 15

Example candidate response – grade C

1 Heart surgeons may stop the heart beating during operations. While this happens blood is pumped through a heart-lung machine that oxygenates the blood.

For Examiner's Use

Fig. 1.1 is a diagram showing a heart-lung machine in use.

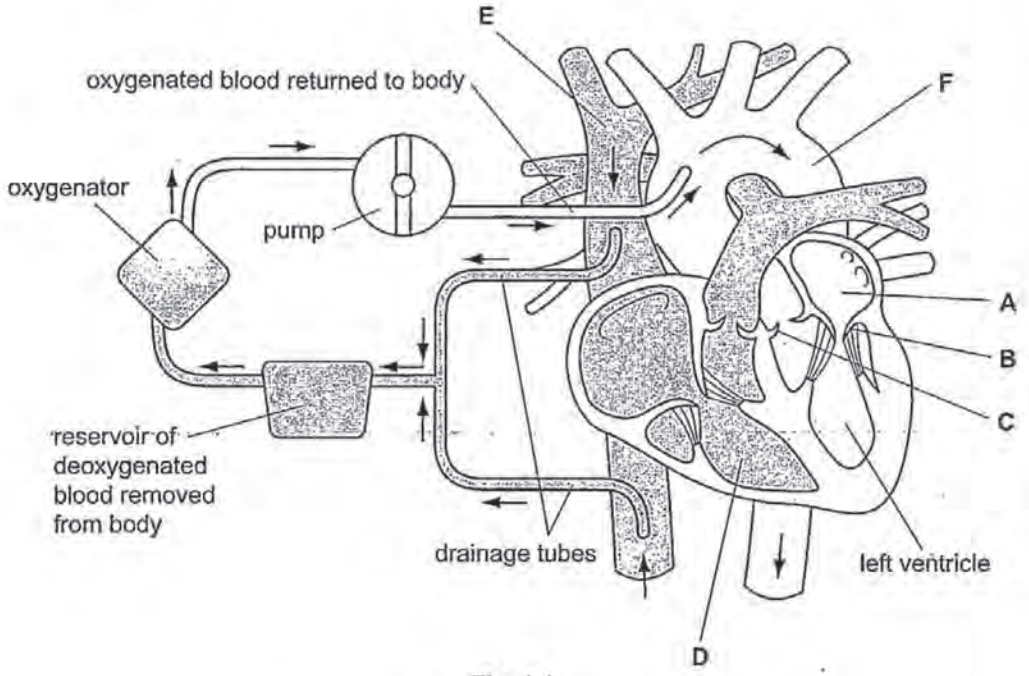


Fig. 1.1

(a) Name the structures labelled A to D.

A left ~~atr~~ atrium

B semi-lunar ~~valves~~ valves

C ~~valves~~ semi-lunar valves

D right ventricle [4]

(b) Name the blood vessels E and F.

E pulmonary artery

F ~~aor~~ ~~aorta~~ aorta [2]

(c) The heart-lung machine is used so that surgeons can operate on the arteries supplying heart muscle. These arteries may be diseased.

Name these arteries and explain how they may become diseased.

name of arteries ~~pulmonary arteries~~ aorta

explanation ~~Sees~~ the ~~pulmonary arteries~~ aorta gives in ~~deoxygenated~~ oxygenated blood if the arteries is diseased, the whole body will get the disease since the oxygenated blood will be circulates in the whole body. when, the whole body got the disease, it may cause some symptoms.

[3]

For Examiner's Use

(d) Suggest why a patient is put on a heart-lung machine during such an operation.

So that they will still receive oxygen and gives out carbon dioxide when in the operation, ~~they still can~~ the heart can still pump the blood.

[2]

Humans have a double circulation system. There is a low pressure circulation and a high pressure circulation.

(e) Explain how the structure of the heart enables it to pump blood into two circulations at different pressures.

When there is a high pressure in the blood, the heart will pump ~~more~~ less blood and ~~vibration~~ our heartbeat will be much more ~~faster~~ slower. when there is a low pressure, the heart will pump more blood and our heartbeat will be much more faster.

[4]

[Total: 15]

Examiner comment – grade C

1(a) Three of these answers are correct. Structure **C** is the bicuspid valve not a semi-lunar valve.

1(b) The first blood vessel **E** is not named correctly. **E** is the vena cava, not the pulmonary artery. The correct answer, aorta, is given for **F**.

1(c) 'Arto' is not the correct name for the coronary arteries and, even if aorta was the expected answer, this way of spelling it would not gain a mark. However, the correct spelling appears in the next line, so the examiner would award a mark if aorta was the correct answer for the name. The explanation should deal with the deposits of fat in the walls of the artery and the reduction in blood flow and supply of oxygen and nutrients to the heart muscle. Candidates also gained marks in this question by explaining that blood clots may form near the fatty deposits to block the supply of blood. No marks can be given to this particular candidate's answer.

1(d) The answer states that the heart 'can still pump the blood' which is completely incorrect. The heart-lung machine takes over the function of the heart in pumping blood. The first part of the answer about 'receiving oxygen' and 'giving out carbon dioxide' should refer to the exchanges between the blood and the air. In this respect the heart-lung machine takes over the functions of the lungs.

1(e) The candidate has misinterpreted the question. The answer given refers to the way the heart may respond to high and low blood pressure in the systemic circulation, not to the different pressures in the systemic and pulmonary systems. There is nothing in the answer about the structure of the heart, which is what is asked in the question. No marks can therefore be given. The answer should deal with the difference between the thickness of the left and right ventricles so that blood is pumped at a higher pressure into the systemic circulation and at a lower pressure into the pulmonary circulation.

Mark awarded = 4 out of 15

Example candidate response – grade E

1 Heart surgeons may stop the heart beating during operations. While this happens blood is pumped through a heart-lung machine that oxygenates the blood.

For Examiner's Use

Fig. 1.1 is a diagram showing a heart-lung machine in use.

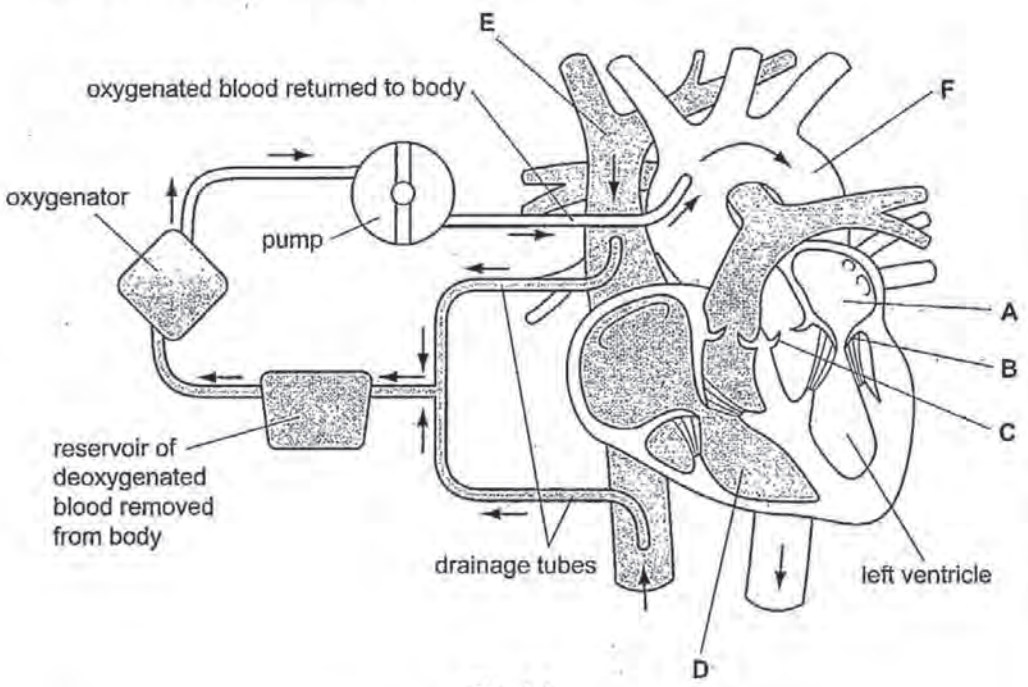


Fig. 1.1

(a) Name the structures labelled **A** to **D**.

A left artide

B .....

C .....

D Right ventricle [4]

(b) Name the blood vessels **E** and **F**.

E Deoxygenated blood vessels.

F ~~Pulmonary vessels~~ Oxygenated blood vessels. [2]

(c) The heart-lung machine is used so that surgeons can operate on the arteries supplying heart muscle. These arteries may be diseased.

Name these arteries and explain how they may become diseased.

name of arteries Pulmonary arteries

explanation When a person is bitten by a poisonous animal or stunk by a poisonous animal, the poison in the tongue or tail of the animal, contaminates the arteries; thereby, making it diseased.

[3]

For Examiner's Use

(d) Suggest why a patient is put on a heart-lung machine during such an operation.

The heart-lung machine helps to keep the patient stable throughout the operation

[2]

Humans have a double circulation system. There is a low pressure circulation and a high pressure circulation.

(e) Explain how the structure of the heart enables it to pump blood into two circulations at different pressures.

The heart is built in such a way that it pumps blood into two circulations; It pumps blood upward and downwards. When it pumps blood upwards, it pumps it with low pressure circulation but when it pumps downwards, it pumps it with high pressure circulation.

[4]

[Total: 15]

Examiner comment – grade E

1(a) 'Artricle' is an incorrect spelling of atrium so no mark can be given for the identification of **A** even though 'left' is correct. Right ventricle is a correct answer. It is not unusual for candidates who gain grade E to leave blanks in their scripts as has happened here with structures **B** and **C**.

1(b) The candidate is correct in that blood vessel **E** contains deoxygenated blood and blood vessel **F** contains oxygenated blood, but the question asked for the names of these two blood vessels. The correct answers are vena cava and aorta.

1(c) The 'pulmonary arteries' are not the blood vessels that supply heart muscle. Coronary arteries is the correct answer. The explanation should deal with the deposits of fat in the walls of the artery and the reduction in blood flow and supply of oxygen and nutrients to the heart muscle, not about poisons from venomous animals.

1(d) It is true to say that the heart-lung machine helps to keep a patient stable during an operation, but this is not a sufficiently detailed answer. The machine takes over the function of the heart in pumping blood around the body and the function of the lungs in exchanging oxygen and carbon dioxide with the air.

1(e) There is nothing in this answer about the structure of the heart. The answer should deal with the difference between the thickness of the left and the right ventricles so that blood is pumped at a higher pressure into the systemic circulation and at a lower pressure into the pulmonary circulation. The left ventricle of the heart pumps blood into the systemic circulation at high pressure – some of this blood goes up and some goes down. All of it has to overcome the resistance of the blood vessels which is much greater in the systemic circulation than in the pulmonary circulation through the lungs.

Mark awarded = 1 out of 15

2	(a)		*whole / part of, organism* changes in position / changes in place ;	[1]	***ignore*** locomotion **A** (moves) from place to place / one place to another
	(b)	(i)	antagonistic ;	[1]	**A** antagonism
		(ii)	*idea of* muscle pull (don't push) ; biceps contracts ; triceps relaxes ; flexion / described as movement of (fore)arm ; during relaxation muscle is, stretched / passive ; both contract to maintain position / holding an object ;	[max 3]	*assume answer is about flexion – credit ora for extension – mark through if both given* if answer does not mention the names of the muscles but has the right idea for one contracts and the other relaxes, then allow one mark for MP2+3 contraction and relaxation of the pair must be linked to the correct movement of the arm. If not, no marks **R** hand **A** named correct bone – radius and/or ulna **A** lengthens
	(c)	(i)	*transmits impulses* from, receptor / nerve endings / sensory endings / skin / sensory organ ; to, CNS / spinal cord / connector neurone / relay neurone ;	[2]	***ignore*** sensory neurone as question says 'describe' ***ignore*** 'messages' / 'signals' / 'senses the stimulus' **R** 'fingers' / 'hand' **A** interneurone **R** 'brain' / 'brain and spinal cord'
		(ii)	*idea that* impulses stimulate muscle to, contract / move hand ; (only) biceps contracts (to raise the forearm) ; ref. to impulse does not cross synapse to **H** ;	[2 max]	*assume answer is about neurone G, but accept about H*
	(d)	1 2 3 4	many / different, stimuli ; brain, decides / controls / coordinates ; impulses in motor, neurones / nerves ; to, (many) muscles / effectors (involved) ;	[max 2]	**R** if one muscle
				[Total: 11]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade A

2 (a) Movement is a characteristic of living organisms.

For Examiner's Use

Define the term *movement*.

The act of an individual to change the place or position.

[1]

When the hand is stimulated by a hot object a reflex action occurs in which the fore-arm is raised.

Fig. 2.1 shows the muscles and the neurones involved in the reflex action.

The arrows show where there are nerve impulses during the reflex action.

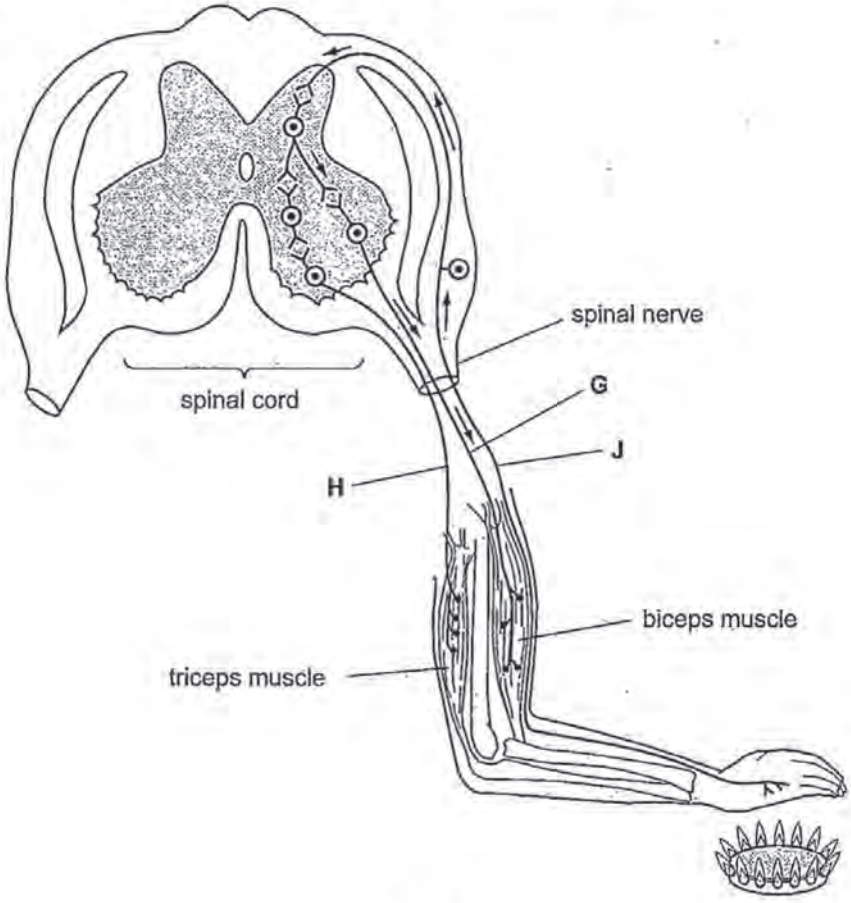


Fig. 2.1

(b) (i) State the name for the action of two opposing muscles, such as the biceps and the triceps.

Antagonistic

[1]

(ii) Explain how two opposing muscles bring about movement at the elbow joint.

For Examiner's Use

It is such kind of antagonistic muscle, where one muscle relax, the another contract. At elbow joint, biceps muscle Contracts, while the triceps muscle relax.

But, when we make our hand become straight, the tricep muscle Contract and the biceps relax.

[3]

(c) (i) Describe the function of neurone **J**.

It is sensory neurone. Its function is bring the stimuli from the environment to the central nervous system.

[2]

(ii) Explain why there are impulses in motor neurone **G**, but not in motor neurone **H**.

Neurone 6 will ~~go~~ be in biceps muscle which will Contract when getting the impulses, and then this muscle brings the hand up and move far away from the stimuli.

[2]

(d) The action shown in Fig. 2.1 is an involuntary reflex action. The muscles can also be used for voluntary actions.

Explain how muscles are controlled during voluntary actions.

In voluntary actions the stimuli will be brought to the brain, then the brain will decide which muscle that suitable for the stimuli, after that it the motor neuron will bring the decision the muscle and it takes longer time rather than involuntary action.

[2]

[Total: 11]

Examiner comment – grade A

2(a) This is a good definition of the term 'movement'.

2(b)(i) This is the correct answer. It is written clearly and the word is spelt correctly.

2(b)(ii) The answer refers to the correct actions of the biceps and the triceps muscles. The third mark is not awarded because it is not the hand that is straightened, but the forearm or lower arm. The question asks for movement about the elbow.

2(c)(i) The question asks for a description of the function of the sensory neurone, so there is no mark for naming it correctly. Sensory neurones conduct impulses from receptors to the other neurones within the central nervous system. It is incorrect to say that they bring 'stimuli' from one place to another. Information about stimuli is encoded as nerve impulses that travel along sensory neurones. One mark is awarded for the idea of transferring information to the central nervous system. 'From the environment' is too vague; from receptors or from the skin is better.

2(c)(ii) The candidate should have stated that impulses travel along neurone **G** to stimulate the biceps muscle. This is not made clear enough in the answer. A mark is awarded for the idea that the biceps contracts to move the hand away from the flame.

2(d) The first sentence implies that there are different stimuli, so the first marking point can be awarded. Voluntary actions are controlled by the brain, so the second mark is also awarded.

Mark awarded = 8 out of 11

Example candidate response – grade C

2 (a) Movement is a characteristic of living organisms.

For Examiner's Use

Define the term *movement*.

to ability to change its position from its initial position usually using energy. a Ability to get from one place to another. [1]

When the hand is stimulated by a hot object a reflex action occurs in which the fore-arm is raised.

Fig. 2.1 shows the muscles and the neurones involved in the reflex action.

The arrows show where there are nerve impulses during the reflex action.

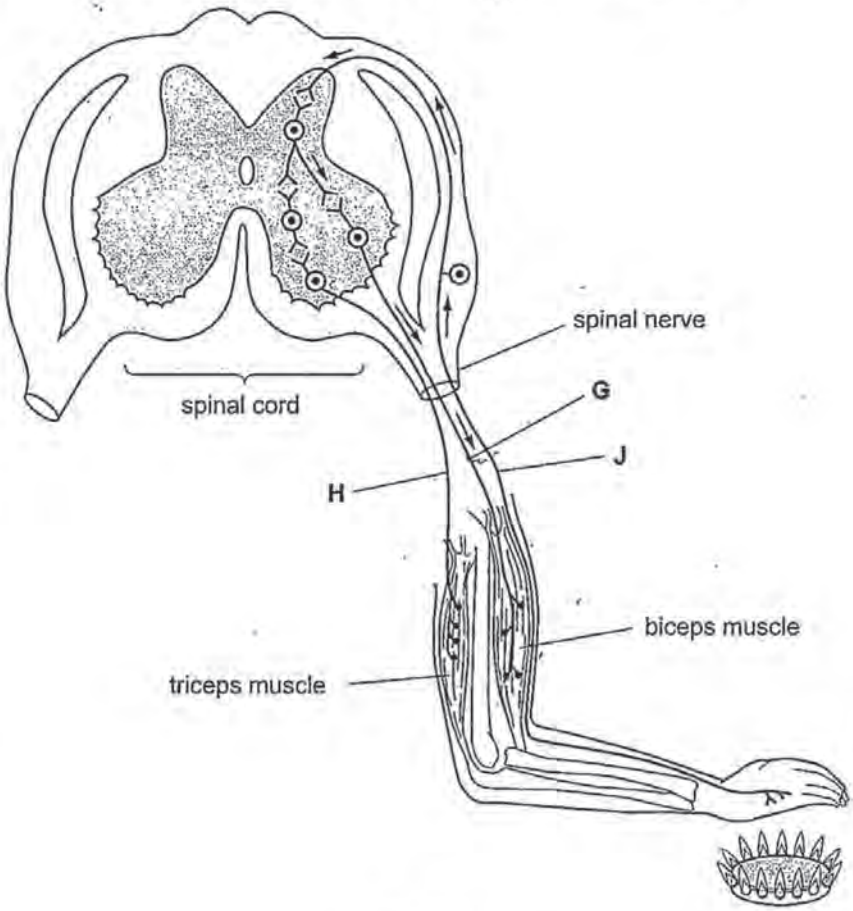


Fig. 2.1

(b) (i) State the name for the action of two opposing muscles, such as the biceps and the triceps.

antagonistic action. [1]

(ii) Explain how two opposing muscles bring about movement at the elbow joint.

For Examiner's Use

When the biceps muscle contracts the triceps muscle relaxes, causing the elbow joint to pull upwards. When the ~~bicep~~ tricep relaxes contracts and the biceps relaxes the elbow joint straightens, straightening the arm in turn. Both muscles cannot contract or relax at the same time. [3]

(c) (i) Describe the function of neurone **J**.

It is the sensory neurone. It senses a change caused by a stimulus and sends the message to the nerve endings of other neurons. [2]

(ii) Explain why there are impulses in motor neurone **G**, but not in motor neurone **H**.

Because the muscles are antagonistic and cannot work at the same time. Motor neurones cause movement in the muscles and if it were sent to both muscles then the arm could not be lifted as the bicep contracts. [2]

(d) The action shown in Fig. 2.1 is an involuntary reflex action. The muscles can also be used for voluntary actions.

Explain how muscles are controlled during voluntary actions.

Voluntary actions are controlled by the brain. The person makes a decision to do some thing and the message is sent to the target muscle by chemical impulses and ~~then~~ then it contracts in reaction. [2]

[Total: 11]

Examiner comment – grade C

2(a) The candidate has written the one required good definition in two slightly different ways.

2(b)(i) The term that describes the opposing action of two muscles is antagonistic. The candidate's answer is not very clear as it may say 'antaganistic' which is not spelt correctly. There is no confusion with another term, so the mark is awarded.

2(b)(ii) This is a very well-written answer that clearly gains three marks for describing the action of the biceps, triceps and the straightening of the arm. Bending of the arm is known as flexion and straightening as extension, but alternative words are accepted when accurate.

2(c)(i) This answer is incorrect and does not gain any marks. The question asks for a description of the function of the sensory neurone, so there is no mark for naming it correctly. Sensory neurones conduct impulses from receptors to neurones within the central nervous system. Sensing the stimulus is the function of a receptor, and 'signals' is too vague a term for impulses.

2(c)(ii) Motor neurones 'cause movement' is not quite precise enough an answer. The candidate should have stated that impulses travel along neurone **G** to stimulate the biceps muscle. A mark is awarded at the very end of the answer as the candidate does convey the idea that it is only the biceps that contracts.

2(d) Voluntary actions are controlled by the brain, so one mark is awarded for the first sentence. The rest of the answer is too vague. 'Chemical impulses' is rather ambiguous since they are electrical impulses that travel the length of a neurone.

Mark awarded = 7 out of 11

Example candidate response – grade E

2 (a) Movement is a characteristic of living organisms.

For Examiner's Use

Define the term *movement*.

This is when an organism is able to move from on place to another [1]

When the hand is stimulated by a hot object a reflex action occurs in which the fore-arm is raised.

Fig. 2.1 shows the muscles and the neurones involved in the reflex action.

The arrows show where there are nerve impulses during the reflex action.

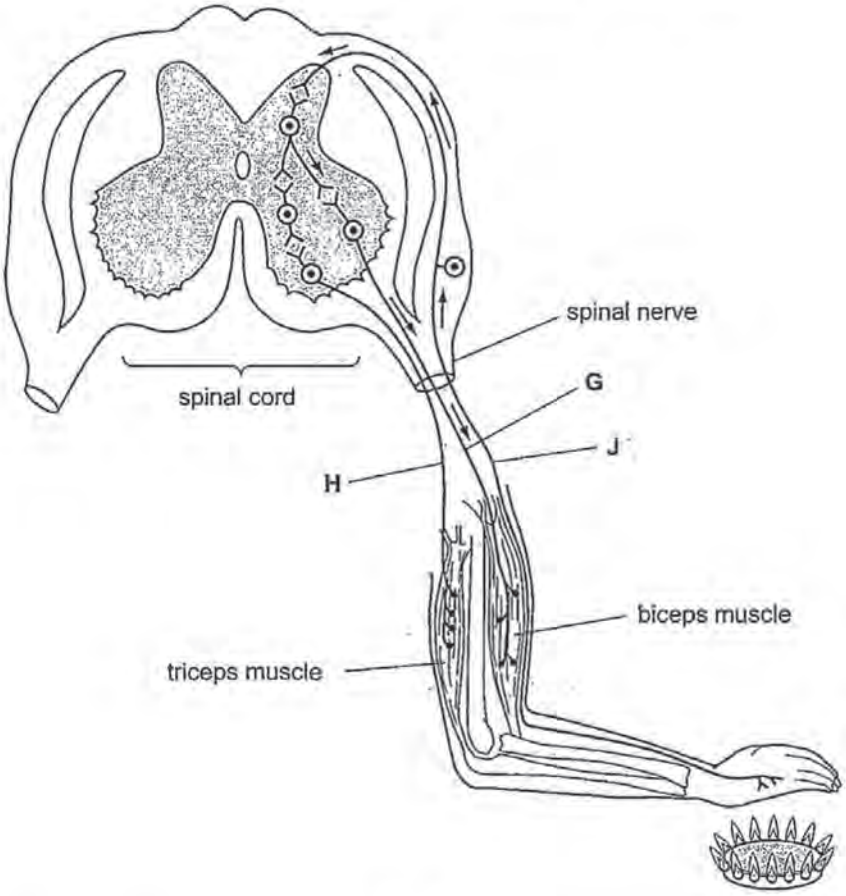


Fig. 2.1

(b) (i) State the name for the action of two opposing muscles, such as the biceps and the triceps.

Contraction [1]

(ii) Explain how two opposing muscles bring about movement at the elbow joint.

For Examiner's Use

the neurones are responsible for this movement and the spinal cord receives impulses and causes an involuntary action or movement to occur. This is also because when one muscle contracts the other muscle relax.

[3]

(c) (i) Describe the function of neurone **J**.

the sensory neurone sends impl. impulses to the body for immediate reactions to the stimulus.

[2]

(ii) Explain why there are impulses in motor neurone **G**, but not in motor neurone **H**.

This maybe is because it is only the bicep muscle that is concerned about this movement and the tricep muscle is not involved in this movement.

[2]

(d) The action shown in Fig. 2.1 is an involuntary reflex action. The muscles can also be used for voluntary actions.

Explain how muscles are controlled during voluntary actions.

The biceps muscle moves when carrying ~~something~~ a bricle and relaxes immediately it is left.

[2]

[Total: 11]

Examiner comment – grade E

2(a) Even though the candidate has written 'on place to another', this is clearly sufficient to match the definition of movement.

2(b)(i) Antagonistic is the correct term, not 'contraction'.

2(b)(ii) This answer starts by referring to the action of neurones, which is not relevant. The second part of the answer is better, but the names of the specific muscles are not used. One mark was awarded as this answer gave a general explanation of antagonistic action.

2(c)(i) The sending of impulses 'to the body' is far too vague. Here, one mark is available for the origin of impulses, and one mark for the destination. Both origin and destination are in 'the body', so this is not sufficient. Sensory neurones carry impulses from receptors to the central nervous system. Giving that information would gain two marks.

2(c)(ii) This answer has the right idea about the use of one muscle rather than the other, but the words 'concerned' and 'involved in' are too vague for an explanation. No mark can be awarded here as the answer does not refer to the neurones **G** and **H**.

2(d) The candidate did not understand that this question is referring to voluntary actions rather than involuntary actions. It is much better to write that 'biceps muscle contracts....' rather than 'the biceps muscle moves....' After all, a muscle might move even though it is not contracting at the time. For example, the triceps moves from one place to another when you walk and your hands are down by your side.

