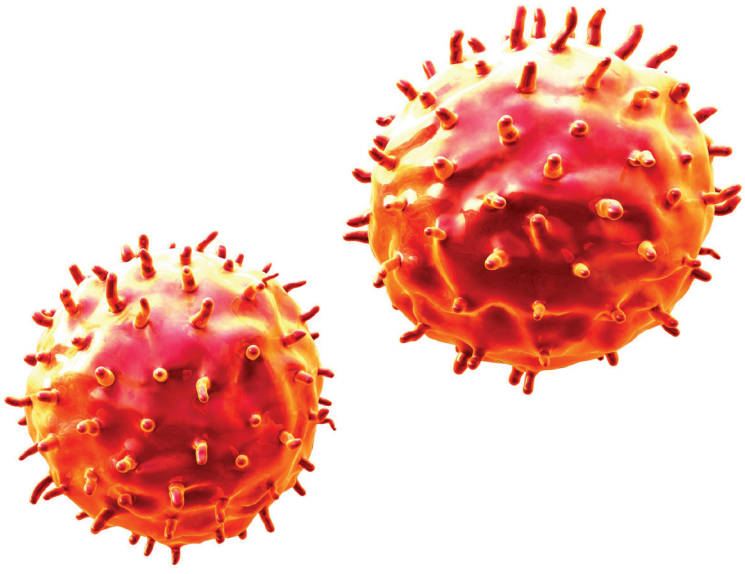
Cambridge Assessment International Education

Example Candidate Responses

Paper 3

Cambridge IGCSE™

Biology 0610



Version 2.0

Cambridge Pathway

In order to help us develop the highest quality resources, we are undertaking a continuous programme of review; not only to measure the success of our resources but also to highlight areas for improvement and to identify new development needs.

We invite you to complete our survey by visiting the website below. Your comments on the quality and relevance of our resources are very important to us.

www.surveymonkey.co.uk/r/GL6ZNJB

Would you like to become a Cambridge International consultant and help us develop support materials?

Please follow the link below to register your interest.

www.cambridgeinternational.org/cambridge-for/teachers/teacherconsultants/

Contents

Introduction

The main aim of this booklet is to exemplify standards for those teaching Cambridge IGCSE Biology (0610), and to show how different levels of candidates' performance (high, middle and low) 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 High, Middle and Low responses. Each response is accompanied by a brief commentary explaining the strengths and weaknesses of the answers.

For each question, the response is annotated with clear explanation of where and why marks were awarded or omitted. This is followed by examiner comments on how the answer could have been improved. In this way, it is possible for you to understand what candidates have done to gain their marks and what they could do to improve their answers. At the end of the booklet, there is a list of common mistakes candidates made in their answers for each question.

This document provides illustrative examples of candidate work with examiner commentary. These help teachers to assess the standard required to achieve marks beyond the guidance of the mark scheme. Therefore, in some circumstances, such as where exact answers are required, there will not be much comment.

The questions, mark schemes and pre-release material used here are available to download as a zip file from the School Support Hub as the Example Candidate Responses Files. The papers used in this booklet are:

Question Paper 4, June 2016	
Question paper	June 2016 Question Paper 31 (0610_s16_qp_31.pdf)
Mark scheme	June 2016 Paper 31 Mark Scheme (0610_s16_ms_31.pdf)

Other past papers, Examiner Reports and other teacher support materials are available on the School Support Hub www.cambridgeinternational.org/support

How to use this booklet

This booklet goes through the paper one question at a time, showing you the high-, middle- and low-level response for each question. The candidate answers are set in a table. In the left-hand column are the candidate answers, and in the right-hand column are the examiner comments.

Example Candidate Response – Question 1, High	Examiner comments
(c) The process of active transport occurs in some cells. Outline **one** way in which diffusion is different to active transport. ~~...molecules...movement...~~ ~~...gradient...while active...~~ [1] ~~molecules against concentration~~ ~~gradient~~	differences between diffusion and active transport, and so gains the mark. **Mark awarded for 1(c)**

Answers are by real candidates in exam conditions. These show you the types of answers for each level.