Mark awarded = 2 out of 11

Question 3

Mark scheme

3	(a)	1	root hairs ;		
		2	water moves from high(er) <u>water potential</u> to low(er) <u>water potential</u> ;		**A** down a water potential gradient ***ignore*** water concentration **R** dilute and concentrated
		3	osmosis ;		
		4	through partially permeable <u>membrane</u> ;		**A** semi-permeable / selectively permeable
		5	ref. to protein pores ;	[max 3]	
	(b)	1	large surface area ;		**A** minerals for ions
		2	thin (cell) walls ;		**A** thin wall as 'cell' is in the question
		3	(many) mitochondria ;		
		4	ref. respiration ;		
		5	provide / release, energy, for active transport ;		**A** active, uptake / transport, uses energy **A** active uptake **R** if water also taken up by active uptake
		6	proteins / carriers / channels, for, diffusion / active transport (of ions) ;	[max 3]	**A** 'moving against concentration gradient' for active transport
	(c)	*in appropriate boxes*			
		adult and zygote = 90 ;			**A** ***ecf*** if half incorrect diploid number
		ovum = 45 ;		[2]	*only allow ecf if* ***both*** *diploid numbers are the same*

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

	(d)	*advantages* ***for plants*** only one, parent / plant ; fast / new plants establish themselves quickly ; (potential) rapid spread close to parent / AW ; less energy required ; no wastage of gametes ; (if parent well adapted) offspring will be adapted to surroundings ; plants grow in a suitable place / no wastage ; AVP ; e.g. greater chance of reproduction	[max 2]	**R** refs to number of plants produced **R** 'does not require male and female gametes' **A** 'more likely to leave offspring' idea ***ignore*** refs to avoiding mutations unqualified **A** 'good' traits / e.g., passed on **R** 'good' genes *do not accept advantages for humans*
		disadvantage for plants plants too crowded / overcrowding ; (lots of) competition for resources ; little / no, (genetic) variation ; disease transmitted directly to offspring ; less evolution / less able to adapt ; (all identical so) can be wiped out by the same disease ; no / little, dispersal ; AVP ;	[max 1]	*genetic or infectious disease* **A** 'disease can spread easily'
		[Total: 11]		

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade A

3 The sweet potato plant, *Ipomoea batatas*, has fibrous roots and storage roots. Fibrous roots absorb water and ions from the soil. Storage roots store insoluble carbohydrates.

For Examiner's Use

Fig. 3.1 shows the growth of these roots on a sweet potato plant.

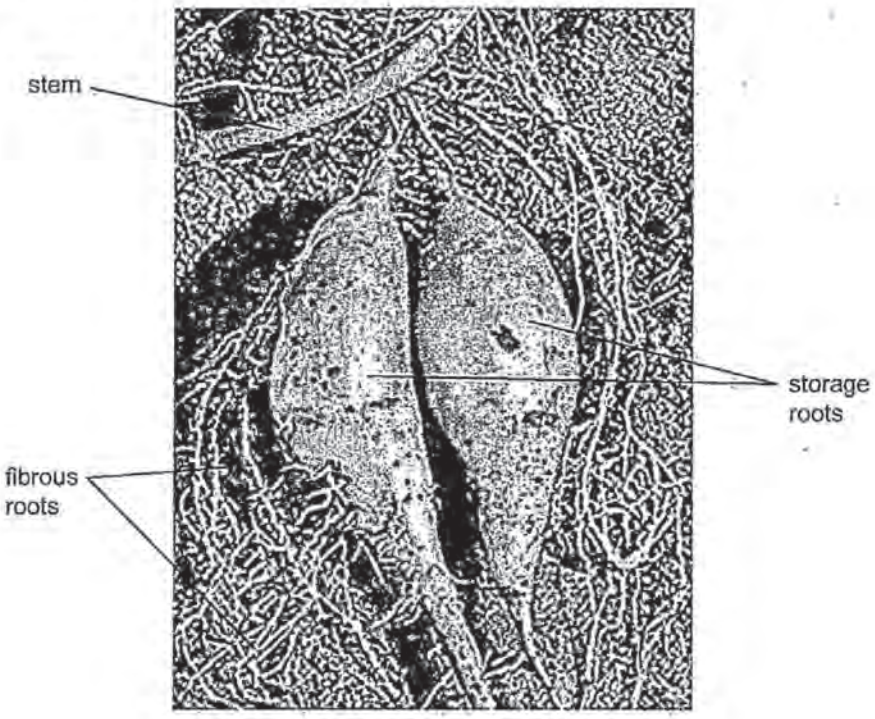


Fig. 3.1

(a) Explain, using the term **water potential**, how fibrous roots absorb water.

Water potential in the roots is less that that of the soil around it. So water moves down the concentration gradient and into the roots through its partially permiable membrane. This process is called osmosis (this happens by random movement of water) [3]

The membranes of root hair cells contain proteins for the absorption of ions.

For Examiner's Use

(b) Describe how root hair cells are adapted for the absorption of ions.

Root hair cells are large in terms of their surface area which allows for good absorbtion of mineral ions. They are also one cell thick and have thin cell walls so mineral ions are easily absorbed and do not have to travel far. They are elongated and are able to tap into deep and further sources of water. [3]

Sweet potato plants produce flowers to reproduce sexually. Sweet potato plants also reproduce asexually when shoots grow from the storage roots to form new plants.

Fig. 3.2 shows the life cycle of sweet potato. The diploid number of this species is 90.

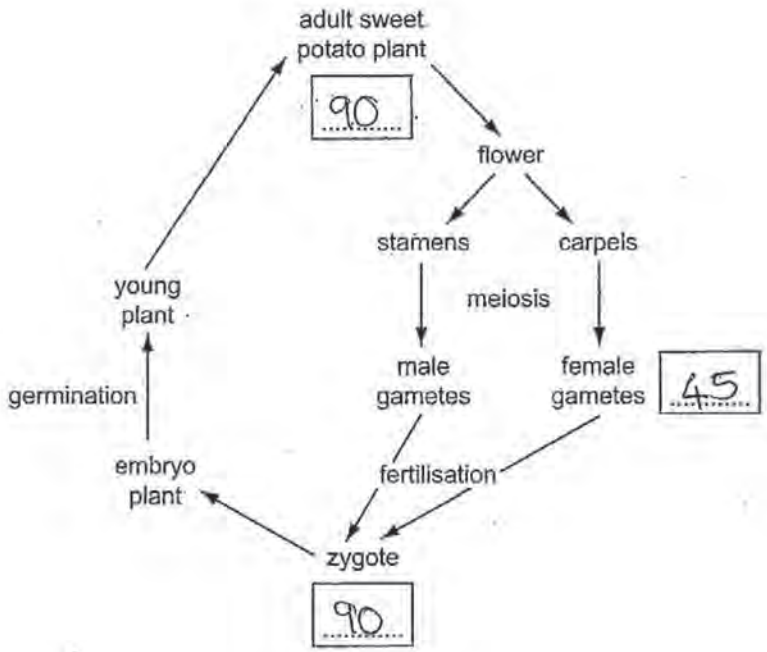
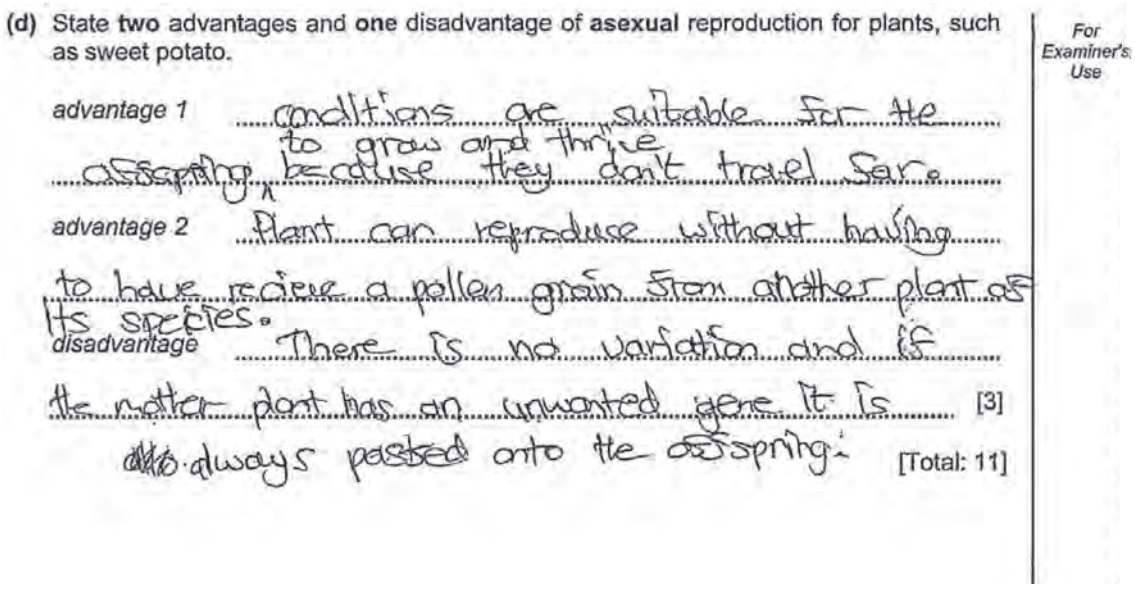


Fig. 3.2

(c) Complete Fig. 3.2 by writing the number of chromosomes in the three boxes. [2]



(d) State **two** advantages and **one** disadvantage of **asexual** reproduction for plants, such as sweet potato.

For Examiner's Use

advantage 1 conditions are suitable for the offspring to grow and thrive because they don't travel far.

advantage 2 Plant can reproduce without having to have recieve a pollen grain from another plant of its species.

disadvantage There is no variation and if the mother plant has an unwanted gene it is always passed onto the offspring. [3]

[Total: 11]

Examiner comment – grade A

3(a) This is a good answer as it explains that water moves into roots by osmosis. The term partially permeable membrane is the best way to describe the membranes that surround cells. The water potential concept is used correctly: water moves down the water potential gradient from the soil solution, which has a higher water potential, to the root cells, that have a lower water potential.

3(b) The candidate has two good adaptations of root hair cells for the absorption of ions: large surface area and thin cell walls. Other acceptable answers are protein carriers in the membranes that move ions. The cells also have mitochondria that provide energy for the movement of ions by active uptake.

3(c) The correct numbers are written in the boxes: 90, 45 and 90. The question states that the diploid number is 90. The candidate has realised that gametes of sweet potato plants have the haploid number of chromosomes, which is half the diploid number and is therefore 45. On fusion to form the zygote, the diploid number (90) is restored.

3(d) The question asks for two advantages and one disadvantage of asexual reproduction. If the parent plant is growing in an area and is reproducing asexually, this suggests that conditions are good for growth and the offspring can grow nearby or in the same place and will be successful. The second answer is not an advantage, it is why the reproduction is not sexual. The candidate could have said that there is no wastage of energy in making pollen or that the flowers may not be pollinated possibly because there are no pollinators. The lack of variation is a good answer to give for a disadvantage.

Mark awarded = 9 out of 11

Example candidate response – grade C

3 The sweet potato plant, *Ipomoea batatas*, has fibrous roots and storage roots. Fibrous roots absorb water and ions from the soil. Storage roots store insoluble carbohydrates.

For Examiner's Use

Fig. 3.1 shows the growth of these roots on a sweet potato plant.

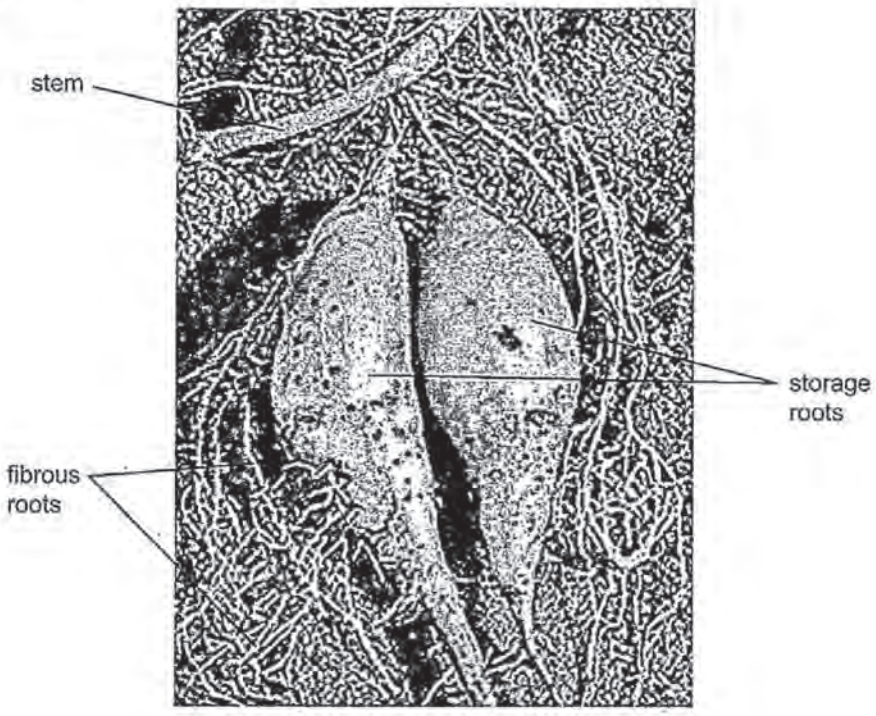


Fig. 3.1

(a) Explain, using the term **water potential,** how fibrous roots absorb water.

Fibrous roots has large surface area to reach and absorb water. By osmosis, the movement of molecule water from the area of high water potential to the lower area of ~~concentration~~ water potential, against water potential gradient. So that, the plant has enough water now.

[3]

The membranes of root hair cells contain proteins for the absorption of ions.

For Examiner's Use

(b) Describe how root hair cells are adapted for the absorption of ions.

It has large surface area to gain more ions in a larger area.
It has thin cell membrane which can allow the ions pass trough easily. Moreover it is long root hair cells.

[3]

Sweet potato plants produce flowers to reproduce sexually. Sweet potato plants also reproduce asexually when shoots grow from the storage roots to form new plants.

Fig. 3.2 shows the life cycle of sweet potato. The diploid number of this species is 90.

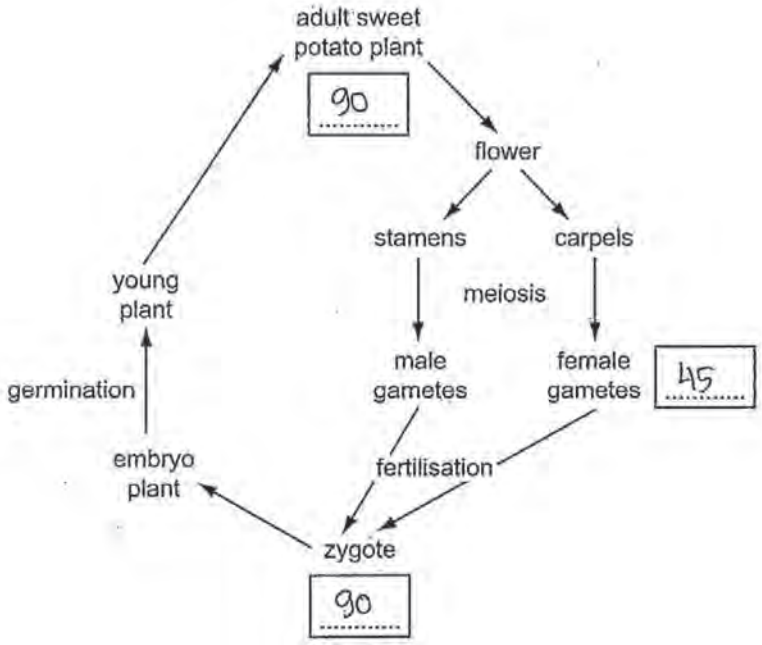


Fig. 3.2

(c) Complete Fig. 3.2 by writing the number of chromosomes in the three boxes. [2]

(d) State **two** advantages and **one** disadvantage of **asexual** reproduction for plants, such as sweet potato.

For Examiner's Use

advantage 1 Grow more rapidly.

advantage 2 Easy to adapt to the environment.

disadvantage Less variation.

[3]

[Total: 11]

Examiner comment – grade C

3(a) The candidate has explained that osmosis is involved with the uptake of water and that the water moves from a region of higher water potential to one of lower water potential. Marking point 2 would not have been given if the candidate had written that 'water moves by osmosis into the root against a water potential gradient' without any further information. A third mark could be gained by stating that the water travels through a partially permeable membrane.

3(b) The large surface area is the only correct point in this answer. All membranes are of the same thickness, it is the cell wall which is thin and thus helps the absorption of ions because they do not have to travel very far from the soil to the membrane of the root cells.

3(c) The correct numbers are written in the boxes: 90, 45 and 90.

3(d) These are very brief answers. They would benefit from more explanation. In the case of the advantages it would be good to know what can grow more rapidly and what can adapt to the environment. It is true that the offspring of plants produced by asexual reproduction do grow more rapidly because they are able to use a large energy supply from their parent. But this point has not been made clear. Plants produced by asexual reproduction will be adapted to the conditions in the environment that their parent is adapted to. But if the environment changes it is likely that the plants will not be as well adapted. 'Less variation' is a correct response even if, again, a very brief answer.

Mark awarded = 6 out of 11

Example candidate response – grade E

3 The sweet potato plant, *Ipomoea batatas*, has fibrous roots and storage roots. Fibrous roots absorb water and ions from the soil. Storage roots store insoluble carbohydrates.

For Examiner's Use

Fig. 3.1 shows the growth of these roots on a sweet potato plant.

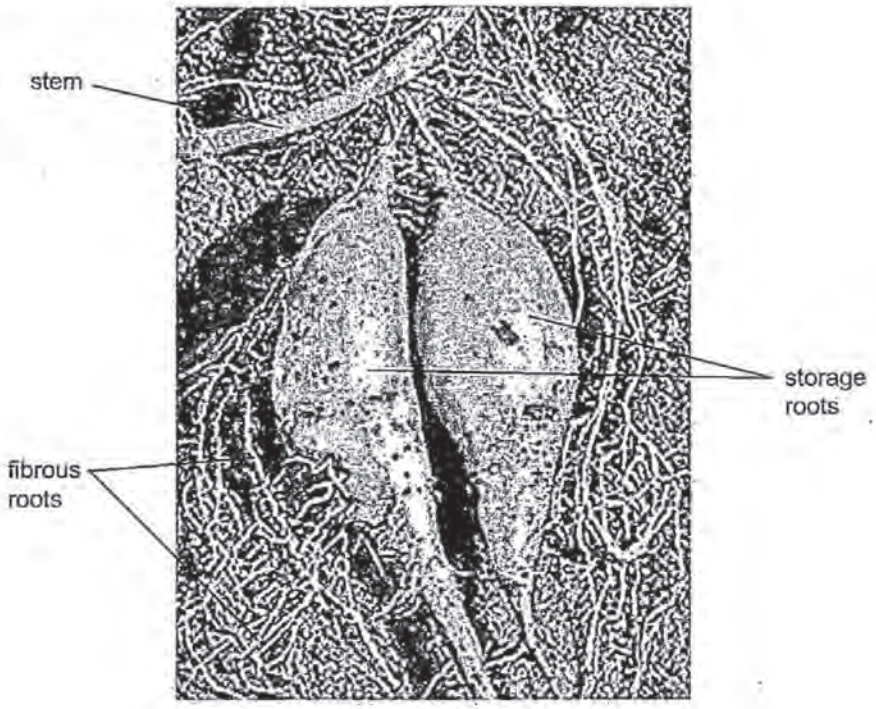


Fig. 3.1

(a) Explain, using the term **water potential**, how fibrous roots absorb water.

their root hair cells absorbs water and minerals from the soil. they move through the vessels and are transported through the whole plant.

[3]

The membranes of root hair cells contain proteins for the absorption of ions.

For Examiner's Use

(b) Describe how root hair cells are adapted for the absorption of ions.

the root hair cells contain proteins for the absorption of ions and other materials, they also help in the storage of minerals

[3]

Sweet potato plants produce flowers to reproduce sexually. Sweet potato plants also reproduce asexually when shoots grow from the storage roots to form new plants.

Fig. 3.2 shows the life cycle of sweet potato. The diploid number of this species is 90.

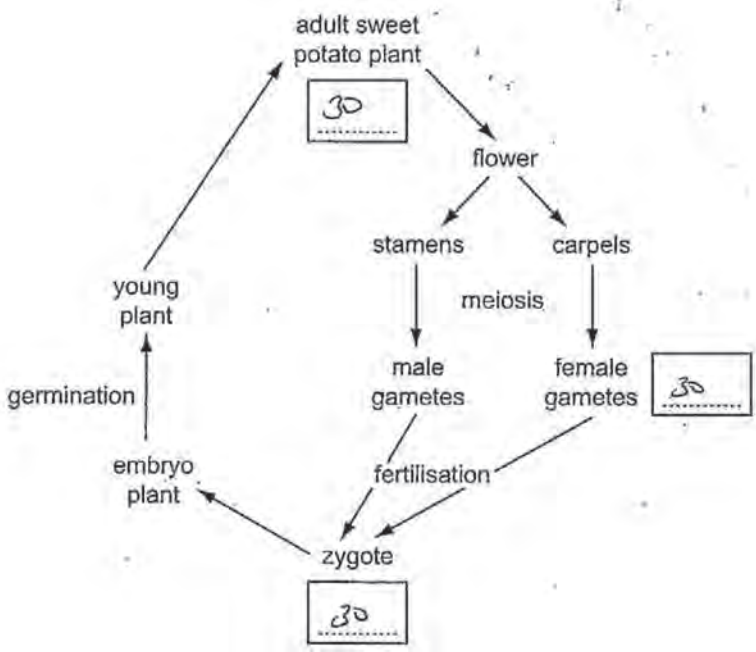
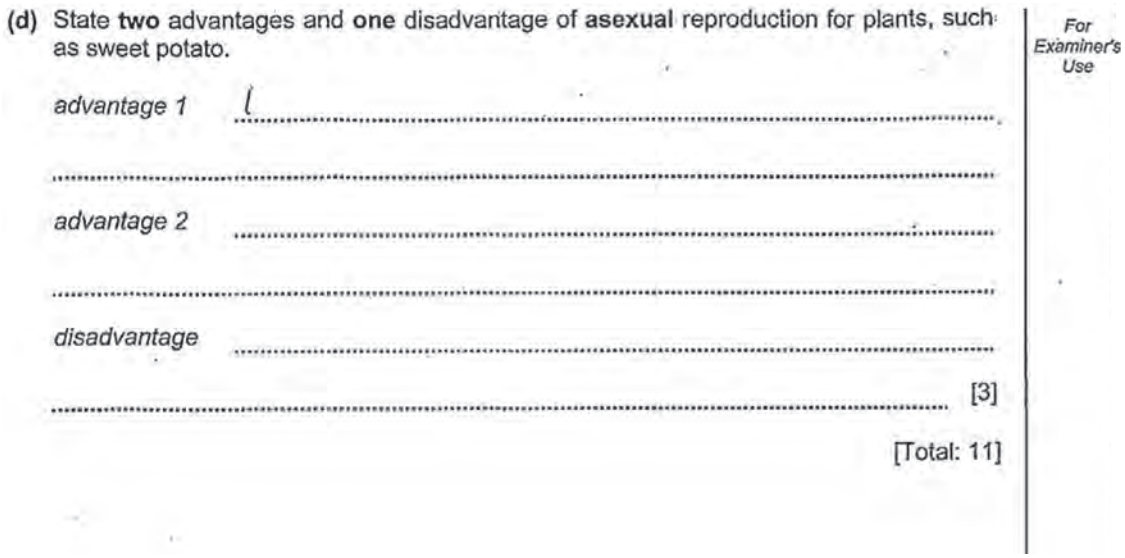


Fig. 3.2

(c) Complete Fig. 3.2 by writing the number of chromosomes in the three boxes. [2]



(d) State **two** advantages and **one** disadvantage of **asexual** reproduction for plants, such as sweet potato.

For Examiner's Use

advantage 1 (

advantage 2

disadvantage

[3]

[Total: 11]

Examiner comment – grade E

3(a) The candidate has stated that root hair cells absorb water. One mark was awarded for this. The way in which water is absorbed has not been given. It is important to say that water is absorbed by osmosis and then to use the water potential principle as required by the question. Candidates should remember that water moves from a place with a high water potential to a place with a low water potential through partially permeable membranes.

3(b) The candidate has repeated information from the question about proteins without explaining what they do. The answer also refers to the uptake of minerals. These minerals are the ions that are the subject of the question. In this case, the answer repeats information given on the examination paper without responding to the command words – 'describe how ...'.

3(c) The same number (30) has been written in each box. This number is not correct either for the diploid number (90) or the haploid number (45). In this paper, the examiners awarded a mark if incorrect numbers were used if the haploid number for the gametes was half the diploid number used for the boxes at top and bottom of Fig. 3.2. If the candidate had given 15 as the haploid number then one mark would have been given.

3(d) No responses have been given to this question. This is not unusual on scripts that gain the lower grades. It is always worth writing something in answer to each question – there are often clues within the question to help think of an answer.

Mark awarded = 1 out of 11

4	(a)	(i)	lymphocyte ;		[1]	***ignore*** leucocyte **A** phonetic spellings
		(ii)	1	attach to, bacteria / viruses / pathogens ;		**A** antigens
			2	cause them to, aggregate / stick together / AW ;		
			3	stop them spreading ;		**R** 'fight' against *anywhere in the answer*
			4	help phagocytes engulf them ;		**A** opsonisation / described **A** 'makes bacteria more detectable by phagocytes'
			5	cause bacteria to burst / kill bacteria / destroy bacteria ;		***ignore*** 'dissolve bacteria
			6	stop bacteria moving / immobilise bacteria ;		
			7	neutralise, toxins / poisons / harmful substances ;		**A** 'detoxify'
			8	stop, viruses / bacteria, entering cells ;	[max 2]	
	(b)	(i)	1	when blood clots / following a cut / when wounded / AW ;		**A** injury
			2	when blood vessels are damaged ;		
			3	on exposure of, blood / fibrinogen, to air ;		
			4	flows over rough surfaces / AW ;	[max 1]	
		(ii)	1	(fibrinogen is converted into) insoluble (fibrin) ;		*assume answer is about fibrin*
			2	forms, mesh / net / network / strands ;		
			3	traps, (red) blood cells / platelets ;		**A** 'gauze' / threads / fibres / web
			4	(dries) to form a scab ;		
			5	prevents, loss of blood / more bleeding ;		
			6	prevents infection / AW ;		**A** prevents entry of (named) pathogens
					[max 3]	**R** foreign bodies

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

	(c)	(i)	5°C – low (kinetic) energy / slow movement of molecules ; low frequency of / few, collisions ; 70°C – enzyme <u>denatured</u> ; ref. to active site / shape of enzyme ;	[max 3]	*accept that 'it' refers to the enzyme* denatures active site = 2 marks, **A** thrombin for enzyme **R** if 'die' / 'die and denature'**A** 'deformed' / AW, active site / enzyme
		(ii)	time taken for fibrin to form / liquid to become sticky / AW ; time taken for fibrinogen / substrate to disappear ; how much fibrin produced in, unit time / stated time ; how much fibrinogen converted, in unit time / stated time ;	[max 1]	**A** rate of fibrin production / how long it takes blood to clot / form a mesh / to reach same viscosity **R** 'how long it took a scab to form' **A** product for fibrin **A** substrate for fibrinogen
		(iii)	pH ; volume of, enzyme / thrombin (solution) ; concentration of, enzyme / thrombin (solution) ; volume of, substrate / fibrinogen (solution) / blood ; concentration of, substrate / fibrinogen (solution) ; calcium ions ; AVP ; e.g. equilibration time	[max 2]	**R** temperature **A** 'amount' for concentration **A** 'amount' for concentration **R** blood **R** size of fibrinogen / substrate
				[Total: 13]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade A

4 Proteins in the blood are involved in protection of the body.

Three proteins found in the blood are

- antibodies
- thrombin
- fibrinogen

For Examiner's Use

(a) (i) Name the type of white blood cell that produces antibodies.

lymphocytes [1]

(ii) Outline how antibodies protect the body.

Antibodies detect pathogen in the body and fight against these pathogens untill they are all destroyed

[2]

(b) Thrombin is an enzyme that catalyses the reaction:

fibrinogen ⟶ fibrin

(i) State when this reaction occurs.

During blood clotting [1]

(ii) Explain how fibrin protects the body.

Fibrin develops into long threads of fibre that entangle each other and form a scab when dry. The scap prevents bacteria from entering into the body. Under the scap, new cells are dividing that also form antibodies that kill bacteria that already existed in the wound.

[3]

An investigation was carried out to determine the effect of different temperatures on the activity of thrombin. The results are shown in Fig. 4.1.

For Examiner's Use

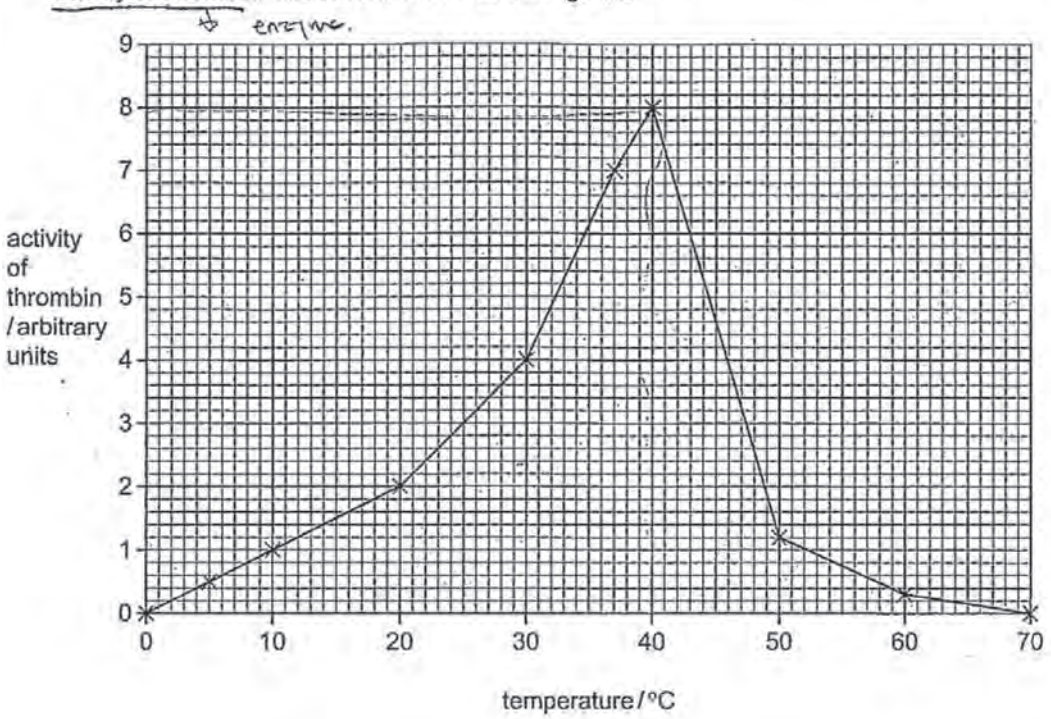


Fig. 4.1

(c) (i) Explain why thrombin functions slowly at 5 °C and does not function at all at 70 °C.

5 °C It functions slowly because at that temperature there is little energy resulting in the slow movement of the substrate in colliding or fitting into the active side of the enzyme.

70 °C At this temperature, the enzyme is denatured, this is because the temperature exceeds the optimum temperature of thrombin hence the active side is destroyed, making it difficult for the substrate to fit exatly into the enzyme. [3]

(ii) Suggest how the activity of thrombin was determined.

By detecting the activity at the optimum temperature

..... [1]

(iii) State **two** conditions that would have been kept constant during the investigation.

1 PH of thrombin

2 Volume of the substrate eg: ..... [2]

[Total: 13]

For Examiner's Use

Examiner comment – grade A

4(a)(i) The term leucocyte refers to all white blood cells, so is not appropriate here. The correct answer is lymphocyte.

4(a)(ii) The idea of antibodies 'detecting' and 'fighting against' pathogens did not gain any marks. It is lymphocytes that detect the pathogens; antibodies work against bacteria in a number of ways, but 'fighting' them is too vague. Antibodies cause bacteria to clump together, neutralise their toxins and make holes through their cell walls so that they burst.

4(b)(i) This is a correct answer. Anything that suggests there is blood loss gained a mark.

4(b)(ii) This is a good answer as marking points 2, 4 and 6 are all gained within the first three lines.

4(c)(i) This is a very well-written answer that makes excellent use of the technical terms for the topic of enzymes. There are four marking points awarded to this answer for a maximum of three marks. At 5 °C, there is little kinetic energy so there are few collisions between the enzyme and the substrate molecules. At 70 °C, the enzyme molecules are denatured as the active sites are destroyed.

4(c)(ii) The activity of thrombin could be determined in a number of different ways. The method for doing this needs to be applicable to all the temperatures selected, not only at the optimum temperature. The activity could be determined by timing how long it takes for blood to clot, for example.

4(c)(iii) pH and the volume of the substrate are two good variables to choose.

Mark awarded = 8 out of 13

Example candidate response – grade C

4 Proteins in the blood are involved in protection of the body.

Three proteins found in the blood are

- antibodies
- thrombin
- fibrinogen

For Examiner's Use

(a) (i) Name the type of white blood cell that produces antibodies.

plasma [1]

(ii) Outline how antibodies protect the body.

When the virus attack our body, the antibodies will kill the virus. [2]

(b) Thrombin is an enzyme that catalyses the reaction:

fibrinogen ⟶ fibrin

(i) State when this reaction occurs.

~~when~~ blood clotting [1]

(ii) Explain how fibrin protects the body.

~~the~~ when we are ~~injured~~ bleeding, the fibrin will make a coat on our bleeding part and the the bleeding process will stop. [3]

An investigation was carried out to determine the effect of different temperatures on the activity of thrombin. The results are shown in Fig. 4.1.

For Examiner's Use

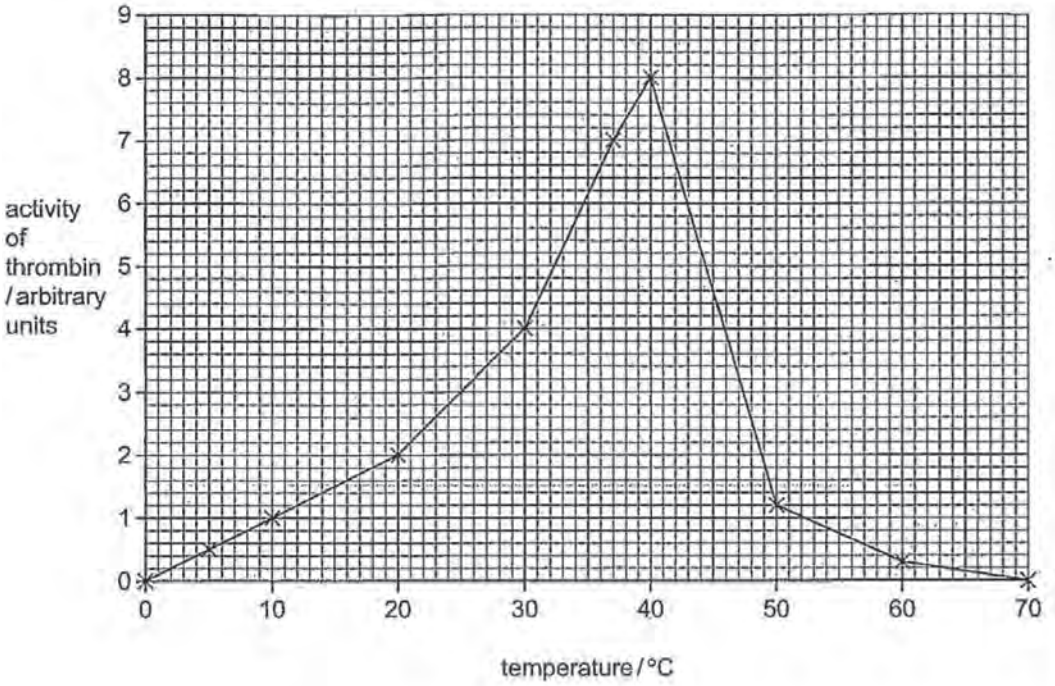


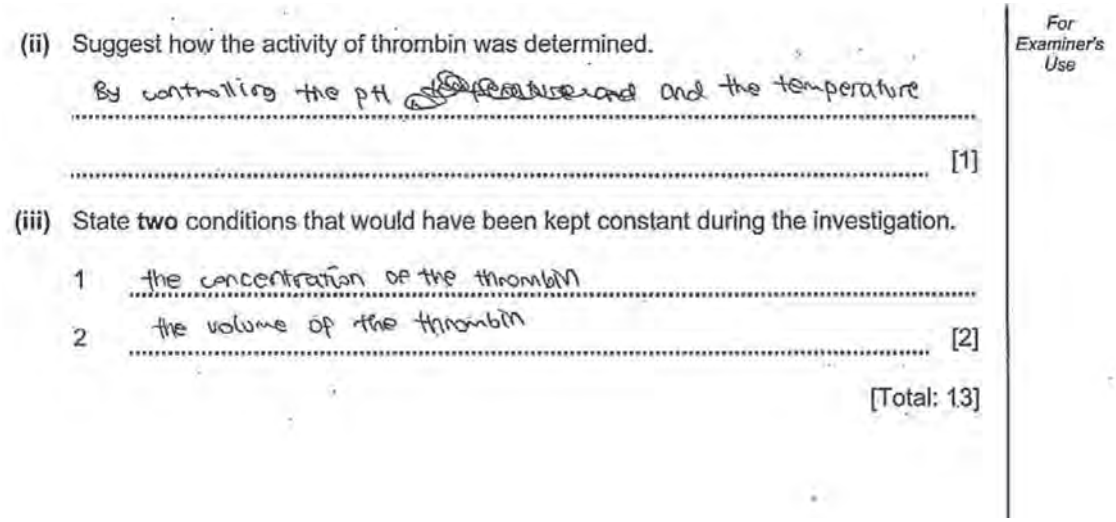
Fig. 4.1

(c) (i) Explain why thrombin functions slowly at 5 °C and does not function at all at 70 °C.

5 °C thrombin work slowly because the temperature is lower than the optimum temperature

70 °C thrombin denatures at 70°C because in higher temperature than the optimum temperature, the enzyme will be ruined.

[3]



(ii) Suggest how the activity of thrombin was determined.

By controlling the pH temperature and the temperature

..... [1]

(iii) State **two** conditions that would have been kept constant during the investigation.

1 the concentration of the thrombin

2 the volume of the thrombin ..... [2]

[Total: 13]

For Examiner's Use

Examiner comment – grade C

4(a)(i) Plasma is the liquid part of the blood, not a type of white blood cell. Lymphocyte is the correct answer.

4(a)(ii) Antibodies attach to viruses and stop them entering cells, but they do not 'kill' them.

4(b)(i) This is the correct answer.

4(b)(ii) This answer is too vague. Forming a 'coat' is not quite the description expected. Fibrin forms a mesh in which blood cells are trapped.

4(c)(i) No mark was given for the statement that 5 °C is lower than the optimum temperature. At 70 °C, the enzyme molecules are denatured so one mark was awarded for the whole question. Rather than saying 'the enzyme will be ruined', it is better to use a technical term and state that the active site of each enzyme is destroyed or changes shape so that the substrate cannot fit.

4(c)(ii) 'By controlling the pH and temperature' is an answer to the question 'what variables should be controlled in this investigation' rather than the question actually set. The activity of thrombin could be determined in a number of different ways, such as timing how long it takes for blood to clot.

4(c)(iii) The volume and concentration of thrombin (the enzyme) are two excellent answers.

Mark awarded = 4 out of 13

Example candidate response – grade E

4. Proteins in the blood are involved in protection of the body.

For Examiner's Use

Three proteins found in the blood are

- antibodies
- thrombin
- fibrinogen

(a) (i) Name the type of white blood cell that produces antibodies.

..... [1]

(ii) Outline how antibodies protect the body.

Antibodies protect the body when they are discharged from the tablets

..... [2]

(b) Thrombin is an enzyme that catalyses the reaction:

fibrinogen ⟶ fibrin

(i) State when this reaction occurs.

Digestion [1]

(ii) Explain how fibrin protects the body.

Fibrin protects the body because it ~~protects~~ keeps the skin tough and strong which do not allow objects to penetrate the skin easily.

..... [3]

An investigation was carried out to determine the effect of different temperatures on the activity of thrombin. The results are shown in Fig. 4.1.

For Examiner's Use

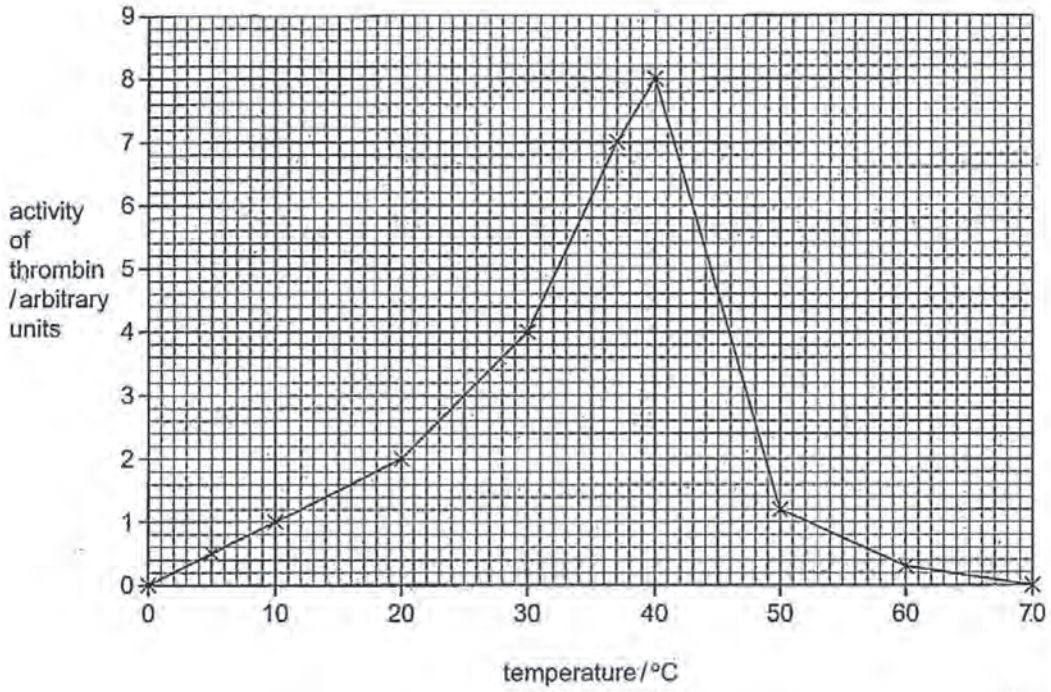
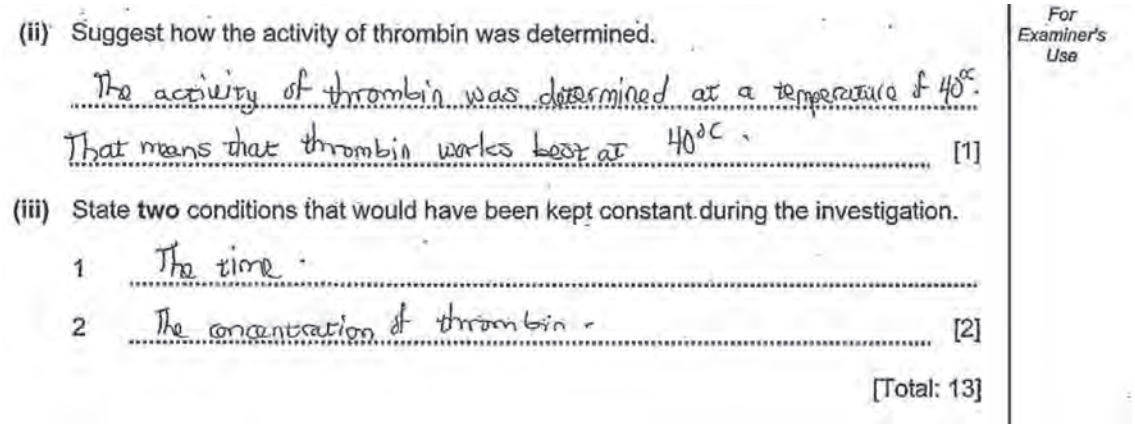


Fig. 4.1

(c) (i) Explain why thrombin functions slowly at 5 °C and does not function at all at 70 °C.

5 °C Thrombin functions slowly at 5°C because the temperature is ~~to~~ low and low temperature reduces the activity of thrombin.

70 °C It does not functions at all at 70°C because the temperature is too high and ~~to~~ that kind of high temperature denatures the thrombin. [3]



(ii) Suggest how the activity of thrombin was determined.

The activity of thrombin was determined at a temperature of 40°C. That means that thrombin works best at 40°C. [1]

(iii) State **two** conditions that would have been kept constant during the investigation.

1 The time.

2 The concentration of thrombin. [2]

[Total: 13]

For Examiner's Use

Examiner comment – grade E

4(a)(i) No response was given to this question. Candidates should know about two types of white blood cell: phagocyte and lymphocyte. If a candidate does not remember an answer, or cannot work it out, it is best to put a mark such as an asterisk (*) by the side of the question. This helps to identify questions that have not been answered and should be attempted before the end of the examination.

4(a)(ii) This answer is inaccurate and not specific enough, so does not merit any marks.

4(b)(i) This is not the correct answer. Fibrinogen is converted to fibrin when blood clots.

4(b)(ii) Fibrin forms a temporary protective cover for the skin; it is not a permanent feature of the skin as this answer suggests. No marks can be given here.

4(c)(i) The answer for 5 °C is a description rather than an explanation, so no mark can be given. At 70 °C, the enzyme molecules are denatured so one mark was awarded for the whole question. Another mark could be obtained by explaining what denaturation involves. The candidate could explain that the active site of the enzyme is destroyed as it loses its shape.

4(c)(ii) 'The activity of thrombin was determined at ... 40 °C' does not answer this question. The activity can be determined by finding out how long it takes the blood to clot. If the activity is low, then it will take a long time for clotting to occur.

4(c)(iii) The concentration of thrombin is an excellent answer. The time is not something that can be controlled unless it is the time for enzyme and substrate to be kept separately at each temperature before mixing them together. Time is the interval within which something happens, so if it is ever part of a correct answers, it usually means that more detail needs to be included about the event.

Mark awarded = 2 out of 13

Question 5

Mark scheme

5	(a)		wings ; beak ; feathers / plumage ; scales on, legs / feet ;	[3]	***ignore*** adjectives such as grey / long / sharp
	(b)	(i)	quantitative (feature) ; range between two extremes ; ref. to (many) intermediates ; not in distinct groups ; influenced by the environment (and genotype) ;	[2]	**A** answer in context of wing length
		(ii)	length of …… *anything suitable* (body) mass ; age ;	[max 1]	**A** height **R** any discontinuous variable, e.g. colour **A** weight **R** size / size of ….. **A** height
	(c)	(i)			*assume answer is about birds trapped unless stated otherwise*

1	largest number of / most, birds trapped ;
2	oldest (mean age for) birds trapped ;
3	comparative data quote for numbers ; *accept fraction / percentage / proportion of total*
4	comparative data quote for age ; **R** 'greater life expectancy'

[max 4]

wing length at ringing / mm	number of birds trapped	mean age at trapping / days
less than 63	24	253
64	72	256
65	130	297
66	183	346
67	167	349
68	106	270
69	66	237
more than 70	23	199
	total = 771	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

		(ii)	1 number of young birds of each wing length ; 2 wing lengths of birds that died ; 3 length of life / length of life after trapping ; 4 results for birds in West Africa ; 5 effects of migration ; 6 wing lengths of birds that breed ; 7 number of times each bird is trapped ; 8 effect of trapping on behaviour ; 9 larger sample ; 10 other locations in, Sweden / anywhere in Europe ; 11 AVP ; 12 AVP ;	[max 3]	*look for types of evidence, not assertions* **R** wing length of newly hatched birds **R** 'study should be repeated' e.g. number of eggs laid by birds of each wing length / test which birds fly furthest / test which birds best at catching food
	(d)		birds with wing length 66–67, survive / live longer ; breed / reproduce / have offspring ; pass on their allele(s) for wing length ; birds with smaller and larger wings, die ; do not reproduce (as successfully) ;	[max 4]	**A** gene(s) *wing length may be implied* **A** 'the others'
				[Total: 17]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade A

5 Reed warblers are small birds that migrate over long distances between western Africa and northern Europe.

For Examiner's Use

Fig. 5.1 shows a reed warbler, *Acrocephalus scirpaceus*.

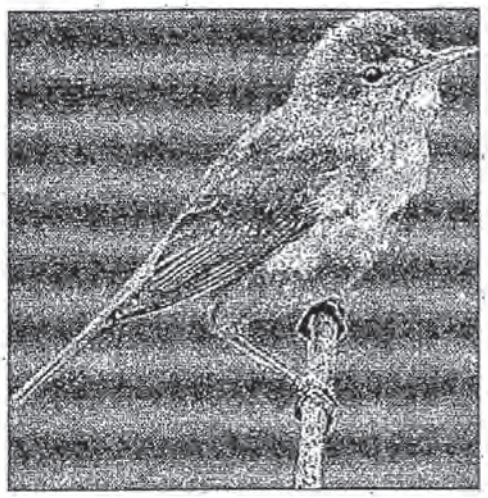


Fig. 5.1

(a) State three characteristic features of birds that are visible in Fig. 5.1.

1 Birds have feathers.

2 Birds have beaks.

3 Birds have eyes (and two limbs). [3]

A study was carried out in Sweden into the effects of natural selection on wing length in reed warblers.

The wings of young reed warblers reach their maximum length a few days after leaving the nest.

At this age the wing length in millimetres of each bird was recorded. Each bird was identified by putting a small ring around one of its legs.

When the birds were caught in net traps as adults, the information on the rings was used to identify specific birds and their ages.

The length of time between ringing and trapping was recorded for each bird that was identified before it was released.

The mean age at trapping was calculated for birds with each wing length.

The results are shown in Table 5.1.

For Examiner's Use

Table 5.1

wing length at ringing / mm	number of birds trapped	mean age at trapping / days
63 or less	24	253
64	72	256
65	130	297
66	183	346
67	167	349
68	106	270
69	66	237
70 or more	23	199
	total = 771	

(b) (i) Explain why wing length is an example of continuous variation.

Wing length is an example of continious variation because although the length of wings can be affected by genes, it is also greatly affected by environmental factors. [2]

(ii) Suggest a feature of reed warblers, **other than wing length**, that shows continuous variation.

The height and weight of the reed warbler [1]

(c) The researchers concluded that reed warblers with a wing length of 66-67 mm had the best chance of survival.

For Examiner's Use

(i) Describe the evidence from Table 5.1 that supports this conclusion.

Reed warblers with a wing length of 66-67mm, as seen in the table, had the best chance of survival because; the birds with a wing length of 66mm, after 346 days when they were trapped again, about 183 of them ~~where~~ were trapped, and birds with a wing length of 67mm, after 349 days when they were trapped again; about 167 of them were trapped. They, compared to others, were more, and after even more days. [4]

(ii) The researchers also suggested that more evidence was needed to make this conclusion.

Suggest what other evidence would show that birds with wings 66-67 mm in length have the best chance of survival.

- The birds wings should be accurately measured
- The birds should be exposed to various environmental conditions
- The experiment should be performed over and over again, before it is concluded that the 66-67mm winged birds have the best chance of survival. [3]

(d) Scientists have discovered that genes are responsible for wing length in reed warblers. The most common length of wing has been 66-67 mm for many generations of these birds.

For Examiner's Use

Explain how natural selection may be responsible for maintaining the mean wing length of reed warblers at 66-67 mm.

Due to the fact that 66-67 mm winged birds have been found to have the best chance of survival, natural selection takes place, as these birds are able to stand competition of the survival of the fittest'. As a result, other birds that cannot survive die due to competition, predators and so on, whereas these reed warblers continue to reproduce and evolve until they are the only types around. [4]

[Total: 17]

Examiner comment – grade A

5(a) The first two answers are characteristic features of birds. The third feature is not. Wings was a common correct answer.

5(b)(i) Features that show continuous variation are affected by the environment, so one mark was awarded. The candidate could also have stated that these features do not fit into distinct categories, e.g. long and short.

5(b)(ii) Both answers are correct. Only one feature is required and it would be the first answer given on the answer line that is marked. The second one is ignored.

5(c)(i) The candidate has explained that there are more birds trapped with a wing length of 66-67 mm and these had lived for the longest time. The examiner did not find the relevant points (marking points 1 and 2) until reaching the very end of the answer. Marking points 3 and 4 were only given if the data for birds of wing length 66 mm and/or 67 mm was contrasted with data from another group. The results for 66 mm and 67 mm are given but no comparison of numbers or mean age with the other groups is included.

5(c)(ii) This is a good way to structure an answer to a question like this. The candidate has realised that there are three marks and using bullet points is a good way to indicate three possible suggestions. Unfortunately, the question says 'what other evidence...', so repeating the study described in the question is not a correct response. The other responses were not correct either. The mark scheme lists some of the studies that could be carried out to find more evidence. In questions where candidates are asked to make suggestions, there are often quite a few marking points and often an AVP or two as well. AVP stands for any valid point.

5(d) This answer clearly shows that the candidate has interpreted the question correctly. References to competition and successful reproduction gain two marks. The candidate could gain the third by stating that the alleles for this wing length are passed on to the offspring.

Mark awarded = 8 out of 17

Example candidate response – grade C

5 Reed warblers are small birds that migrate over long distances between western Africa and northern Europe.

For Examiner's Use

Fig. 5.1 shows a reed warbler, *Acrocephalus scirpaceus*.

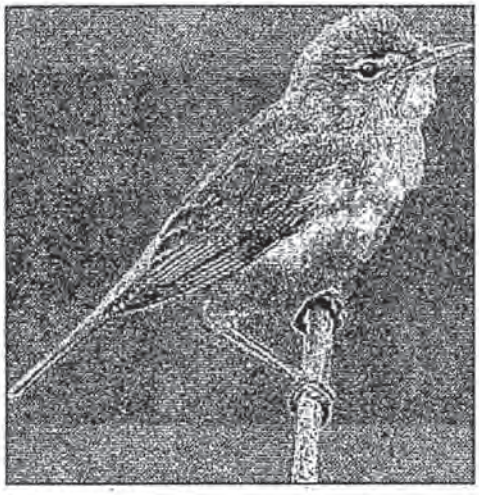


Fig. 5.1

(a) State three characteristic features of birds that are visible in Fig. 5.1.

1 Has a sharp beak

2 Has a two-toned feathers, top different from bottom

3 Also has long back feathers/wing [3]

A study was carried out in Sweden into the effects of natural selection on wing length in reed warblers.

The wings of young reed warblers reach their maximum length a few days after leaving the nest.

At this age the wing length in millimetres of each bird was recorded. Each bird was identified by putting a small ring around one of its legs.

When the birds were caught in net traps as adults, the information on the rings was used to identify specific birds and their ages.

The length of time between ringing and trapping was recorded for each bird that was identified before it was released.

For Examiner's Use

The mean age at trapping was calculated for birds with each wing length.

The results are shown in Table 5.1.

Table 5.1

wing length at ringing / mm	number of birds trapped	mean age at trapping / days
63 or less	24	253
64	72	256
65	130	297
66	183	346
67	167	349
68	106	270
69	66	237
70 or more	23	199
	total = 771	

(b) (i) Explain why wing length is an example of continuous variation.

Because the length of the wing can reach their maximum when the age of the birds has reached.

[2]

(ii) Suggest a feature of reed warblers, **other than wing length**, that shows continuous variation.

Length of beak [1]

(c) The researchers concluded that reed warblers with a wing length of 66-67 mm had the best chance of survival.

For Examiner's Use

(i) Describe the evidence from Table 5.1 that supports this conclusion.

Warblers with length of 66mm has an average of 346 mean/age. They ~~also have the lowest~~ Those who have have a width length of 67mm, have an even better average of year place. However, the number of Warblers with wing length of 66m which are trapped is ~~best~~ better is higher than all the others.

[4]

(ii) The researchers also suggested that more evidence was needed to make this conclusion.

Suggest what other evidence would show that birds with wings 66-67 mm in length have the best chance of survival.

a the wings are proportional to their body so the birds will
b not have a difficulties when flying and they can fly
c high since the birds will not feel heavy when flying.

[3]

(d) Scientists have discovered that genes are responsible for wing length in reed warblers. The most common length of wing has been 66-67 mm for many generations of these birds.

Explain how natural selection may be responsible for maintaining the mean wing length of reed warblers at 66-67 mm.

By reproduction of ~~the birds can a [illegible] birds has~~ the same allele.

[4]

[Total: 17]

Examiner comment – grade C

5(a) The first two answers are characteristic features of birds. Examiners take the first answer on each line. The third line has a feature (feathers) that has already been given so no mark is awarded even though the answer includes 'wings' which was a correct answer. Two marks were awarded for the question.

5(b)(i) This answer implies that wing length is an example of continuous variation because wings continue to grow. This is not the reason. If the candidate had stated that wing length is influenced by the environment, then a mark would have been awarded.

5(b)(ii) Length of beak is a correct answer. 'Beak' on its own is not, even though the candidate might have thought that was what he or she meant. There are many possible answers to this question, but each correct answer has to refer to a linear dimension, e.g. width or length, or to the mass of the whole bird or part of the bird. Age was another feature that was suitable.

5(c)(i) The candidate gains a mark at the very end of the answer. Marking point 1 is awarded as the answer refers to the large number of warblers of this wing length that are captured. The first sentence refers to the mean age of the warblers, but does not say that this is greater than the mean age of warblers with other wing lengths. This statement was required to gain marking point 2. To gain marking points 3 and 4, candidates had to give the age or numbers for the group 66–67 mm and compare this with the age or numbers of the other groups. The statement in the middle of the answer '... an even better average of your place' does not make sense. Candidates should reread their answers to check for errors such as this.

5(c)(ii) This answer gives a reason why they may be successful. This is not asked by the question, which asks for suggestions of evidence that they have the best chance of survival. The candidate's answer could be adapted to say something like 'find out how far birds with different wing lengths can fly' or 'find out how high birds with different wing lengths can fly'. Both aspects may be related to the food that they can catch.

5(d) The candidate gains a mark for stating that birds with wings 66–67 mm in length are successful at breeding. Candidates should refer to competition, survival and the inheritance of alleles for this length of wing. They can also say that birds with longer or shorter wings may not survive and do not get the chance to pass on their alleles.

Mark awarded = 5 out of 17

Example candidate response – grade E

5 Reed warblers are small birds that migrate over long distances between western Africa and northern Europe.

For Examiner's Use

Fig. 5.1 shows a reed warbler, *Acrocephalus scirpaceus*.

Fig. 5.1

(a) State three characteristic features of birds that are visible in Fig. 5.1.

1 Has a very long beak.

2 The wings are very long.

3 Has furs. [3]

A study was carried out in Sweden into the effects of natural selection on wing length in reed warblers.

The wings of young reed warblers reach their maximum length a few days after leaving the nest.

At this age the wing length in millimetres of each bird was recorded. Each bird was identified by putting a small ring around one of its legs.

When the birds were caught in net traps as adults, the information on the rings was used to identify specific birds and their ages.

The length of time between ringing and trapping was recorded for each bird that was identified before it was released.

The mean age at trapping was calculated for birds with each wing length.

The results are shown in Table 5.1.

For Examiner's Use

Table 5.1

wing length at ringing / mm	number of birds trapped	mean age at trapping / days
63 or less	24	253
64	72	256
65	130	297
66	183	346
67	167	349
68	106	270
69	66	237
70 or more	23	199
	total = 771	

(b) (i) Explain why wing length is an example of continuous variation.

Wing length is an example of continuous variation because it is common among organism of the same species but varies among organism of different species. [2]

(ii) Suggest a feature of reed warblers, **other than wing length**, that shows continuous variation.

Long beak. [1]

(c) The researchers concluded that reed warblers with a wing length of 66-67 mm had the best chance of survival.

For Examiner's Use

(i) Describe the evidence from Table 5.1 that supports this conclusion.

The researchers concluded that reed warblers with a wing length of 66–67 mm had the best chance of survival due to the result that the numbers of birds trapped was higher than the other birds with the other length of wings.

[4]

(ii) The researchers also suggested that more evidence was needed to make this conclusion.

Suggest what other evidence would show that birds with wings 66-67 mm in length have the best chance of survival.

The mean age at trapping ~~was~~ ~~it~~ had the greatest value compared to the wing length of other reed warblers.

[3]

(d) Scientists have discovered that genes are responsible for wing length in reed warblers. The most common length of wing has been 66-67 mm for many generations of these birds.

Explain how natural selection may be responsible for maintaining the mean wing length of reed warblers at 66-67 mm.

By reduction in the research of reed warblers at 66–67mm so as to reduce its value compared to other heights of the reed warblers.

[4]

[Total: 17]

Examiner comment – grade E

5(a) The first two answers are correct. Birds have feathers not fur so the third feature is incorrect.

5(b)(i) This answer suggests that the candidate was confused about continuous and discontinuous variation, and about variation between species and variation within species. The candidate could have referred to the range of wing lengths and all the intermediate lengths within the range. Alternatively, they could have explained that in discontinuous variation there are distinct categories, such as long and short wings without any intermediates.

5(b)(ii) The candidate should refer to the length of the beak as the feature.

5(c)(i) The candidate has made one point in this answer: the number of birds with this wing length was the largest. The question asks for evidence from the table, so an answer like this should be supported with numbers – for example, the numbers of birds with wing lengths of 66 mm and/or 67 mm that were trapped compared with the numbers for at least one of the other wing lengths.

5(c)(ii) The candidate has used more evidence from the table rather than suggesting other types of evidence that the scientists could find. If this answer had been written in part **(c)(i)** then another mark would have been awarded for that question.

5(d) The candidate has not used the cue of 'natural selection' in the question to discuss variation in wing length, competition for food and other resources, survival of those best adapted to the environment, breeding success and passing on alleles for wing length to the next generation.

Mark awarded = 3 out of 17

Question 6

Mark scheme

6	(a)		amylase ; prote(in)ase ; lipase ;	[3]	**R** carbohydrase **R** trypsin / pepsin / peptidase **R** 'protase', **A** 'proteas'
	(b)	1 2 3 4 5 6	prevents spread of (named) disease / AW ***ora*** ; avoids pollution / removes harmful substances ; makes, water / sewage / effluent, safe / AW ; avoids smells ; recycling of water ; AVP ; e.g. ref. to eutrophication	[max 1]	**A** removes harmful microbes / bacteria **R** 'germs' **A** examples no need to specify for whom or what it is safe, but **R** 'safer' unqualified, treat 'marine organisms' as 'aquatic'
	(c)	1 2 3 4 5 6 7 8 9	mixes microorganisms with sewage ; good contact between microorganisms and solids ; more collisions ; (aerobic) respiration ; **R** if anaerobic respiration microorganisms produce carbon dioxide ; gain / release / transfer, energy ; (for) growth ; (for) reproduction ; to make enzymes ; **A** ref. to digestion	[max 4]	**A** microbes / bacteria
	(d)		to start the breakdown of the sewage quickly ; continuous process ; do not have to, breed / buy, the microorganisms ; *idea of* without waiting for the lag phase ;	[max 3]	**A** 'the right organisms to digest the sewage' **A** ref. to cost / less wastage of microbes **A** keeps the population of microbes constant *idea* **R** 'to save time' unqualified **R** 'to use over and over again'
	(e)		destroys / kills, bacteria / microorganisms ; prevents spread of, disease / pathogens ; makes water suitable for drinking ;	[max 2]	**R** disinfection **R** 'removes bacteria'
				[Total: 13]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

A suitable grade A candidate response is not available for this question.

Example candidate response – grade C

6 Sewage disposal involves the removal of human waste in pipes from houses to sewage treatment works.

Fig. 6.1 is a diagram that shows how sewage is treated.

For Examiner's Use

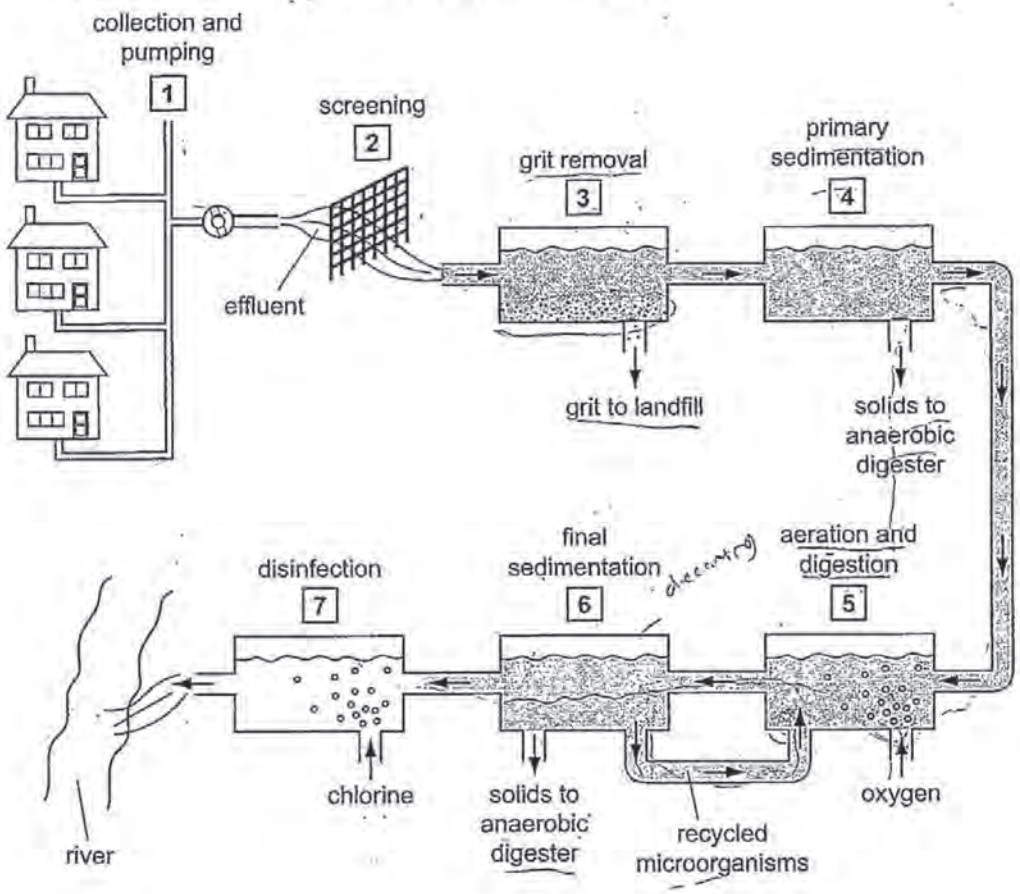


Fig. 6.1

(a) During stage 5 microorganisms break down organic matter consisting of cellulose, starch, protein and lipid (fat). The microorganisms multiply during this stage and are recycled.

For Examiner's Use

Complete Fig. 6.2 by writing in the boxes the names of the enzymes used to catalyse the reactions shown. The first box has been completed for you.

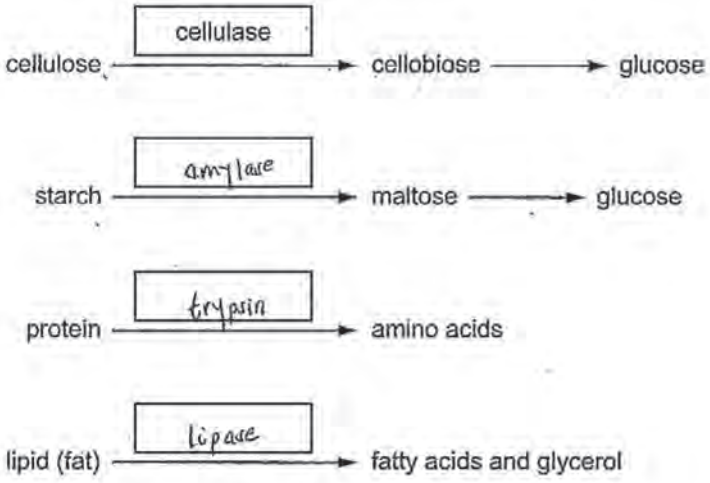


Fig. 6.2 [3]

For Examiner's Use

(b) State why it is important that sewage is treated.

To kill any present bacteria from the water and to purify it making it suitable for human consumption.

[1]

(c) At stage **5** in Fig. 6.1, oxygen and microorganisms are added.

Explain why oxygen is bubbled through the tank at this stage.

The oxygen would react with the micro-organism to produce carbon dioxide and ethanol that can be easily purified by chlorine.

[4]

(d) Suggest **and** explain the advantage of recycling microorganisms from stage **6** to stage **5** as shown in Fig. 6.1.

So that more of the product could be produced that is ethanol and carbon dioxide

[3]

(e) Explain why chlorine is added at stage **7**.

Chlorine is added at stage 7 to purify the water making it safe for human consumption.

[2]

[Total: 13]

Examiner comment – grade C

6(a) Amylase and lipase are correct answers. Trypsin is an enzyme found in the gut of animals. The correct answer for the final box is protease.

6(b) A variety of general answers were accepted for this question. Making water fit for human consumption is an excellent answer.

6(c) This is not a very good answer. Oxygen does not 'react with the microorganism(s)' but is used by them in aerobic respiration. The examiner has given a mark for the production of carbon dioxide, which happens in aerobic respiration, but rejected the point about ethanol as that would be a product from anaerobic respiration. In aerobic respiration the glucose, fatty acids and amino acids from the equations given in answer **(6a)** are broken down completely to carbon dioxide and water in aerobic respiration. This is the point of the question.

6(d) This answer is not correct. The microorganisms are recycled so that they can break down the organic waste immediately. If they were not recycled, small quantities of microorganisms would have to be introduced which would take time to reproduce and give a large enough population to complete the breakdown of the sewage.

6(e) There are two elements to this answer. Chlorine is added to purify water, making it fit for human consumption; it does this by killing any bacteria left in the water. The candidate would have got the second mark by explaining how chlorine makes the water fit for consumption.

Mark awarded = 5 out of 13

Example candidate response – grade E

6 Sewage disposal involves the removal of human waste in pipes from houses to sewage treatment works.

For Examiner's Use

Fig. 6.1 is a diagram that shows how sewage is treated.

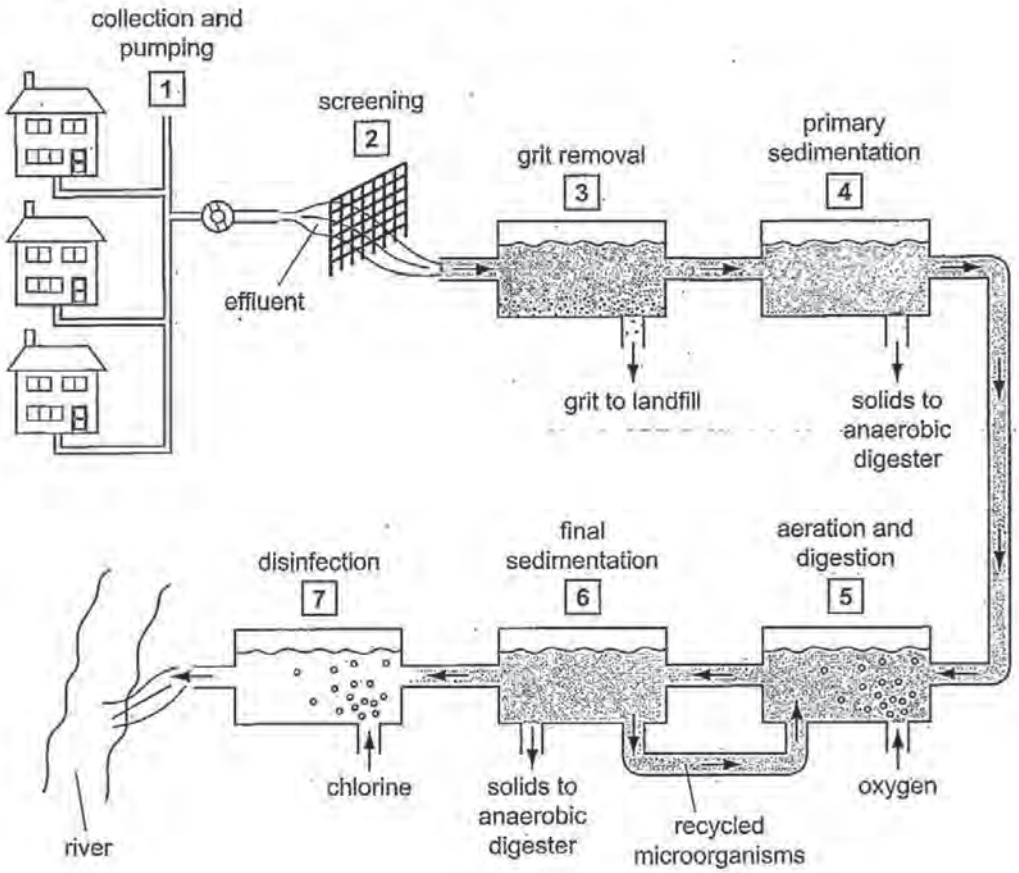


Fig. 6.1

(a) During stage **5** microorganisms break down organic matter consisting of cellulose, starch, protein and lipid (fat). The microorganisms multiply during this stage and are recycled.

For Examiner's Use

Complete Fig. 6.2 by writing in the boxes the names of the enzymes used to catalyse the reactions shown. The first box has been completed for you.

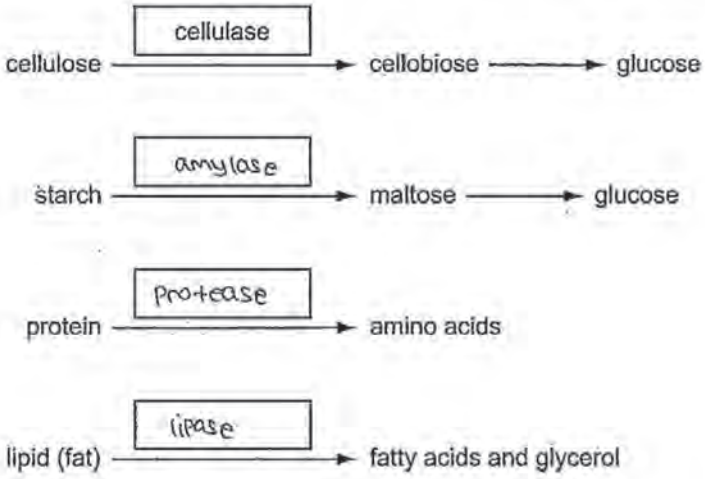


Fig. 6.2 [3]

(b) State why it is important that sewage is treated.

Because sewage can be a toxtcal chemical that can be harm to the ecosystem.

[1]

For Examiner's Use

(c) At stage 5 in Fig. 6.1, oxygen and microorganisms are added.

Explain why oxygen is bubbled through the tank at this stage.

Because oxygen is used in the transpiration of the microorganisms, they take in oxygen. The microorganisms can breakdown impurity of the water so that it can be clean.

[4]

(d) Suggest **and** explain the advantage of recycling microorganisms from stage **6** to stage **5** as shown in Fig. 6.1.

- can remove the bacteria
- can make the water became pure
- can recycle the solid then remove it to anaerobic digester

[3]

(e) Explain why chlorine is added at stage **7**.

to kill the bacteria and make the water colour became clear.

[2]

[Total: 13]

Examiner comment – grade E

6(a) All three names are correct.

6(b) The candidate has stated that sewage is a 'toxical' chemical that can harm the ecosystem. If the candidate had explained how sewage can harm ecosystems, a mark would have been awarded.

6(c) The candidate is confused over terminology. It is quite clear that he or she meant to write 'respiration' not 'transpiration' of microorganisms. If the candidate had given some more detail of respiration then marks would have been awarded. It is very important to know the terms used in the syllabus and not to confuse them as here.

6(d) This answer suggests that an advantage of the recycling of microorganisms from tank 6 to tank 5 is that the solids from tank 6 will go to the anaerobic digester as shown in Fig. 6.1. This is not an advantage of the recycling of the microorganisms, which are reused in the aerobic process in tank 5, this speeding up the process.

6(e) Chlorine is added to kill the bacteria. This gains one mark. The important point about this is that water now becomes safe for use as drinking water and this point could have been made for an extra mark. There may be bacterial pathogens in the water and these would be killed, thus reducing the spread of disease.

Mark awarded = 4 out of 13

Question 1

Mark scheme

1 (a) (i)	lines clearly divide columns ; lines clearly divide rows ; headings ; Units only in headings ;	[4]	
(ii)	overall decrease in both tubes ; 6 results in test-tube **A** ; 6 results in rest-tube **B** ;	Max [3]	
(iii)	A – axes labelled with suitable scale ; S – size ; P – plots accurate ; L – line ; K – key / means to identify both lines ;	[5]	must fill at least half the grid +/– 1 mm **A** point to point / smooth curve / line of best fit
(b)	*Description* overall temperature decreased in both tubes ; test-tube A greater loss in temperature ; *Explanation* air trapped between layers of paper in test-tube B ; (still) air is a good insulator / poor conductor of heat ; AW	Max [3]	Allow ecf from candidates results
(c)	two suitable sources of error ; ; two suitable improvements ; ;	[4]	Must relate to the method in the question. Improvement must relate to error.
(d)	25 ;	[1]	
(e)	Correct lines and labels to: hair follicle ; fatty tissue ;	[2]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

(f) (i)	length of line **PQ** on Fig.1.3 = 80 mm;	[1]	+/– 1 mm / 79 – 81
(ii)	formula – $\frac{\text{length of PQ}}{\text{actual length}}$; magnification = 20 ;	[2]	**A** Ecf from f(i)
(g)	cobalt chloride paper ; (blue to) pink ;	[2]	
		[Total: 27]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade A

Read through all the questions on this paper carefully before starting work.
You may need to spend more time on Question 1.

For Examiner's Use

1 Some animals have an outer layer of fur or feathers which helps to keep their internal body temperature constant.

You are going to investigate the effect of an outer layer on the cooling rate of water in test-tubes.

- test-tube **A** – leave uncovered
  Label this test-tube 2 cm from the top, **A**.
- test-tube **B** – cover with two layers of paper towel
  Secure the covering with two elastic bands, as shown in Fig. 1.1.
  Label this test-tube 2 cm from the top, **B**.

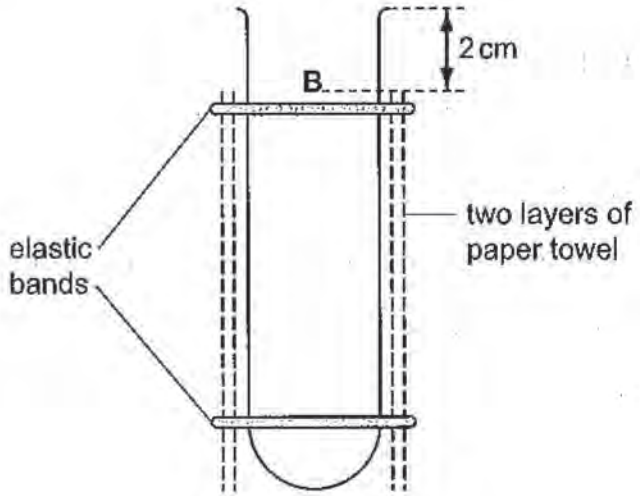


Fig. 1.1

You are going to measure the temperature of water in test-tubes **A** and **B** over 10 minutes.
You must read and record the temperature at 0 (start), 2, 4, 6, 8 and 10 minutes.

For Examiner's Use

(a) (i) Construct a suitable table in which to record your results.

Time/minutes	Temperature of Tube A/°C	Temperature of Tube B/°C
0	61	61
2	56	59
4	53	56
6	50	54
8	48	52
10	46	50

[4] 4 ✓

When you have reached this stage, raise your hand for the Supervisor to bring you a beaker of hot water.

(ii)

- Carefully fill both test-tubes with hot water, up to the letter label.
- Place the thermometer in test-tube **A** and read the starting temperature.
  Write this in your table.

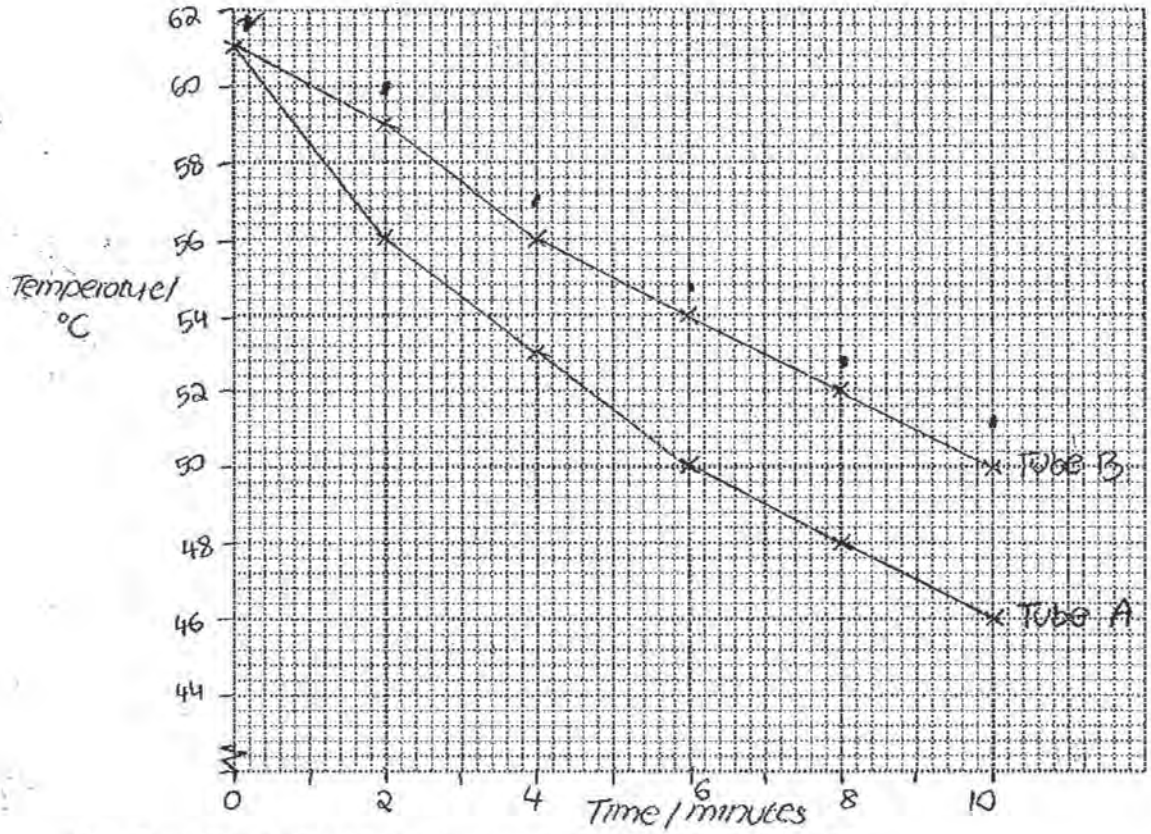
  Start timing.
- Immediately place the thermometer into test-tube **B** and read the starting temperature.
  Write this in your table.
- Place the thermometer back into test-tube **A**.
- At 2 minutes, read the temperature and write this in your table.
- Immediately place the thermometer in test-tube **B** and read the temperature.
  Write this in your table.
- Repeat this process at 4, 6, 8 and 10 minutes.

[3] 3?

(iii) Construct a graph using your results, to compare the cooling of the water in test-tubes **A** and **B**.

Use the same axes for both test-tubes.

For Examiner's Use



[5]

5 ✓

(b) Describe **and** explain your results for test-tubes **A** and **B**.

The starting temperature for both tubes is the same, 61°C. Tube A loses heat more rapidly than Tube B. This is because, in Tube B, the tissue paper traps a layer of air, which acts as insulation. over ten minutes, Tube B only loses 11°C, whereas Tube A loses 15°C. Tube A is uninsulated and loses heat rapidly. [3]

3 ✓

(c) State **two** sources of error in the **method** of this investigation.
Suggest how to improve the method to reduce **each** source of error.

15 ✓

For Examiner's Use

source of error Using one thermometer for both the tubes - readings may be innacurate. ✓

improvement use two thermometers, one in each tube. ✓

source of error ~~The top of the tubes are not covered.~~ The volume of water in the tubes are not exactly equal ✓

improvement use a measuring cylinder to measure equal volumes of water for each tube. This ensures a fair test. [4] 4 ✓

(d) A student repeated this investigation in a room at 25°C.
Predict the temperature of the water in test-tubes **A** and **B** after one hour.

temperature 25 ✓ °C [1] 1 ✓

(e) On Fig. 1.3 draw a line and label each of the following structures:

- hair follicle
- fatty tissue [2]

2 ✓

(f) (i) Measure the length of line **PQ** on Fig. 1.3.

PQ ..... 80 ✓ mm [1]

1 ✓

(ii) On the microscope slide, the actual length of line **PQ** was 4 mm.

Calculate the magnification of Fig. 1.3.

Show your working.

magnification = observed ~~size~~ length / actual ~~size~~ length

= 80 / 4 ✓

= 20×

magnification ..... 20× ✓ [2]

2 ✓

(g) When the body temperature is raised sweat is released from sweat glands to the surface of the skin.

Describe how you could test for the presence of water in sweat.

The sample of sweat can be heated and its boiling point can be found. It will be around 100°C, but not exactly 100°C because there are salts in it. It can also be added to white anhydrous copper (II) sulphate. If it turns blue water is present. [2]

2 ✓

[Total: 27]

20 For Examiner's Use

Examiner comment – grade A

1(a)(i) The candidate produced a table divided into rows and columns with ruled lines. The headings were complete and the units were not repeated in the body of the table.

1(a)(ii) The table showed six readings for tubes A and B, and the temperature of both decreased during the ten minutes of the investigation.

1(a)(iii) Axes: both axes were labelled clearly. Also the scale for the *y*-axis had been chosen to show clearly the differences between the two lines. This was not essential for the mark, but it is obviously good practice.
Scale: the graph correctly filled more than half the grid.
Plots: all accurate.
Line: ruler drawn dot to dot.
Key: lines for tubes A and B labelled.

1(b) The candidate gained the first two marking points together in the sentence, 'Tube A loses heat more rapidly than Tube B'. The explanation that air was trapped in the paper towel around B is correct.

1(c) The candidate states two sources of error and suggests how each could be reduced.

1(d) 25 °C stated correctly.

1(e) Both the labels were accurate.

1(f)(i)+(ii) The candidate measured the line accurately, used the correct formula and completed the calculation correctly.

1(g) The first suggestion made by the candidate (using the boiling point of water) was impractical for use on a sample of sweat. However, the second suggestion of white anhydrous copper II sulfate turning blue was an acceptable alternative to the use of cobalt chloride paper, as given on the mark scheme.

Mark awarded = 27 out of 27

Example candidate response – grade C

Read through all the questions on this paper carefully before starting work.
You may need to spend more time on Question 1.

For Examiner's Use

1 Some animals have an outer layer of fur or feathers which helps to keep their internal body temperature constant.

You are going to investigate the effect of an outer layer on the cooling rate of water in test-tubes.

- test-tube **A** – leave uncovered
  Label this test-tube 2 cm from the top, **A**.
- test-tube **B** – cover with two layers of paper towel
  Secure the covering with two elastic bands, as shown in Fig. 1.1.
  Label this test-tube 2 cm from the top, **B**.

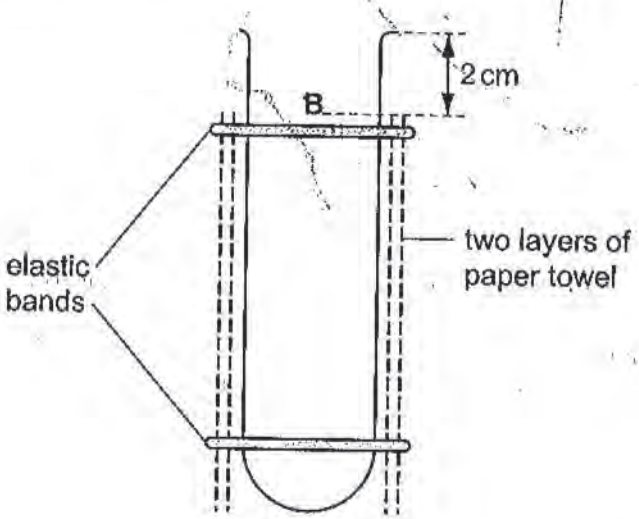


Fig. 1.1

You are going to measure the temperature of water in test-tubes **A** and **B** over 10 minutes.
You must read and record the temperature at 0 (start), 2, 4, 6, 8 and 10 minutes.

For Examiner's Use

(a) (i) Construct a suitable table in which to record your results.

TIME (3)	TEMPERATURE/°C	
	A	B
0	58	58
2	56	57
4	54	56
6	53	55
8	52	54
10	51	53

[4] 3

When you have reached this stage, raise your hand for the Supervisor to bring you a beaker of hot water.

(ii)

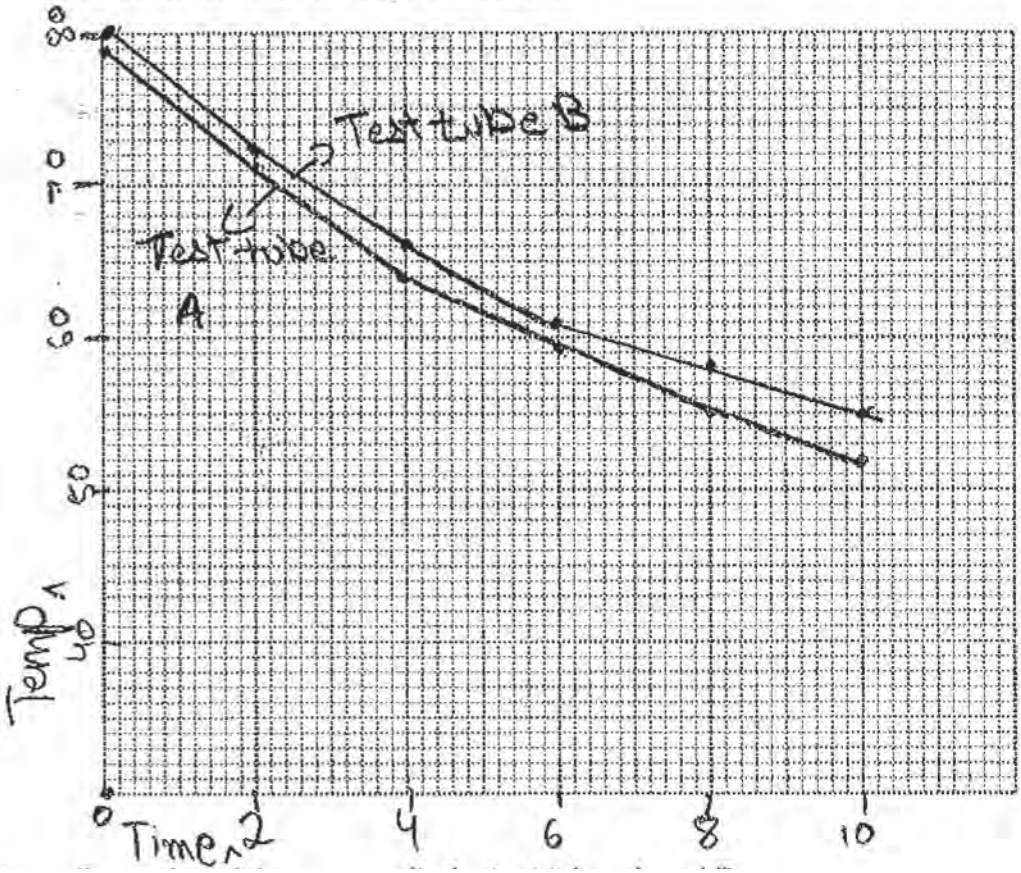
- Carefully fill both test-tubes with hot water, up to the letter label.
- Place the thermometer in test-tube **A** and read the starting temperature.
  Write this in your table.

  Start timing.
- Immediately place the thermometer into test-tube **B** and read the starting temperature.
  Write this in your table.
- Place the thermometer back into test-tube **A**.
- At 2 minutes, read the temperature and write this in your table.
- Immediately place the thermometer in test-tube **B** and read the temperature.
  Write this in your table.
- Repeat this process at 4, 6, 8 and 10 minutes. [3]

3

(iii) Construct a graph using your results, to compare the cooling of the water in test-tubes **A** and **B**.

Use the same axes for both test-tubes.



[5]

For Examiner's Use

A ✗
S ✓
P ✓
L ✓
K ✓

10
4

(b) Describe **and** explain your results for test-tubes **A** and **B**.

The initial temp in test tube A was less than Testtube B's initial temperature. Then Temp. in Test tube A dropped more rapidly than testtube B because B had been covered with a paper towel so the heat constant and hotter ✗

[3]

2

(c) State **two** sources of error in the **method** of this investigation.
Suggest how to improve the method to reduce **each** source of error.

source of error Timing of the test tubes, unable to time accurately, so unable to record data accurately X

improvement Should have two stop watches so that both test tubes can be timed accurately to allow more accurate readings. X

source of error Only one thermometer to measure two test tubes, cannot measure temperatures accurately ✓

improvement Should have two thermometers to measure both temperatures accurately as there is no need to take thermometers out of test tubes. ✓ [4]

2

(d) A student repeated this investigation in a room at 25°C.
Predict the temperature of the water in test-tubes **A** and **B** after one hour.

temperature Test tube A = 25° Test tube B = 30° X °C [1]

0

For Examiner's Use

(e) On Fig. 1.3 draw a line and label each of the following structures:

- hair follicle
- fatty tissue [2]

For Examiner's Use

1 ✓

(f) (i) Measure the length of line **PQ** on Fig. 1.3.

PQ 800 ✗ mm [1]

0

(ii) On the microscope slide, the actual length of line **PQ** was 4 mm.

Calculate the magnification of Fig. 1.3.

Show your working.

200
800
4

ecf. ✓

2

magnification 200 ✓ [2]

(g) When the body temperature is raised sweat is released from sweat glands to the surface of the skin.

For Examiner's Use

Describe how you could test for the presence of water in sweat.

When sweat is produced it has many substances in it. The water evaporates, cooling the body. The water also leaves back the impurities present in it. So the evaporation of the sweat is one of the test (tests) for the presence of water. ✗ [2]

0

[Total: 27]

18

Examiner comment – grade C

1(a)(i) The candidate produced a table divided into rows and columns with ruled lines. However, the time heading had seconds as the unit, so the third marking point was not awarded. No units were given in the body of the table.

1(a)(ii) The table showed six readings for tubes A and B, and the temperature of both decreased during the ten minutes of the investigation.

1(a)(iii) Axes: both axes were included the units concerned.
Scale: the graph correctly used more than half the grid.
Plots: not all the plots were accurate.
Line: the line was drawn dot to dot using a ruler. The extrapolation of line B was acceptable as it was slight.
Key: lines for tubes A and B were labelled.

1(b) The candidate gained the first two marking points, but failed to explain why the paper towel wrapped round tube B had its effect.

1(c) The first source of error suggested is invalid as all candidates were provided with a suitable clock or timer. It follows that the improvement was unacceptable. The second source of error is sound, as is the suggestion of providing two thermometers.

1(d) The candidate recognised that tube A would not drop below 25 ^{0}C, but thought that the insulation around tube B would have slowed the cooling sufficiently for it only to have reached 30 ^{0}C.

1(e) The follicle was correctly labelled but the candidate could not identify fatty tissue.

1(f)(i)+(ii) The candidate gave an incorrect measurement for the line but went on to use it in the correct formula and completed the calculation accurately.

1(g) The candidate uses a circular argument, essentially saying that as sweat cools the body by evaporation of water, then water must be present in sweat. A chemical test was required for a correct answer.

Mark awarded = 20 out of 27

Example candidate response – grade E

Read through all the questions on this paper carefully before starting work.
You may need to spend more time on Question 1.

For Examiner's Use

1 Some animals have an outer layer of fur or feathers which helps to keep their internal body temperature constant.

You are going to investigate the effect of an outer layer on the cooling rate of water in test-tubes.

- test-tube **A** – leave uncovered
  Label this test-tube 2 cm from the top, **A**.
- test-tube **B** – cover with two layers of paper towel
  Secure the covering with two elastic bands, as shown in Fig. 1.1.
  Label this test-tube 2 cm from the top, **B**.

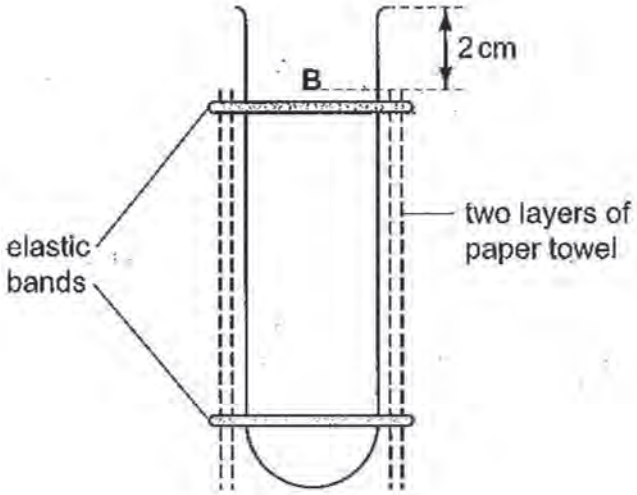


Fig. 1.1

You are going to measure the temperature of water in test-tubes **A** and **B** over 10 minutes.
You must read and record the temperature at 0 (start), 2, 4, 6, 8 and 10 minutes.

For Examiner's Use

(a) (i) Construct a suitable table in which to record your results.

Temperature of water/°C		
Mins /	A	B
2	62°	65°
4	54°	55°
6	45°	50°
8	41°	45°
10	38°	42°

[4]

When you have reached this stage, raise your hand for the Supervisor to bring you a beaker of hot water.

(ii)

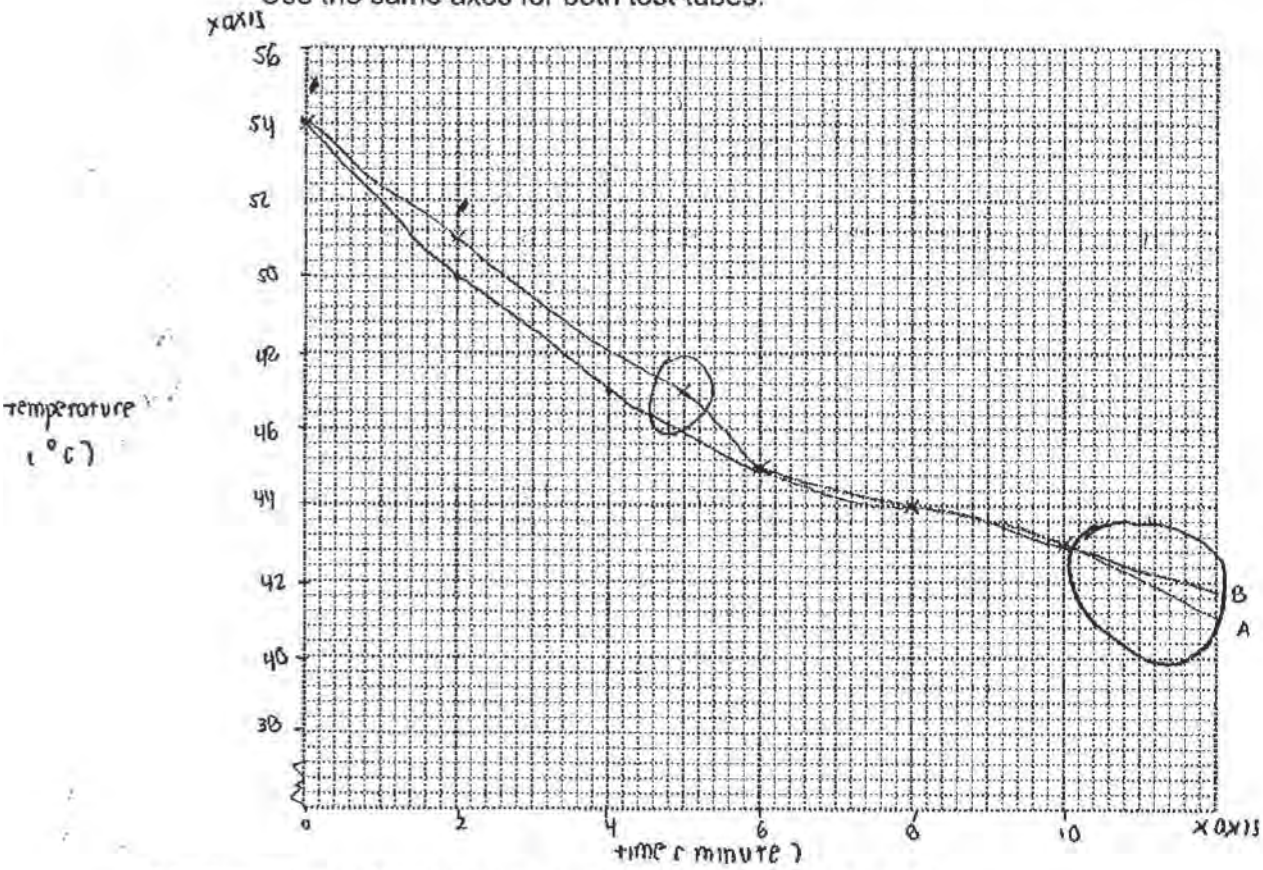
- Carefully fill both test-tubes with hot water, up to the letter label.
- Place the thermometer in test-tube **A** and read the starting temperature.
  Write this in your table.

  Start timing.
- Immediately place the thermometer into test-tube **B** and read the starting temperature.
  Write this in your table.
- Place the thermometer back into test-tube **A**.
- At 2 minutes, read the temperature and write this in your table.
- Immediately place the thermometer in test-tube **B** and read the temperature.
  Write this in your table.
- Repeat this process at 4, 6, 8 and 10 minutes. [3]

(iii) Construct a graph using your results, to compare the cooling of the water in test-tubes **A** and **B**.

Use the same axes for both test-tubes.

For Examiner's Use



[5]

3

(b) Describe **and** explain your results for test-tubes **A** and **B**.

test tube B has greater change of temperature at the ~~initial~~ 0-6 min time whereas test tube A has smaller change of temperature. test tube B has lower rate of temperature in the average due to the presence of tissue whereas test tube A has larger rate of temperature because ~~the~~ tissue is absent. the initial temperature (a°c) for ~~the~~ both the test tube are equal

[3]

0

(c) State **two** sources of error in the **method** of this investigation.
Suggest how to improve the method to reduce **each** source of error.

For Examiner's Use

source of error 1 Temperature difference. X

.....

improvement The temperature should be constant no source of sudden wind to be provided ✓

source of error Impurities X

.....

improvement The water should be boil and the utensils should be clean properly before experiment [4]

1

(d) A student repeated this investigation in a room at 25°C.
Predict the temperature of the water in test-tubes **A** and **B** after one hour.

✓

temperature 15°c X °C [1]

0

(e) On Fig. 1.3 draw a line and label each of the following structures:

- hair follicle
- fatty tissue

[2]

For Examiner's Use

0

(f) (i) Measure the length of line **PQ** on Fig. 1.3.

PQ ..... 80 mm [1]

1

(ii) On the microscope slide, the actual length of line **PQ** was 4 mm.

Calculate the magnification of Fig. 1.3.

Show your working.

magnified length / Actual = 8/4 = 2 X

0

magnification ..... x 2 times ..... [2]

(g) When the body temperature is raised sweat is released from sweat glands to the surface of the skin.

Describe how you could test for the presence of water in sweat.

Take a drop of the ~~sample~~ water in to a test tube. Pour drops of iodine into the test tube. If the ~~sweat~~ water turns ~~purple~~ blue-black, starch is present, which means there is sweat in the sample X [2]

0

[Total: 27]

20

Examiner comment – grade E

1(a)(i) The candidate gained the two marks available for constructing the table. The mark for the headings was not awarded as no units were given and the temperature heading overarched the time column. The degree symbol appeared with each temperature entry, thus losing the fourth marking point.

1(a)(ii) The candidate's results show a temperature decrease over the ten minutes of the investigation. However, there are only five entries for each tube as the starting temperatures have been omitted.

1(a)(iii) Axes: both axes were labelled clearly.
Scale: the graph correctly used more than half the grid.
Plots: the third plot for tube B was entered in error at 4.5 minutes.
Line: both lines had been extrapolated to eleven minutes so lost a mark.
Key: the lines for tubes A and B were correctly labelled.

1(b) The candidate refers to 'range of temperature' but does not state that there is a decrease in temperature. The candidate refers to the presence of tissue paper around tube B but does not explain its effect.

1(c) The first source of error is not sufficiently clear as it is not stated what is varying in temperature. However, the improvement (effectively protecting from draughts) was acceptable. The second source of error is incorrect (and the improvement given is also invalid).

1(d) The candidate predicted that both tubes would cool to a temperature below that of the room in which the investigation was carried out, which is incorrect.

1(e) Neither label was correct.

1(f)(i)+(ii) The line was measured accurately so one mark was awarded. However, the substitution in the formula was incorrect and therefore the calculated magnification was also incorrect and no marks were awarded.

1(g) The candidate gave a confused answer including wanting to test for the presence of starch. No marks could be awarded.

Mark awarded = 8 out of 27

2 (a)	5 petals ; shape ; detail – attachment / honey guides / veins / AW ;	[3]	Check against Supervisor's Report
(b)	**Outline:** use of single clear lines for drawing ; **Size:** at least half of the space available ; **Detail:** sepals or receptacle shown; **Label:** stigma **and** style ;	[4]	**R** shading / cross hatching
(c)	***one** from:* large, (brightly) coloured or conspicuous flower ; petals ; honey guides ; central or enclosed stigma and style ; enclosed stamens ;	Max [1]	
(d)	Seed = ovule ; Fruit = ovary (wall) ;	[2]	
(e)	***three** from:* feathery stigma ; light pollen ; exposed stigma and style ; a lot of pollen produced ;	Max [3]	
		[Total: 13]	

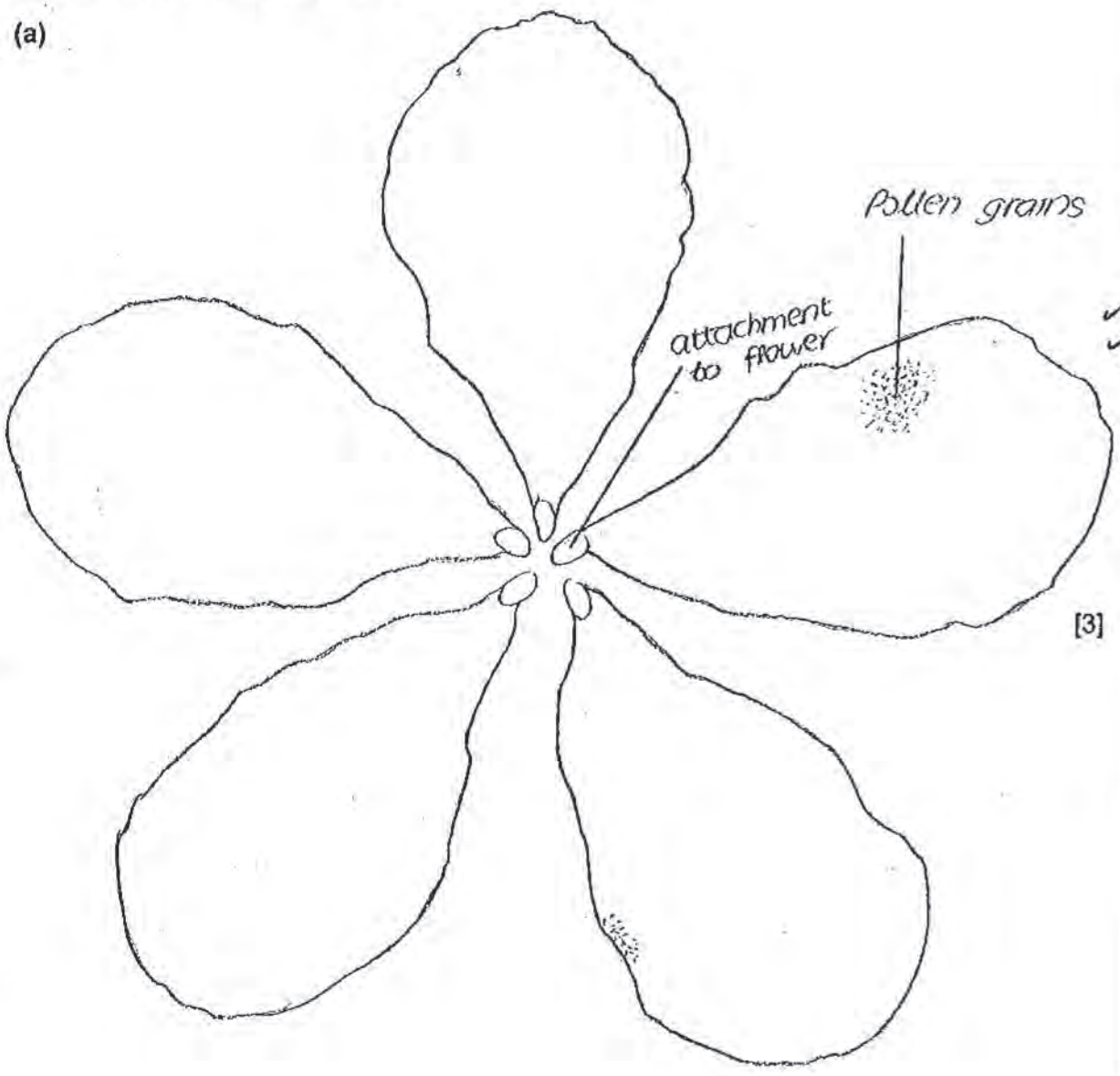
The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade A

2 You are provided with a flower in a beaker of water.

- Remove the petals one at a time.
- Put the central reproductive structures on the white tile. You will need them for **(b)**.
- Place each petal in the space below.
- Draw around each petal.
- Use the hand lens to examine the petals.
- Record any detail you observe.

(a)



[3]

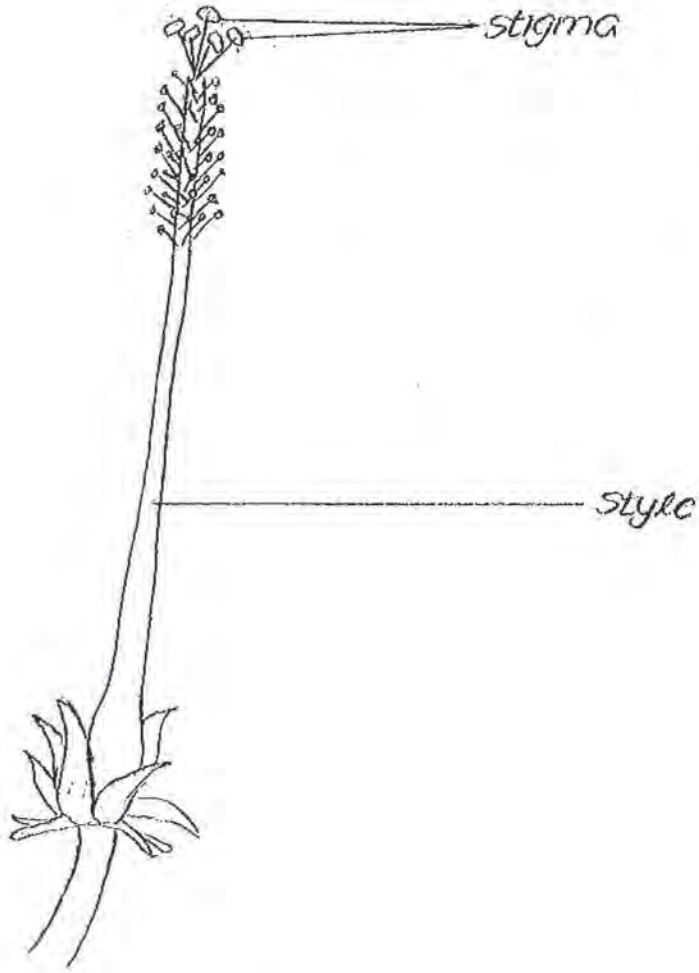
3/

For Examiner's Use

(b) Make a large drawing of the central reproductive structures.

Label the stigma **and** style.

For Examiner's Use



[4] 4 /

(c) Describe **one** visible feature that shows the flower is insect-pollinated.

The large, brightly-coloured petals show that it is an insect-pollinated flower. [1] 1 /

(d) State the part of the reproductive structures which become

the seed, ovule

the fruit. ovary [2]

(e) Describe how a typical wind-pollinated flower is different from a typical insect-pollinated flower.

A wind-pollinated flower does not have any fragrance. It also does not have nectaries, An insect-pollinated flower is fragant and has nectaries that produce nectar to attract insects for pollination. A wind-pollinated flower has numerous anthers and a large, feathery stigma that hangs outside the flower. An insect-pollinated flower has the anthers and stigma held inside the flower. A wind-pollinated flower has dull-coloured petals, unlike an insect-pollinated flower's brightly-coloured petals. [3]

[Total: 13]

For Examiner's Use

8 1

2 1

max

3 1

13

Examiner comment – grade A

2(a) The candidate correctly drew five petals all of the same shape and corresponding to those provided in the examination. The attachment point (detail) was also drawn and labelled correctly.

2(b) Outline: a clear line was used.
Size: the diagram was larger than half the space provided, as required.
Detail: the sepals and receptacle were both drawn.
Label: both the stigma and style were labelled accurately.

2(c) The candidate correctly stated that the petals are large and brightly coloured.

2(d) The candidate correctly stated the ovule and the ovary.

2(e) The candidate correctly pinpointed three differences between a wind-pollinated flower and an insect-pollinated flower.

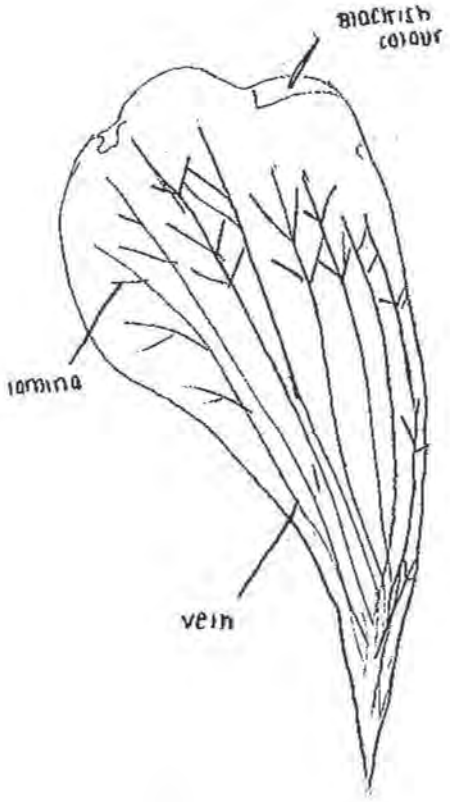
Mark awarded = 13 out of 13

Example candidate response – grade C

2 You are provided with a flower in a beaker of water.

- Remove the petals one at a time.
- Put the central reproductive structures on the white tile. You will need them for **(b)**.
- Place each petal in the space below.
- Draw around each petal.
- Use the hand lens to examine the petals.
- Record any detail you observe.

(a)



- the petal has branching vein (lamina)
- has blackish color

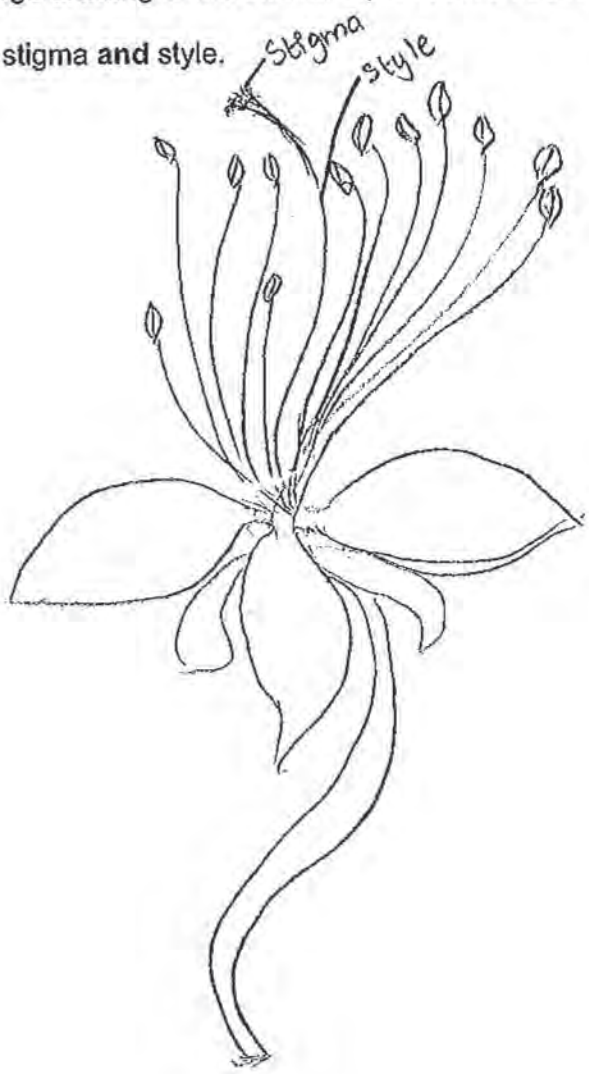
X

[3] 2/

For Examiner's Use

(b) Make a large drawing of the central reproductive structures.

Label the stigma **and** style.



[4]

For Examiner's Use

4

(c) Describe **one** visible feature that shows the flower is insect-pollinated.

Colourful Petals.

[1]

1

(d) State the part of the reproductive structures which become

the seed, ovum ✗

the fruit. Ovary ✓ [2]

For Examiner's Use

2

(e) Describe how a typical wind-pollinated flower is different from a typical insect-pollinated flower.

Wind pollinated	insect-pollinated
- leaves are pointy	- no pointy +
- grow in winters	- usually in summer +
- no scent ✓	- with scent
- Green in color	- colourfull
~~eg grass~~	- ~~eg sun flower~~
- pollen grains with wings ✓ ±	- pollen grains + without wings.
- ~~pollen grains~~	eg - sunflower
- eg - grass	

[Total: 13]

2

9

Examiner comment – grade C

2(a) Although the shape of the petal corresponded to that of the flower provided in the examination, only one petal was drawn rather than the five required. The candidate provided some observed details to go with it as required in the mark scheme.

2(b) Outline: overlapping, sketchy lines used.
Size: the diagram was larger than half the space provided, as required.
Detail: the receptacle was drawn.
Label: both stigma and style were labelled accurately.

2(c) The candidate correctly stated colourful petals.

2(d) The candidate knew that the fruit developed from the ovary, but stated incorrectly that it was the ovum that produced the seed.

2(e) The candidate has given one clear difference between the two types of flowers: scent production in the insect-pollinated flower. The difference about pollen grains having 'wings' in wind-pollinated flowers was accepted as, although it is not a universal feature, many such flowers produce pollen with air bladders. The candidate was not awarded a mark for the fourth suggestion. Presumably the candidate was referring to the petals of a wind-pollinated flower, but the feature is not named so this cannot be confirmed. The candidate's other suggested differences, particularly in relation to insect-pollinated flowers were not creditworthy.

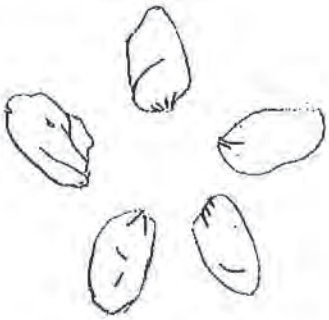
Mark awarded = 9 out of 13

Example candidate response – grade E

2 . You are provided with a flower in a beaker of water.

- Remove the petals one at a time.
- Put the central reproductive structures on the white tile. You will need them for **(b)**.
- Place each petal in the space below.
- Draw around each petal.
- Use the hand lens to examine the petals.
- Record any detail you observe.

(a)



For Examiner's Use

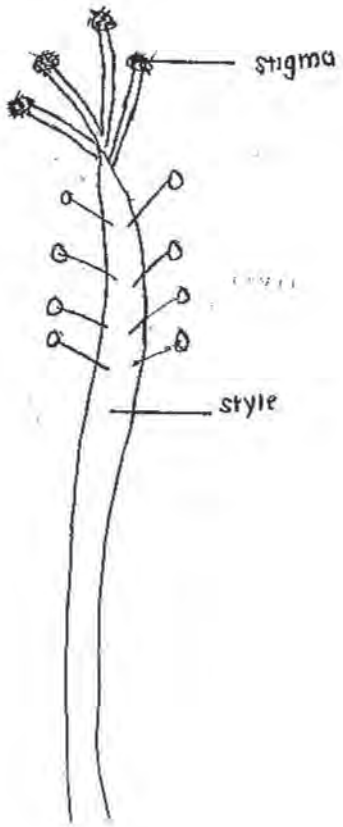
2

[3]

(b) Make a large drawing of the central reproductive structures.

Label the stigma **and** style.

For Examiner's Use



[4]

2/

(c) Describe **one** visible feature that shows the flower is insect-pollinated.

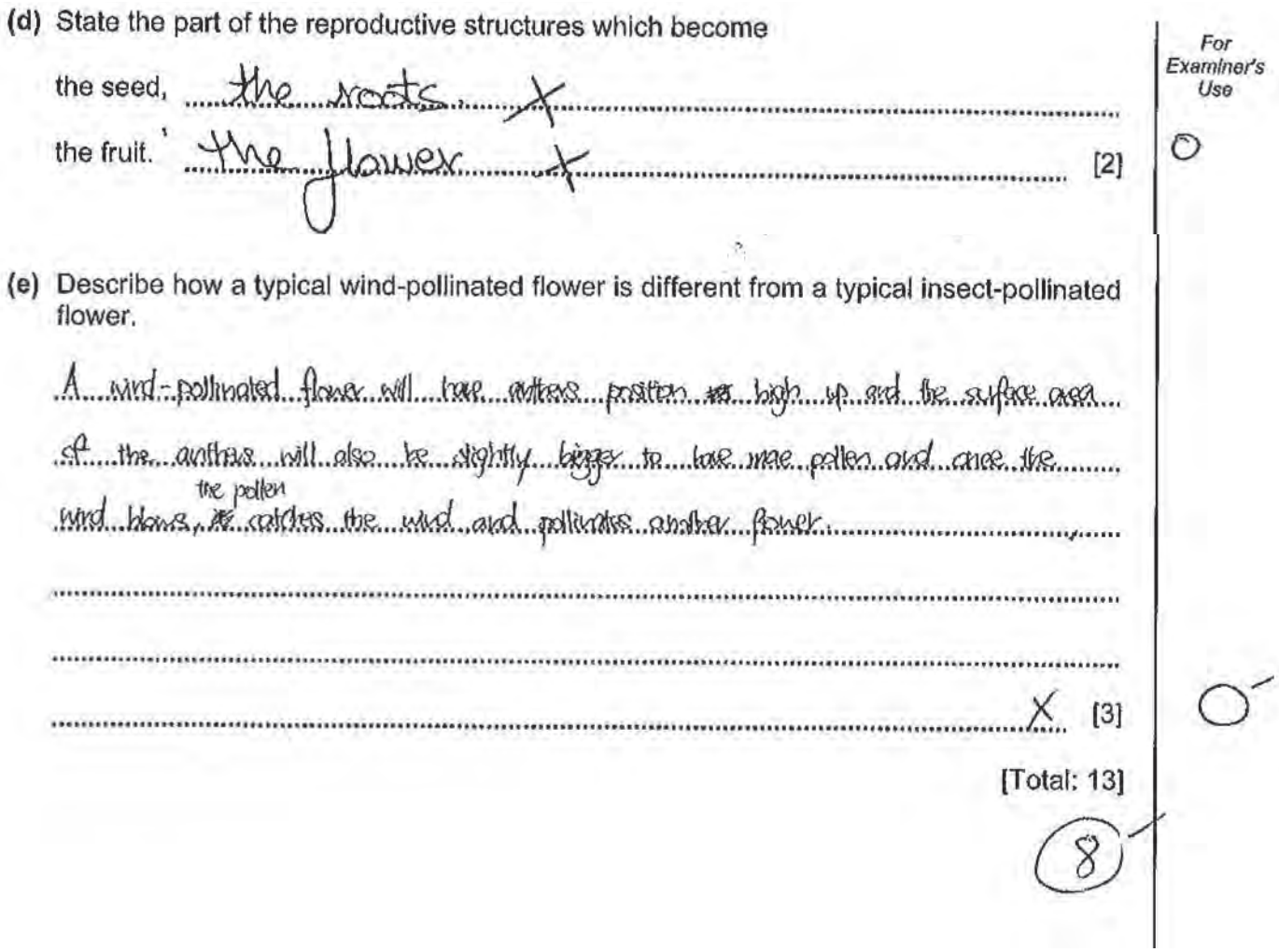
- it has feathery stigma X

.....

.....

[1]

0/



(d) State the part of the reproductive structures which become

the seed, the roots X

the fruit, the flower X [2]

For Examiner's Use

0

(e) Describe how a typical wind-pollinated flower is different from a typical insect-pollinated flower.

A wind-pollinated flower will have anthers postion as high up and the surface area of the anthers will also be slightly bigger to have mae pollen and once the wind blows, the pollen catches the wind and pollinates another flower.

X [3]

[Total: 13]

8

0

Examiner comment – grade E

2(a) The candidate drew five (very small) petals, and their shape corresponded approximately to those provided in the examination. The representation of the shape was only just acceptable. No consistent detail was shown, and that given was not sufficient.

2(b) Outline: the shading on the stigmas negates the single clear line used in the outline, so not acceptable.
Size: the diagram was larger than half the space provided, as required.
Detail: the receptacle was correctly indicated.
Label: the label for the style was incorrectly placed.

2(c) The candidate has given a feature of a wind-pollinated flower instead of an insect-pollinated one.

2(d) The candidate answered by suggesting incorrect parts of a plant for both seed and fruit reproductive structures.

2(e) The candidate gained no marks here. The suggestion of 'anthers being high up' is not acceptable as it is just an alternative way of saying that the stamens have long filaments and protrude from the flower. The suggestion that anthers have a large surface area is not sufficiently precise in relation to the mark scheme requirements.

Mark awarded = 4 out of 13

<table>
<tr>
<td>1 (a) (i)</td>
<td>
<u>osmosis</u> ; [1]

accept any two boxes from the table. [2]
<table>
<tr><th>point</th><th>water</th><th>salt solution</th><th>air</th></tr>
<tr><td>direction of water movement</td><td>into</td><td>out of</td><td>out of</td></tr>
<tr><td>reason for water movement</td><td>cell contents solution is more concentrated</td><td>cell contents solution is less concentrated</td><td>cell contents have more water than air</td></tr>
<tr><td>result of water movement</td><td>cells swell / turgid</td><td>cells shrink / flaccid / plasmolysis</td><td>cells shrink / flaccid</td></tr>
<tr><td>additional explanation</td><td>cuticle / leaf curves because inside is different / AW</td><td>cell sap lost</td><td>evaporation / transpiration</td></tr>
</table>
; ;
</td>
<td>Max [3]</td>
<td></td>
</tr>
<tr>
<td>(ii)</td>
<td>more leaf pieces / samples eats ;
leave for longer time ;
reference to controls – eg same type / age / species / thickness ;
determination of mass / weight ;</td>
<td>Max [2]</td>
<td></td>
</tr>
</table>

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

(b) (i)	mesophyll cell – label **A** ; xylem vessel – label **B** ; an epidermal cell – label **C** ;	[3]	End of line must be in contact with cell.
(ii)	ring round stoma ;	[1]	
(c)	*Measurement of diam from Fig. 1.3 [external]:* [7.1 – 6.0 **cm** or 71 – 60 **mm**] Units need to be given. *Formula:* show ÷ of measurement by 0. 5 / 5 ; *Mag* 14.2 – 12 ;	[3]	
(d) (i)	preparation of sample e.g. cut / grind make into solution ; add Benedict's [solution] ; heat ; safety aspect, e.g. goggles / tongs / lab. coat ;	Max [3]	
(ii)	(if absent) stays / turns blue ; (if low concentration) changes to green / yellow ; (if high concentration) changes to orange / red ;	[3]	
(e)	**stage 1** – break cell walls / denature enzymes / or suitable description ; **stage 2** – remove chlorophyll / decolourise leaf / or suitable description ; **stage 3** – to soften it / or suitable description ; **stage 4** – to show colour change (white tile)/ (iodine solution) to test for starch / or suitable description ;	[4]	
		[Total: 22]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade A

1 Some students investigated the effect of different conditions on onion leaves.

For Examiner's Use

Fig.1.1 is a photograph of growing onion plants. They have tubular leaves that are hollow inside.

Fig. 1.1

In an experiment an onion leaf was cut into three pieces each 2 cm long.

Four cuts were made in each piece as shown in Fig. 1.2.

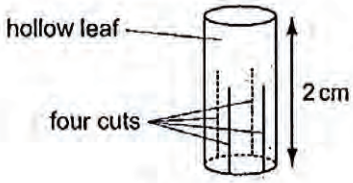


Fig. 1.2

The first piece was put into water.

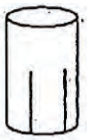
The second piece was put into salt solution.

The third piece was put on dry filter paper.

The three pieces were left in their different conditions for 10 minutes after which the students made their observations.

Table 1.1 shows the shape of the pieces and how they felt when the students held them between their fingers.

Table 1.1

in water	in salt solution	in air
		
springy, firm	soft, slimy	soft, limp

1 (a) (i) Explain the reasons for any differences that were observed.

The piece left in the water undergoes endosmosis, water goes inside the tube (diffuses/moves up the tube) and it becomes firm; while the one in salt solution undergoes exosmosis - water moves from the tube (piece) into the solution so it becomes soft and slimy (flaccid); the one in air loses water by evaporation (into the atmosphere) and becomes soft limpy [3]

(ii) Suggest how this investigation could be improved.

Repeat the experiment (for more accurate and less error); Use same diameter tubes with same environmental conditions - More cuts can be made on longer tube used

[2]

1 **(b)** Fig. 1.3 is a photomicrograph of a section through a tubular onion leaf.

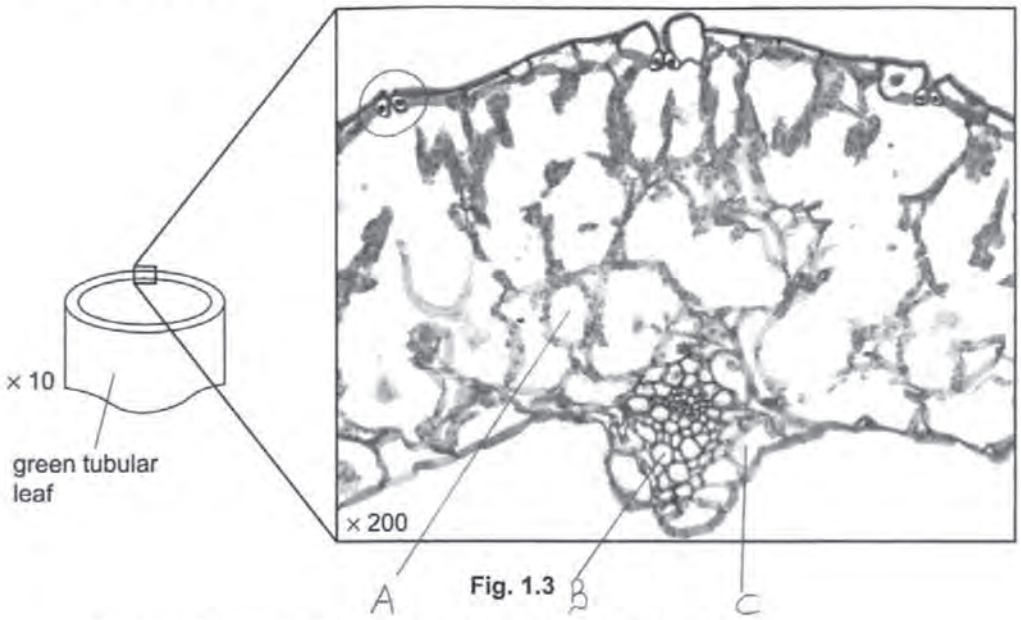


Fig. 1.3

(i) On Fig. 1.3, use lines and the letters **A**, **B** and **C** to label,

A - a mesophyll cell
B - a xylem vessel
C - an epidermal cell.

Draw the label lines with the letters **A**, **B** and **C** on Fig. 1.3. [3]

(ii) There are stomata on the leaf in Fig. 1.3. Draw a circle round **one** of them.

Draw the circle on Fig. 1.3. [1]

1 (c) Fig. 1.4 shows a photograph of a section through the onion leaf. Its actual diameter was 5 mm.

For Examiner's Use

Fig. 1.4

Measure the diameter of the leaf shown in the photograph in Fig. 1.4.

diameter ..... 6.5 cm, 65 mm

Calculate the magnification of the onion leaf in the photograph in Fig. 1.4.

Show your working.

$M = \frac{m}{a} = \frac{65\,mm}{5\,mm} = 13$

Magnification X ..... 13 ..... [3]

1 (d) (i) Explain exactly how you would safely test another 2 cm piece of onion leaf for the presence of reducing sugar.

For Examiner's Use

First, Crush the 2cm piece of onion with water (to make a solution) Pour some of the solution into the test tube (use tongs to hold the test tube) Add benedicts solution. Heat the solution (using water bath) - (In this case use goggles, lab coat and tie your hair back so it doesn't catch fire) If sugar present it will change colour to orange/brick red. [3]

(ii) The reducing sugar test can tell you that:

- reducing sugar is absent
- reducing sugar is present at a low concentration
- reducing sugar is present at a high concentration

Explain how you can tell the difference between these possible results.

'sure' that any flammable substance is close to the bunsen burner. If the glucose is present then it will change from green to red.

If the substance is absent then the solution will remain blue which is the colour of the Benedict's solution. If it comes out green or yellow then it means that the sugar is present but that it is in a low concentration. Lastly, if the product comes out orange or red then it means that there is sugar in a high concentration. [3]

1 (e) Onion leaves are green. Students testing onion leaves for the presence of starch used the method shown in the four stages of Fig. 1.5.

For Examiner's Use

Explain the reasons for the details shown in each stage. Write your answers on the lines below Fig. 1.5

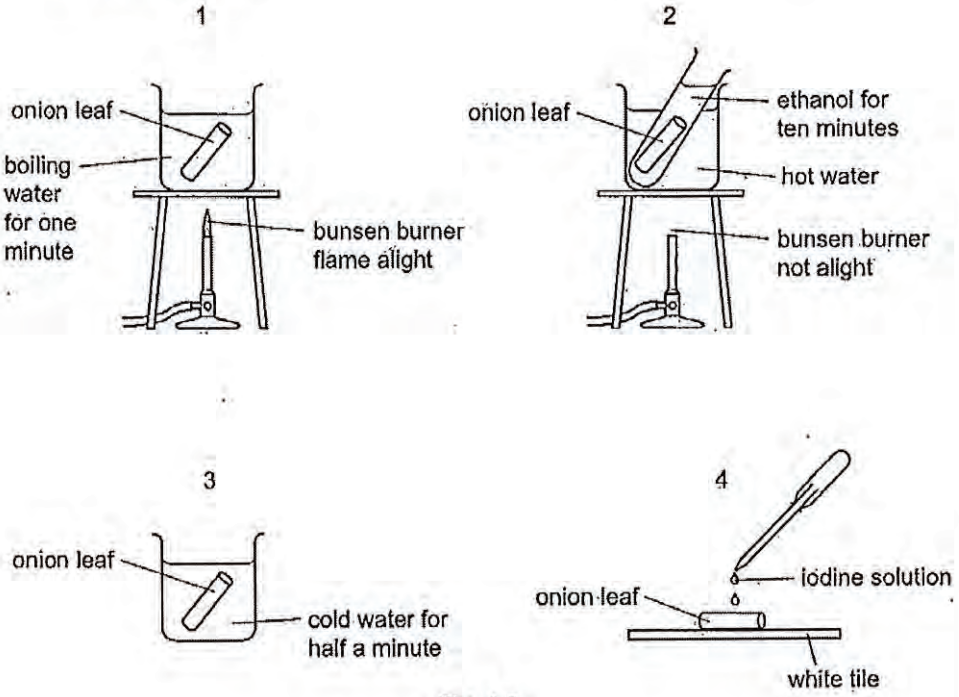


Fig. 1.5

reasons for stage 1 The leaf is boiled to break down the cell walls, stop enzyme activity and allow easier penetration of ethanol.

reasons for stage 2 The leaf is placed in ethanol to dissolve the chlorophyll, ~~so~~ to remove the colour of the leaves for easy view of change in colour.

reasons for stage 3 The leaf is brittle, so it is placed in cold water to soften it.

reasons for stage 4 Iodine is used to test for starch by observing the color change, and white tile is used for easier view of colour change. [4]

[Total: 22]

Examiner comment – grade A

1(a)(i) The candidate stated more mark-worthy points than were actually required. The first point made (with reference to the onion piece placed in water) was 'endosmosis'. This by itself would have gained two marks, but the candidate went on to state that water moved into the onion piece. However, there is no credit for saying that this made the piece firm, as the word is given in Table 1.1. The final mark was awarded for water moving out of the onion piece that was in salt solution.

1(a)(ii) The candidate gained two marks for suggesting that the investigation could be improved by repeating the experiment and by using tubes (sections of leaf) of the same diameter.

1(b)(i)+(ii) The candidate identified all three cell types correctly, with each label line ending clearly on the cell selected. A small circle was drawn round a pair of guard cells encircling a stoma.

1(c) The measurement of the external diameter of the leaf was within the acceptable range and given in cm (and then converted into mm.) The formula used was correct and the calculation accurately completed.

1(d)(i) The candidate wrote correctly about preparing the sample by crushing the leaf and adding water to produce a solution. Benedict's reagent was correctly added and the mixture heated in a water bath. The use of the latter gains the safety mark, although other safety features were also given.

1(d)(ii) The candidate stated clearly that the solution would stay blue if no reducing sugar was present. The correct colour ranges indicating low and high concentrations of reducing sugar were accurately given.

1(e) Stage 1: in all, three correct reasons for boiling the leaf in water were stated.
Stage 2: the candidate not only knew that ethanol would dissolve the chlorophyll, but also explained why this was desirable.
Stage 3: the candidate knew that the brittle leaf would soften in cold water.
Stage 4: the reason for using a white tile was given as was the test for starch. However, it should be noted that the candidate referred to the use of iodine (and not iodine solution) in the starch test. This did not result in loss of a mark here as the marking point had already been gained. However, candidates should be aware that iodine undergoes sublimation and so has to be dissolved in potassium iodide for use in this test.

Mark awarded = 22 out of 22

Example candidate response – grade C

1 Some students investigated the effect of different conditions on onion leaves.

For Examiner's Use

Fig.1.1 is a photograph of growing onion plants. They have tubular leaves that are hollow inside.

Fig. 1.1

In an experiment an onion leaf was cut into three pieces each 2 cm long.

Four cuts were made in each piece as shown in Fig. 1.2.

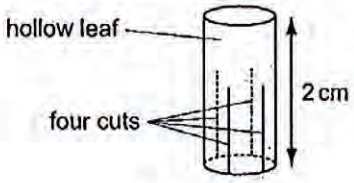


Fig. 1.2

The first piece was put into water.

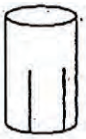
The second piece was put into salt solution.

The third piece was put on dry filter paper.

The three pieces were left in their different conditions for 10 minutes after which the students made their observations.

Table 1.1 shows the shape of the pieces and how they felt when the students held them between their fingers.

Table 1.1

in water	in salt solution	in air
		
springy, firm	soft, slimy	soft, limp

For Examiner's Use

1 (a) (i) Explain the reasons for any differences that were observed.

In water, water molecules would diffuse into the first pie✓, causing it to expan✓ In the salt solution, the salt molecules break down the outer cell wall, causing it to become slimy. In air, there is no diffusion of water molecules by osmosis, so it remains soft. [3]

(ii) Suggest how this investigation could be improved.

Repeat the experiment and take more frequent time readings. Do the experiment with different sizes of the piece. [2]

1 (b) Fig. 1.3 is a photomicrograph of a section through a tubular onion leaf.

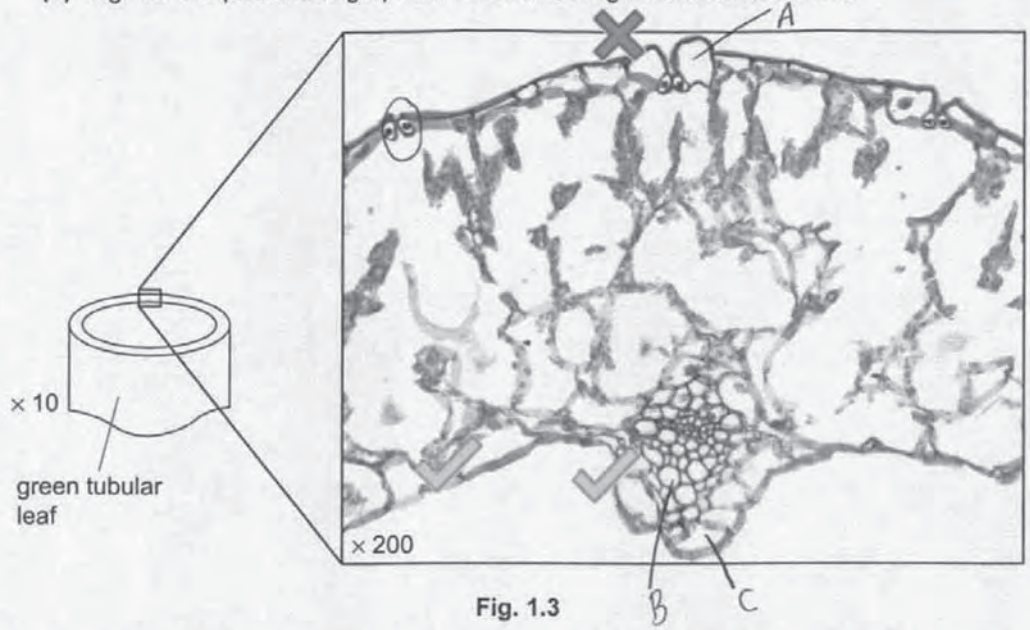


Fig. 1.3

(i) On Fig. 1.3, use lines and the letters **A**, **B** and **C** to label,

A - a mesophyll cell
B - a xylem vessel
C - an epidermal cell.

Draw the label lines with the letters **A**, **B** and **C** on Fig. 1.3. [3]

(ii) There are stomata on the leaf in Fig. 1.3. Draw a circle round **one** of them.

Draw the circle on Fig. 1.3. [1]

1 **(c)** Fig. 1.4 shows a photograph of a section through the onion leaf. Its actual diameter was 5 mm.

For Examiner's Use

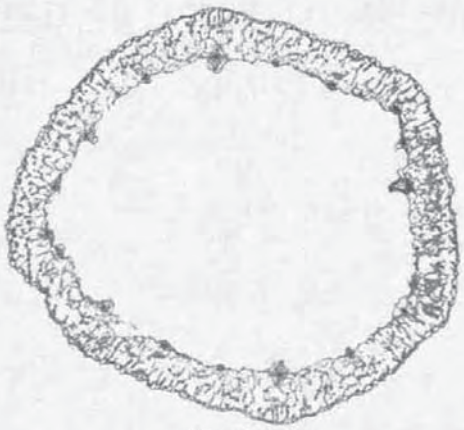


Fig. 1.4

Measure the diameter of the leaf shown in the photograph in Fig. 1.4.

diameter ....57mm.....

Calculate the magnification of the onion leaf in the photograph in Fig. 1.4.

Show your working.

$$\frac{\text{Size of the image}}{\text{Actual size}} = \frac{57\text{mm}}{5\text{mm}} = 11.4$$

$$= 11.4 \times 1000$$

$$= 11400$$

Magnification X ...11400... [3]

1 (d) (i) Explain exactly how you would safely test another 2 cm piece of onion leaf for the presence of reducing sugar.

For Examiner's Use

For our ~~safety~~ safety we have to use safety goggles and a lab coat then put the 2cm piece ~~into equal sample~~ of onion leaf in a water bath and add drops of benedict re agent to the ~~solut~~ solution, if ~~it turns~~ the colour changes to orange/brick red then a sugar/ glucose is present.

[3]

(ii) The reducing sugar test can tell you that:

- reducing sugar is absent
- reducing sugar is present at a low concentration
- reducing sugar is present at a high concentration

Explain how you can tell the difference between these possible results.

If reducing sugar is absent there is no colour change.
If it is present at a low concentration, the colour change takes place at a slower rate and is less clear.
If it is present at a high concentration, the rate of the colour change is fast and a red-orange colour is ~~shown~~ seen. [3]

1 (e) Onion leaves are green. Students testing onion leaves for the presence of starch used the method shown in the four stages of Fig. 1.5.

For Examiner's Use

Explain the reasons for the details shown in each stage. Write your answers on the lines below Fig. 1.5

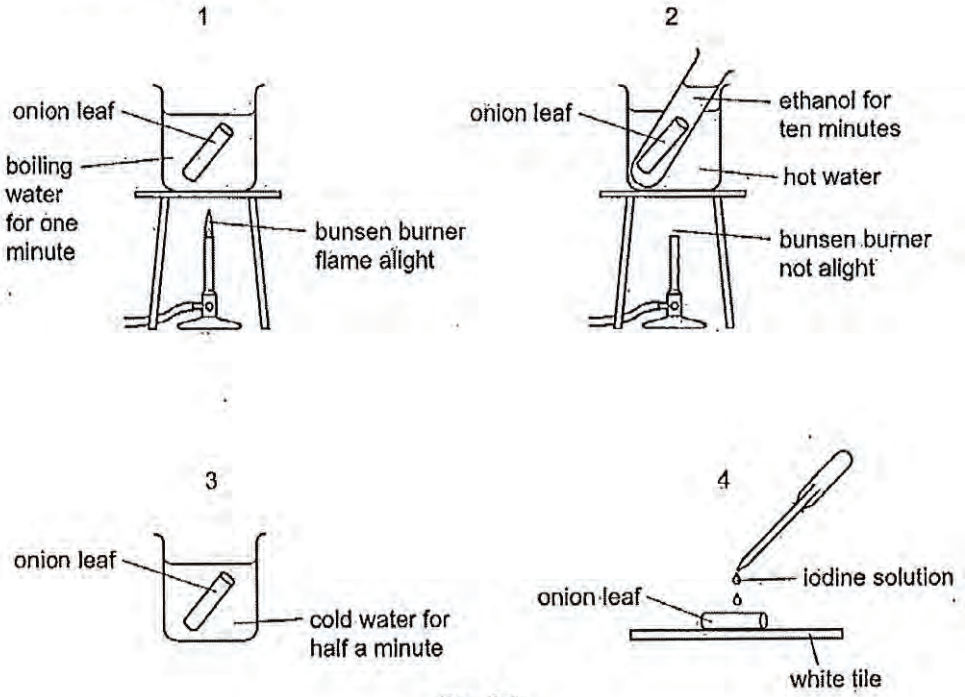


Fig. 1.5

reasons for stage 1 to destroy the chlorophyll in the leaf in order to stop production of starch.

reasons for stage 2 to break down the cell wall, which is normally impermiable.

reasons for stage 3 to lower the temperature and soften the leaf. ✓

reasons for stage 4 to test if ~~&~~ starch is present, if it is then the iodine will create a blue-black colour clearly visible against the white ✓ tile. [4]

[Total: 22]

Examiner comment – grade C

1(a)(i) The candidate used the word osmosis, but in an incorrect context. The remaining two marks were gained for stating that water would move into the onion piece left in water and that this would cause it to expand (which is equivalent to the cells swelling).

1(a)(ii) One mark was awarded as the candidate stated that repeating the investigation would be an improvement. However, the second idea of repeating the investigation with different sized pieces was not acceptable.

1(b)(i)+(ii) The xylem vessel and the epidermal cell were correctly labelled, but a cell in the upper epidermis had been incorrectly identified as a mesophyll cell. A small circle was drawn round a pair of guard cells encircling a stoma.

1(c) The candidate had measured the internal diameter of the leaf and the units were correct (in this question either the external or internal diameter of the leaf is acceptable). The formula used and the original calculated answer were also both correct. However, the candidate then multiplied the answer by 1000, thus negating the third marking point.

1(d)(i) The candidate gained a mark for a safety feature (either of the two stated examples was acceptable). However, the leaf was merely placed in water, so no preparation mark could be given. The addition of Benedict's reagent gained a second mark, but placing the sample in warm water would not supply sufficient heat for the reaction to occur.

1(d)(ii) Here the marks for the absence of reducing sugar and its presence in high concentrations were awarded. However, no colour was specified for low concentrations of reducing sugar and the statement that the reaction would be slower was insufficient for the third mark to be awarded.

1(e) The reasons for Stages 1, 2 and 4 were all stated accurately. For Stage 3 the candidate gave the result of Stage 2 rather than a reason for carrying out Stage 3.

Mark awarded = 15 out of 22

Example candidate response – grade E

1 Some students investigated the effect of different conditions on onion leaves.

For Examiner's Use

Fig.1.1 is a photograph of growing onion plants. They have tubular leaves that are hollow inside.

Fig. 1.1

In an experiment an onion leaf was cut into three pieces each 2 cm long.

Four cuts were made in each piece as shown in Fig. 1.2.

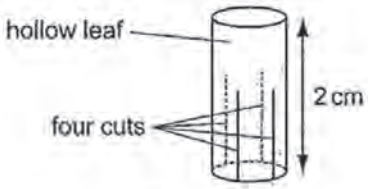


Fig. 1.2

The first piece was put into water.

The second piece was put into salt solution.

The third piece was put on dry filter paper.

The three pieces were left in their different conditions for 10 minutes after which the students made their observations.

Table 1.1 shows the shape of the pieces and how they felt when the students held them between their fingers.

For Examiner's Use

Table 1.1

in water	in salt solution	in air
		
springy, firm	soft, slimy	soft, limp

(a) (i) Explain the reasons for any differences that were observed.

The piece left in water became firm and springy as ~~oxygen~~ H_2O was present. The cell became turgid. In the salt solution, it only became slimy and stayed soft and in air it did not change. It stayed the same in air. [3]

(ii) Suggest how this investigation could be improved. areas.

This investigation could be improved by measuring the amount of water the plant is given and how will the plant behave when ~~cared~~ different water concentrations are given. [2]

1 **(b)** Fig. 1.3 is a photomicrograph of a section through a tubular onion leaf.

For Examiner's Use

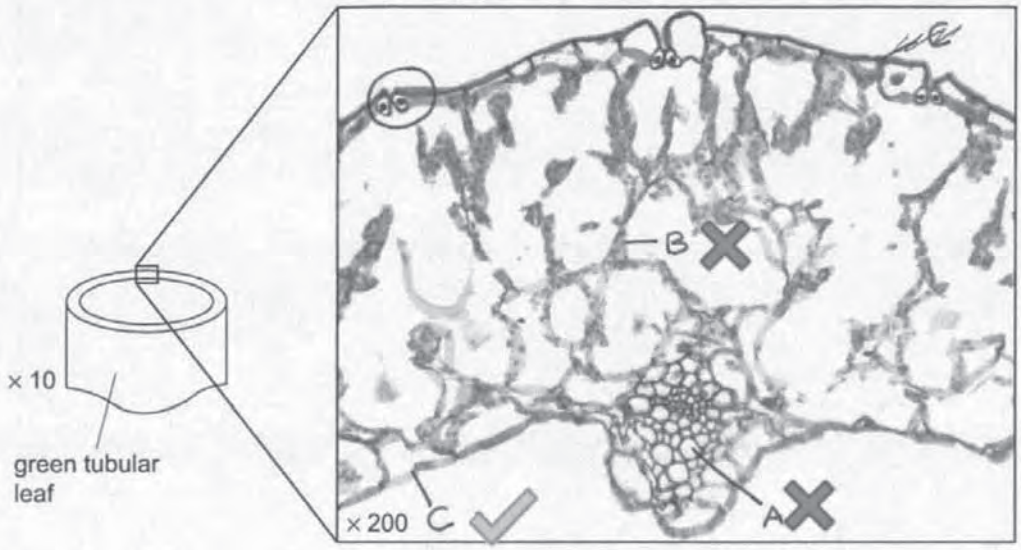


Fig. 1.3

(i) On Fig. 1.3, use lines and the letters **A**, **B** and **C** to label,

A - a mesophyll cell
B - a xylem vessel
C - an epidermal cell.

Draw the label lines with the letters **A**, **B** and **C** on Fig. 1.3. [3]

(ii) There are stomata on the leaf in Fig. 1.3. Draw a circle round **one** of them.

Draw the circle on Fig. 1.3. [1]

1 **(c)** Fig. 1.4 shows a photograph of a section through the onion leaf. Its actual diameter was 5 mm.

For Examiner's Use

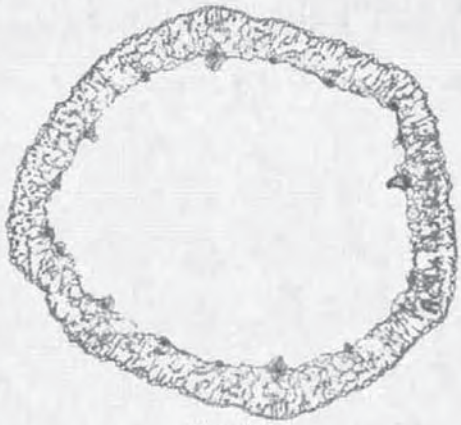


Fig. 1.4

Measure the diameter of the leaf shown in the photograph in Fig. 1.4.

diameter ..... 57 mm .....

Calculate the magnification of the onion leaf in the photograph in Fig. 1.4.

Show your working.

original diameter / magnified diameter

= 5 / 57 = 0.088

Magnification X 0.088 ..... [3]

1 (d) (i) Explain exactly how you would safely test another 2 cm piece of onion leaf for the presence of reducing sugar.

For Examiner's Use

add 2 cm^3 of benedict's solution to a piece of onion leaf in a test tube, if the solution goes brick red, a reducing sugar is present

[3]

(ii) The reducing sugar test can tell you that:

- reducing sugar is absent
- reducing sugar is present at a low concentration
- reducing sugar is present at a high concentration

Explain how you can tell the difference between these possible results.

If the reducing sugar is absent the solution stays colourless, if the reducing sugar is present at low concentration the solution slightly goes brick red. If the reducing sugar is present at high concentration the solution goes deep brick red

[3]

reasons for stage 1 to break down cell walls

reasons for stage 2 to remove chlorophyll

reasons for stage 3 to soften up the leaf

reasons for stage 4 the Iodine turns starch blue-black

[4]

[Total: 22]

(e) Onion leaves are green. Students testing onion leaves for the presence of starch used the method shown in the four stages of Fig. 1.5.

For Examiner's Use

Explain the reasons for the details shown in each stage. Write your answers on the lines below Fig. 1.5

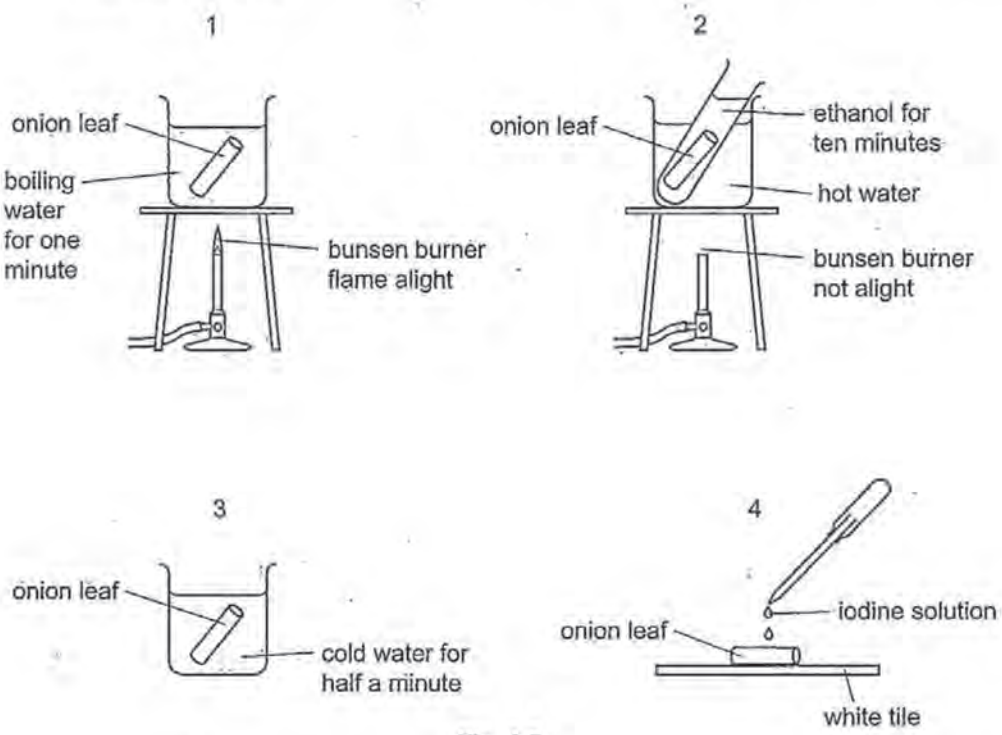


Fig. 1.5

reasons for stage 1 .....

.....

reasons for stage 2 .....

.....

reasons for stage 3 F Cold water is used to see if the water layer will harden.

reasons for stage 4 iodine drops of iodine is added, if colour changes to blue/black starch is present. [4]

[Total: 22]

Examiner comment – grade E

1(a)(i) To answer this question the candidate has used several descriptive terms already provided in Table 1.1, and as such, these were disregarded. One mark was awarded for stating that the onion piece left in water had cells that became turgid.

1(a)(ii) Neither suggestion made by the candidate was worthy of credit.

1b(i)+(ii) The candidate labelled an epidermal cell correctly, but not the mesophyll cell nor the xylem vessel.

1(c) The candidate had (presumably) measured the internal diameter of the leaf, but the measurement was given in mm (when the figure indicates it ought to be in cm). An incorrect formula was also used, so the calculated answer was also wrong.

1(d)(i) The candidate knew that Benedict's reagent was used to test for the presence of reducing sugar, but gave no details about the preparation of the specimen, the necessity for heating, nor any safety feature. The colour intensity of a positive result for the presence of a reducing sugar in part (d)(i) was redundant, so no mark was given.

1(d)(ii) The colour indicating a high reducing sugar concentration (deep brick red) was stated correctly. However, the presence of a low concentration producing a 'slightly brick red' colour was inaccurate. The negative result was also an incorrect statement.

1(e) Stages 1 and 2 were not answered. Although the candidate knew that Stage 3 was connected with changing the leaf texture, the explanation given was confused. In Stage 4, the candidate knew that iodine (drops) tested for the presence of starch and knew the colour of a positive result.

Mark awarded = 6 out of 22

2 (a) (i)	C ;	[1]	
(ii)	any **two** from small(er); smooth surface ; **no** segments **no** chaetae ;	Max [2]	
(iii)	annelid(s) / annelida / segmented worm ;	[1]	**B** annelid but **A** is a myriapod [1] ignore ref to myriapod.
(b)	**Outline:** use of single clear lines for drawing ; **Size:** larger than photograph ; **Detail:** segments / saddle ; **Label:** 1 label mark only ; **one** from: segments / saddle / chaetae or bristles / clitellum ;	[4]	

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

<table>
<tr>
<td>(c) (i)</td>
<td>One in each range to ;;
<table>
<tr><td>worm</td><td>range / cm</td></tr>
<tr><td>D</td><td>8.2–8.6</td></tr>
<tr><td>C</td><td>10.8–11.3</td></tr>
<tr><td>A</td><td>11.4–11.9</td></tr>
<tr><td>B</td><td>12.2–12.6</td></tr>
<tr><td>E</td><td>13.6–13.9</td></tr>
</table>
</td>
<td>[2]</td>
<td>(worms identified clockwise A to E)</td>
</tr>
<tr>
<td>(ii)</td>
<td>
<table>
<tr><td>range of length / cm</td><td>tally</td><td>frequency</td></tr>
<tr><td>5.0–6.9</td><td></td><td>3</td></tr>
<tr><td>7.0–8.9</td><td>+1</td><td>9</td></tr>
<tr><td>9.0–10.9</td><td>+1 or 0
[if worm C is , 11.0]</td><td>7 or 6</td></tr>
<tr><td>11.0–12.9</td><td>+2 or +3
[if worm C is › 11.0]</td><td>10 or 11</td></tr>
<tr><td>13.0–14.9</td><td>+1</td><td>8</td></tr>
<tr><td>15.0–16.9</td><td></td><td>3</td></tr>
</table>
tally method correct ;

frequencies correct ; ;
</td>
<td>[3]</td>
<td>ecf from (c)(i)

Worm C may fall into either of 2 categories.

Tally should show the 5 bars correctly i.e. '5 bar gate'.</td>
</tr>
<tr>
<td>(iii)</td>
<td>A – axes label and scale ;

S – size to fill at least ½ of grid ;

P – plot ;

C – columns touching and equal in width ;</td>
<td>[4]</td>
<td>+/– 1 mm</td>
</tr>
<tr>
<td>(iv)</td>
<td>any suitable suggestion, e.g. sexes are different lengths / different ages ;</td>
<td>Max [1]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Total: 18]</td>
<td></td>
</tr>
</table>

The mark schemes provided in this booklet have been extracted from the original mark scheme document used by Cambridge examiners to mark the candidate scripts. The headings of the columns (from left to right) are: Question, Mark scheme/Expected answers, Marks and Guidance. The 'Guidance' column gives suggestions to the examiners for what can be accepted (**A**), rejected (**R**) and ignored (**I**).

Example candidate response – grade A

2 Fig. 2.1 shows three worms. One is a nematode.

For Examiner's Use

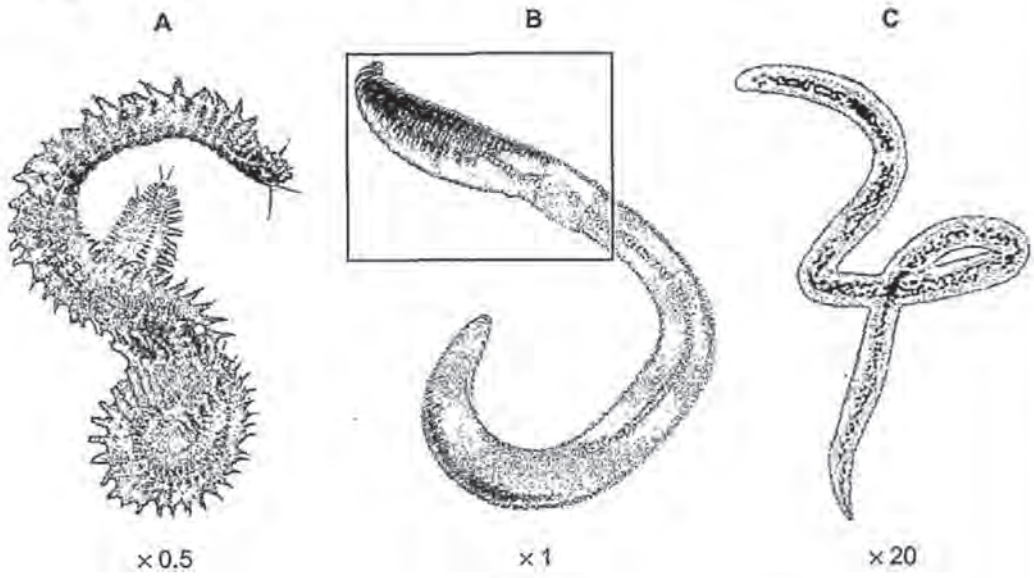


Fig. 2.1

(a) (i) Write the letter that identifies a nematode worm ...C..... [1]

(ii) Give **two** reasons for your answer.

it does not have a segmented body and it is much smaller than worms A and B, it is enlarged 20 times, while the others are only enlarged 0.5 and 1 times. [2]

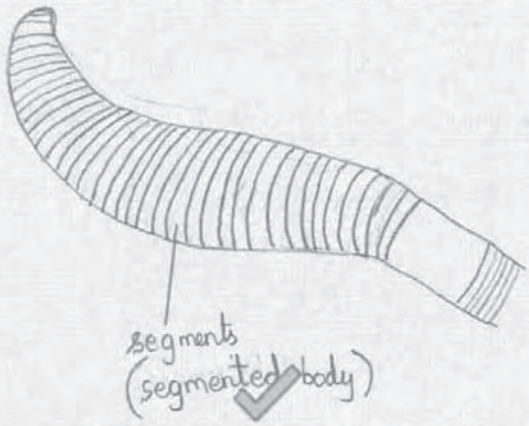
(iii) The other two worms belong to a different group.

Name this group annelids [1]

2 (b) Part of the worm labelled **B** is shown in a rectangle.

Make a large labelled drawing of this part of worm **B**.

For Examiner's Use



2 (c) Some students studied a population of 40 worms. They measured the lengths of 35 worms. These measurements are shown in Table 2.1.

For Examiner's Use

(i) Complete Table 2.1 by measuring the lengths of the five worms shown in Fig. 2.2. Use a ruler to measure them.

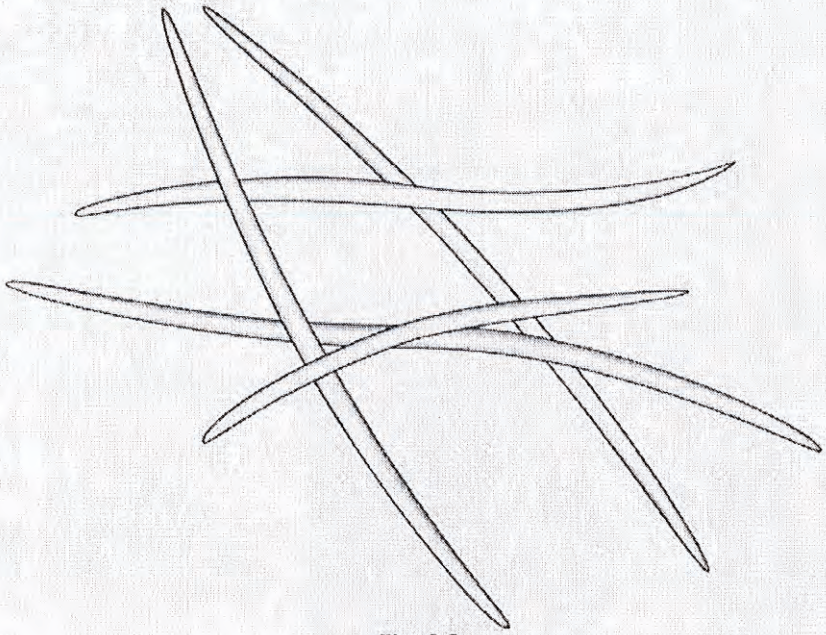


Fig. 2.2

Table 2.1

length/cm	7.0	8.1	10.8	6.2	11.4	9.0	10.3	12.1	13.5	5.6
length/cm	11.3	7.9	12.9	7.4	13.1	13.7	15.5	8.8	14.1	15.2
length/cm	9.6	8.4	14.7	16.0	7.2	10.5	9.2	12.4	6.7	13.3
length/cm	14.0	11.6	12.6	12.2	8.3	11.8	13.9	8.5	12.3	11.1

Record the length of each worm in Table 2.1 [2]

2 (c) (ii) Complete the tally chart, Table 2.2, to show the number of worms in each range of lengths.

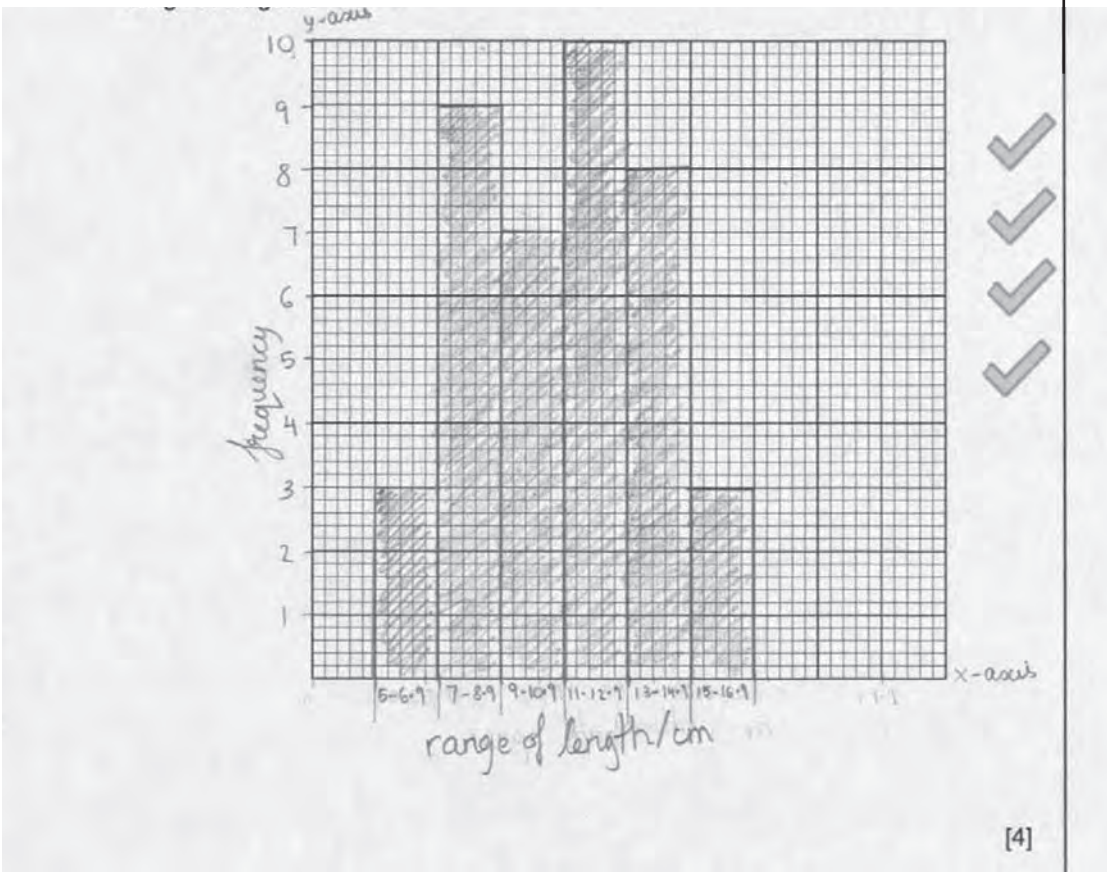
For Examiner's Use

Table 2.2

range of lengths / cm	tally	frequency
5.0 - 6.9	III	3
7.0 - 8.9	𝍸 I	9
9.0 - 10.9	𝍸 I	6
11.0 - 12.9	𝍸 𝍸 I	~~10~~ 11
13.0 - 14.9	𝍸 III	8
15.0 - 16.9	III	3

[3]

(iii) Use the data from Table 2.2 to plot a histogram showing the frequency of each range of lengths.



[4]

(iv) Suggest a reason for the shape of the histogram.

due to different types of lengths. ~~each~~ worm have different species. there are more worms in the range of 9 to 8.9 cm [1]

[Total: 18]

Examiner comment – grade A

2(a)(i) The nematode worm was correctly identified as C.

2(a)(ii) The candidate gave two correct reasons for this choice.

2(a)(iii) 'Annelids' was correctly stated.

2(b) Outline: the candidate used a single clear line and the diagram was correctly not shaded (shading is not permitted in biological diagrams). The minimal sketchiness at the anterior end was acceptable.
Size: the diagram was larger than the photograph and the orientation was correct.
Detail: both the clitellum and segments were drawn, the latter being narrow and transverse.
Label: one segment was clearly labelled

2(c)(i) All five measurements were within the ranges allowed.

2(c)(ii) The candidate used the correct method for producing a tally, each tally was transferred accurately to the frequency column and the frequencies correctly totalled to 40.

2(c)(iii) The axes were fully labelled and the scales covered the frequencies and ranges. The histogram filled more than half the grid, was plotted accurately and the columns were of equal width and touching.

2(c)(iv) The reason given for the histogram shape being that the worms belonged to different species was an acceptable answer.

Mark awarded = 18 out of 18

Example candidate response – grade C

2 Fig. 2.1 shows three worms. One is a nematode.

For Examiner's Use

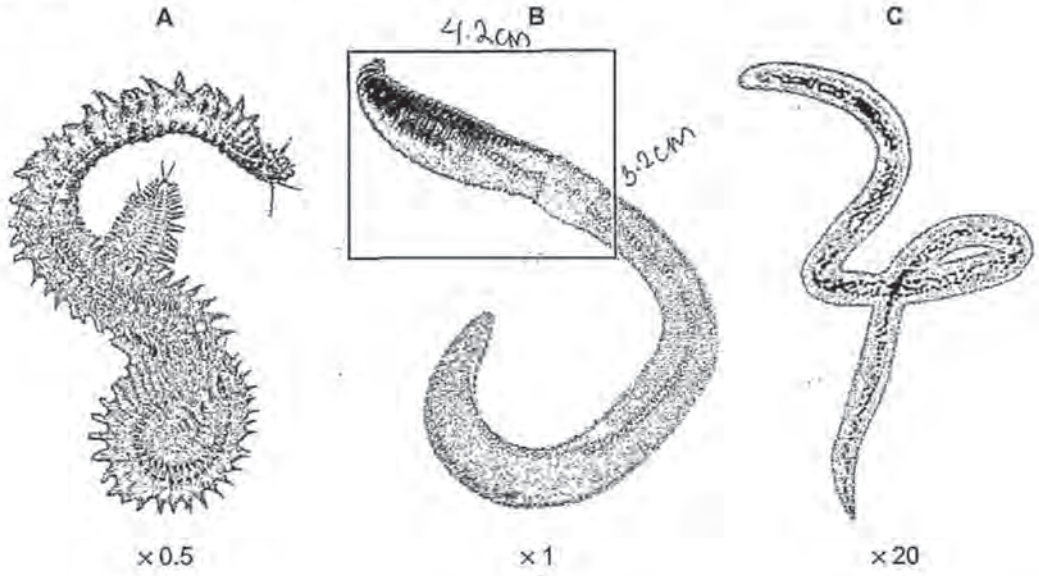


Fig. 2.1

(a) (i) Write the letter that identifies a nematode worm C [1]

(ii) Give **two** reasons for your answer.

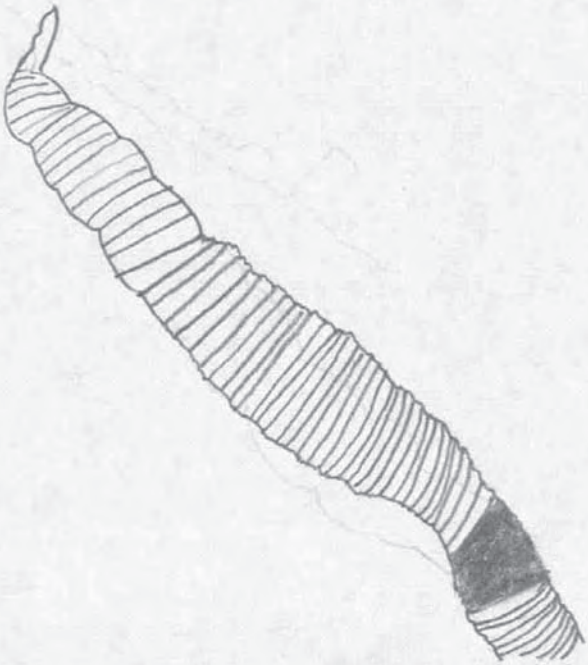
C is a flake worm which is a nematode, you can see the insides, it wiggles for movement, it is a parasite ~~that~~ that's why it is ×20 as it is really small living inside their host sucking the blood. [2]

(iii) The other two worms belong to a different group.

Name this group Annelids [1]

(b) Part of the worm labelled **B** is shown in a rectangle.

Make a large labelled drawing of this part of worm **B**.



For Examiner's Use

[4]

2 (c) Some students studied a population of 40 worms. They measured the lengths of 35 worms. These measurements are shown in Table 2.1.

For Examiner's Use

(i) Complete Table 2.1 by measuring the lengths of the five worms shown in Fig. 2.2. Use a ruler to measure them.

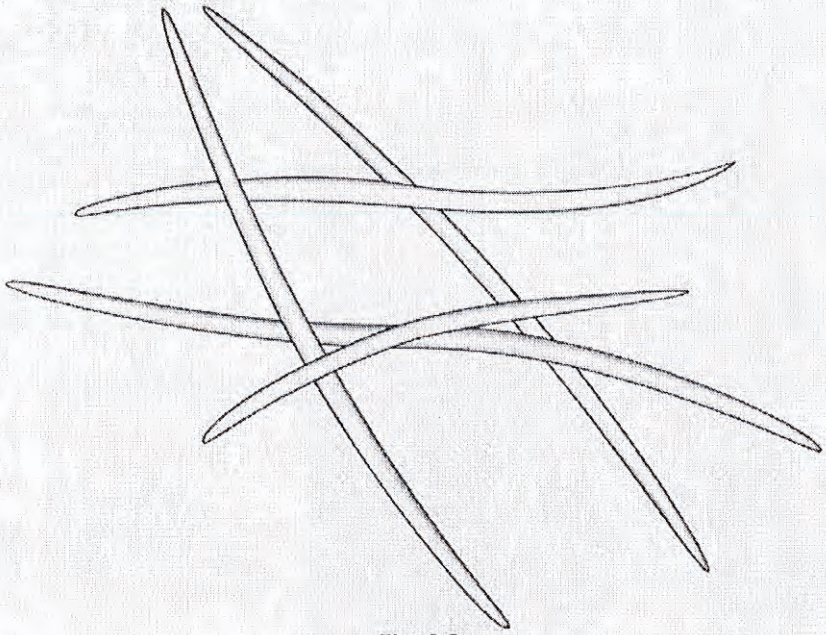


Fig. 2.2

Table 2.1

length/cm	7.0	8.1	10.8	6.2	11.4	9.0	10.3	12.1	13.5	5.6
length/cm	11.3	7.9	12.9	7.4	13.1	13.7	15.5	8.8	14.1	15.2
length/cm	9.6	8.4	14.7	16.0	7.2	10.5	9.2	12.4	6.7	13.3
length/cm	14.0	11.6	12.6	12.2	8.3	8.3	10.9	12.4	11.6	13.3

Record the length of each worm in Table 2.1 [2]

(ii) Complete the tally chart, Table 2.2, to show the number of worms in each range of lengths.

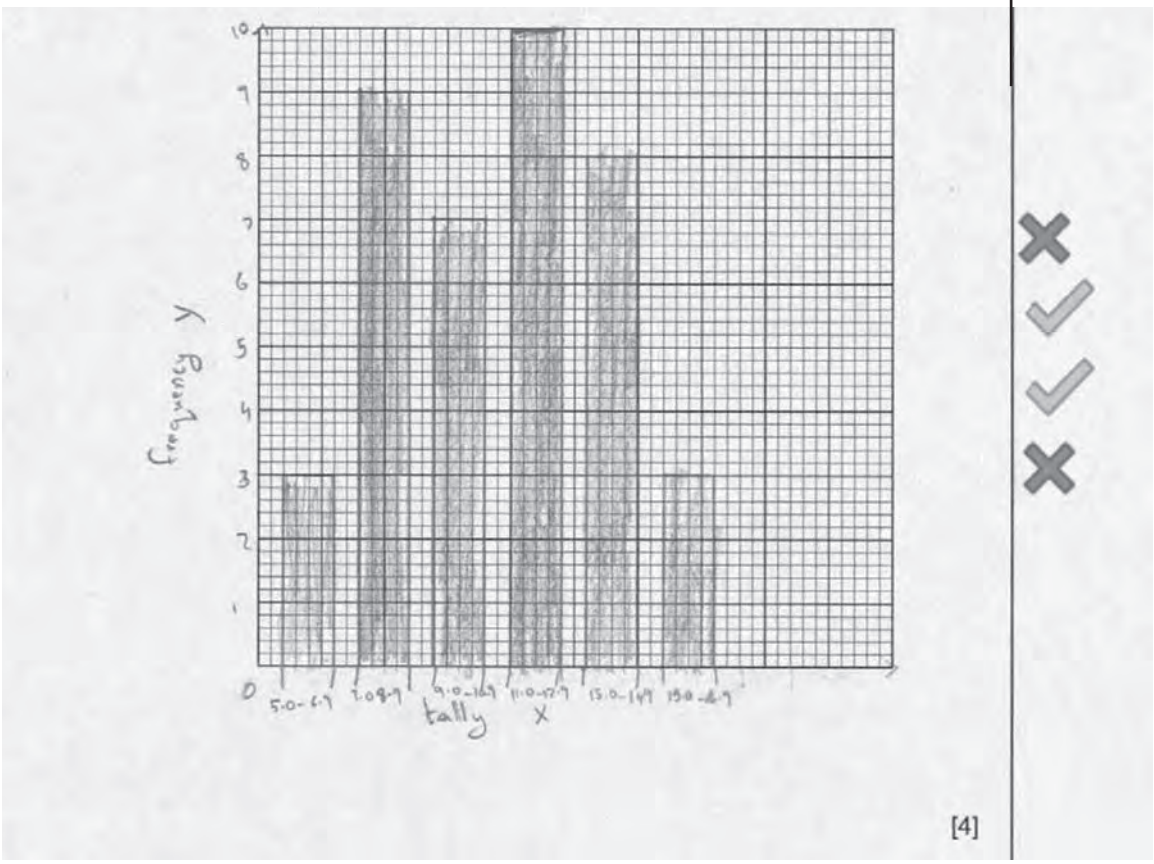
For Examiner's Use

Table 2.2

range of lengths / cm	tally	frequency
5.0 - 6.9	6.2, 5.6, 6.7	3
7.0 - 8.9	7.0, 8.1, 7.9, 7.4, 8.8, 8.4, 7.7, 8.3, 8.3	9
9.0 - 10.9	10.8, 9.0, 10.3, 10.5, 9.2, 10.9, 10.6	7
11.0 - 12.9	11.4, 12.1, 11.3, 12.9, 12.4, 11.6, 12.6, 12.3, 11.6, 12.4	10
13.0 - 14.9	13.5, 13.1, 13.7, 14.1, 14.7, 13.3, 14.0, 13.8	8
15.0 - 16.9	15.2, 15.5, 16.0	3

[3]

(iii) Use the data from Table 2.2 to plot a histogram showing the frequency of each range of lengths.



[4]

(iv) Suggest a reason for the shape of the histogram.

there is no continual pattern, because there is no specific reason for the difference in length, but the frequency is the lowest for the longest and the shortest worms showing that most worms are between 7.0 and 14.9 cm long. (in this experiment) [1]

[Total: 18]

Examiner comment – grade C

2(a)(i) The nematode worm was correctly identified as C.

2(a)(ii) The candidate had noticed the 'x20' magnification and so could state that the organism was very small. However, the other information given about method of movement and parasitic existence were not points visible from the diagrams, so could not be credited.

2(a)(iii) 'Annelids' was correctly stated.

2(b) Outline: the outline itself was acceptable, but unfortunately the clitellum was shaded (shading is not acceptable on biological diagrams, even if done neatly and to differentiate one feature).
Size: larger than the photograph and correctly orientated.
Detail: both clitellum and segments were drawn, the latter being narrow and transverse.
Label: no label was given.

2(c)(i) All five measurements were within the ranges allowed.

2(c)(ii) The candidate did not know how to produce a tally, and entered each measurement individually. However, the numerical frequencies were accurate and they correctly totalled to 40.

2(c)(iii) The axis mark was not awarded as the candidate had labelled the x-axis 'tally' (not 'range of lengths/cm' as required). The histogram filled more than half the grid and the plotting was correct, gaining the candidate two marks. The mark for the columns was not awarded as they had to be touching to be a correct histogram.

2(c)(iv) The candidate states several points shown by the histogram, but makes no attempt to provide a reason for its shape. The answer given for continuous variation was therefore insufficient.

Mark awarded = 11 out of 18

Example candidate response – grade E

2 Fig. 2.1 shows three worms. One is a nematode.

For Examiner's Use

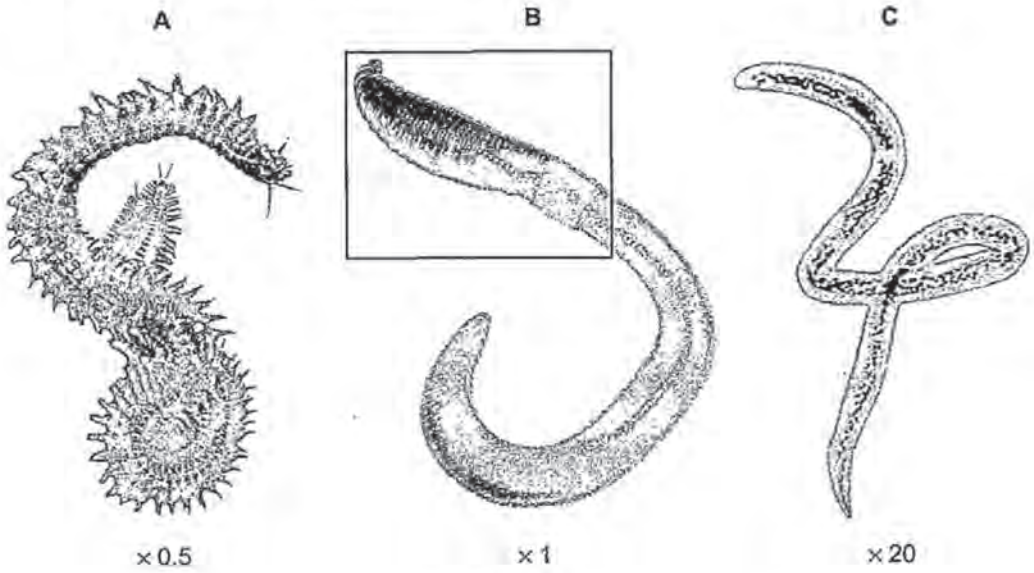


Fig. 2.1

(a) (i) Write the letter that identifies a nematode worm ...C..... [1]

(ii) Give **two** reasons for your answer.

it does not have a segmented body and it is much smaller than worms A and B, it is enlarged 20 times, while the others are only enlarged 0.5 and 1 times. [2]

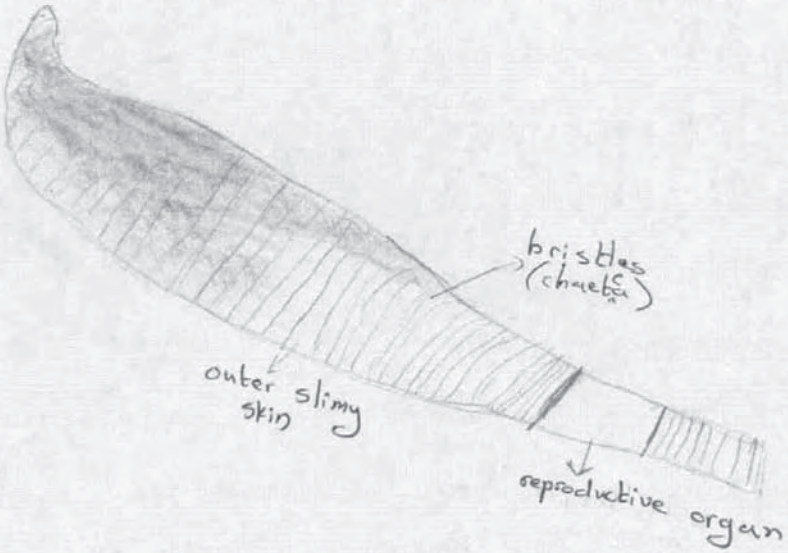
(iii) The other two worms belong to a different group.

Name this group annelids [1]

2 (b) Part of the worm labelled **B** is shown in a rectangle.

Make a large labelled drawing of this part of worm **B**.

For Examiner's Use



[4]

2 (c) Some students studied a population of 40 worms. They measured the lengths of 35 worms. These measurements are shown in Table 2.1.

For Examiner's Use

(i) Complete Table 2.1 by measuring the lengths of the five worms shown in Fig. 2.2. Use a ruler to measure them.

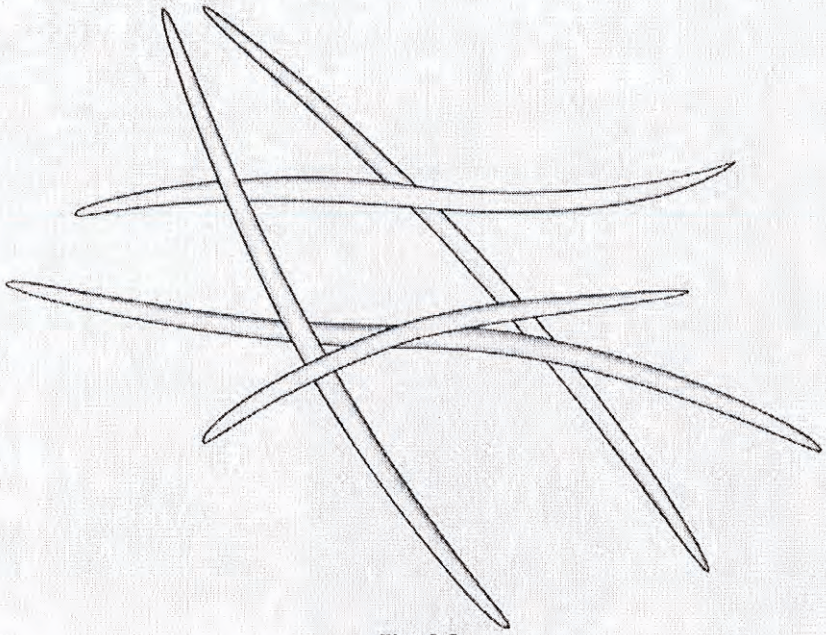


Fig. 2.2

Table 2.1

length/cm	7.0	8.1	10.8	6.2	11.4	9.0	10.3	12.1	13.5	5.6
length/cm	11.3	7.9	12.9	7.4	13.1	13.7	15.5	8.8	14.1	15.2
length/cm	9.6	8.4	14.7	16.0	7.2	10.5	9.2	12.4	6.7	13.3
length/cm	14.0	11.6	12.6	12.2	8.3	11·6	10·8	13·3	8·0	12·5

Record the length of each worm in Table 2.1 [2]

(ii) Complete the tally chart, Table 2.2, to show the number of worms in each range of lengths.

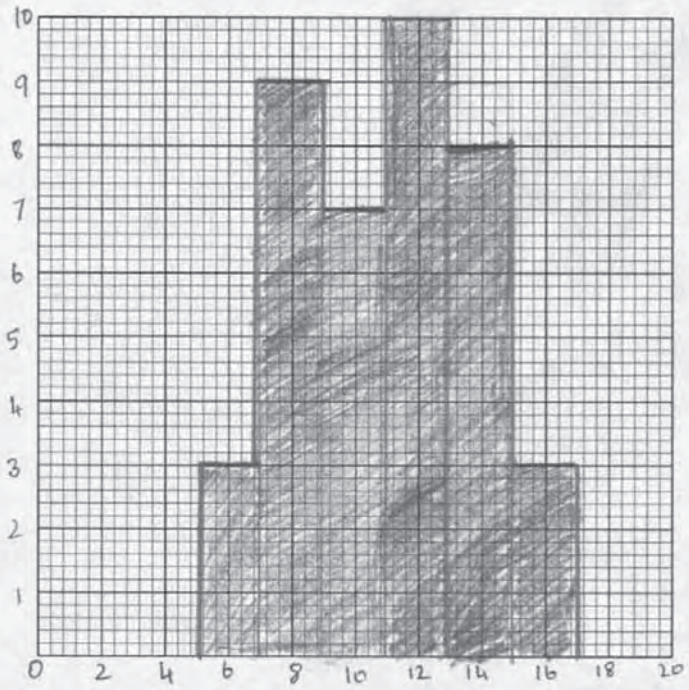
For Examiner's Use

Table 2.2

range of lengths / cm	tally	frequency
5.0 - 6.9	6.2, 5.6, 6.7, (3)	
7.0 - 8.9	12 ~~7.0, 8.1, 6.2, 5.6, 7.9, 7.4, 8.3, 8.4, 8.8,~~	
9.0 - 10.9	5	
11.0 - 12.9	10	
13.0 - 14.9	7	
15.0 - 16.9	2	

[3]

(iii) Use the data from Table 2.2 to plot a histogram showing the frequency of each range of lengths.



[4]

(iv) Suggest a reason for the shape of the histogram.

~~The lowest number and the highest number are extreme.~~
This is because the length of the worms are not equal. [1]

[Total: 18]

Examiner comment – grade E

2(a)(i-iii) Having incorrectly identified A as the nematode worm, the reasons for the choice are incorrect.

The answer of 'molluscs' for part (iii) was inaccurate.

2(b) Outline: the outline itself would have been acceptable, but the mark was negated by the diffuse shading obscuring some of the detail (shading is not allowed in biological drawings).
Size: the diagram was larger than the photograph and correctly orientated.
Detail: both the segments and the clitellum were drawn.
Label: the candidate gained no mark for the labels: 'reproductive organ' is incorrect, 'slimy skin' was not acceptable as 'skin' is too general and found in many animals, and chaetae (visible on the original photograph) are not positioned as indicated by the label line.

2(c)(i) Both 13.3 cm and 8.0 cm were outside the acceptable ranges in the mark scheme.

2(c)(ii) The candidate did not know the method for producing a tally. To begin with each individual measurement was entered, but then there was a change to entering the frequencies in the tally section. No credit could be given as these frequencies were incorrect and so did not total to 40.

2(c)(iii) Neither axis was labelled and the x-axis did not have the ranges of lengths inserted. The histogram filled more than half the grid and the plotting was accurate. However, although the columns were touching, they were of unequal width. Three marks were awarded.

2(c)(iv) The candidate states an obvious fact about the histogram, but does not give a suitable suggest to gain a mark.

Mark awarded = 4 out of 18

Cambridge International Examinations
1 Hills Road, Cambridge, CB1 2EU, United Kingdom
Tel: +44 (0)1223 553554 Fax: +44 (0)1223 553558
Email: info@cie.org.uk www.cie.org.uk

PART OF THE
CAMBRIDGE ASSESSMENT
GROUP