Discuss and analyse the answers with your learners in the classroom to improve their skills.

Examiner comments are alongside the answers. These explain where and why marks were awarded. This helps you to interpret the standard of Cambridge exams so you can help your learners to refine their exam technique.

How the candidate could have improved the answer

(a)(ii) The candidate named the structure that carries DNA, rather than naming the chemical as requested. As this response is from a candidate who gained very high marks overall, it is most likely that they misread the question.

This section explains how the candidate could have improved each answer. This helps you to interpret the standard of Cambridge exams and helps your learners to refine their exam technique.

Common mistakes candidates made in this question

(c) The examiner was expecting a brief description of one difference between the processes of active transport and diffusion. The use of the term 'outline' implies that brevity is required.

Many candidates gave a definition of diffusion but left the response incomplete as they did not say how active transport was different.

Often candidates lose marks because they misread or misinterpret the questions.

Lists the common mistakes candidates made in answering each question. This will help your learners to avoid these mistakes and give them the best chance of achieving the available marks.

Assessment at a glance

All candidates take three papers. Candidates who have studied the Core subject content, or who are expected to achieve a grade D or below, should be entered for Paper 1, Paper 3 and either Paper 5 or Paper 6. These candidates will be eligible for grades C to G. Candidates who have studied the Extended subject content (Core and Supplement), and who are expected to achieve a grade C or above, should be entered for Paper 2, Paper 4 and either Paper 5 or Paper 6. These candidates will be eligible for grades A* to G.

Core candidates take:

Paper 1 45 minutes
Multiple Choice 30%
40 marks
40 four-choice multiple-choice questions
Questions will be based on the Core subject content
Assessing grades C–G
Externally assessed

Extended candidates take:

Paper 2 45 minutes
Multiple Choice 30%
40 marks
40 four-choice multiple-choice questions
Questions will be based on the Extended subject content (Core and Supplement)
Assessing grades A*–G
Externally assessed

and Core candidates take:

Paper 3 1 hour 15 minutes
Theory 50%
80 marks
Short-answer and structured questions
Questions will be based on the Core subject content
Assessing grades C–G
Externally assessed

and Extended candidates take:

Paper 4 1 hour 15 minutes
Theory 50%
80 marks
Short-answer and structured questions
Questions will be based on the Extended subject content (Core and Supplement)
Assessing grades A*–G
Externally assessed

All candidates take either:

Paper 5 1 hour 15 minutes
Practical Test 20%
40 marks
Questions will be based on the experimental skills in Section 4
Assessing grades A*–G
Externally assessed

or:

Paper 6 1 hour
Alternative to Practical 20%
40 marks
Questions will be based on the experimental skills in Section 4
Assessing grades A*–G
Externally assessed

Teachers are reminded that the latest syllabus is available on our public website at www.cambridgeinternational.org and the School Support Hub at www.cambridgeinternational.org/support

Paper 3 – Theory (Core)

Question 1

Example Candidate Response – Question 1, High	Examiner comments

1 Fig. 1.1 shows an animal cell.

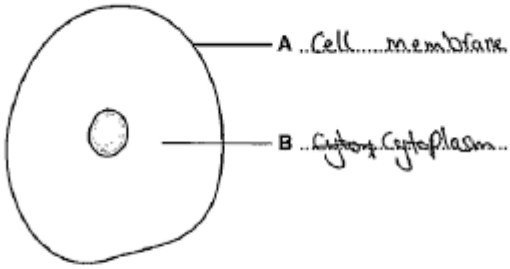


Fig. 1.1

(a) (i) Name the features labelled **A** and **B**.

Write your answers on Fig. 1.1. [2]

Both parts of the cell are labelled accurately.

Mark awarded for 1(a)(i) = 2 out of 2

(ii) The nucleus of living cells contains genetic material.

Name the **chemical** that this genetic material is made from.

Chromosomes [1]

'DNA' was the required answer here.

Mark awarded for 1(a)(ii) = 0 out of 1

(b) The cell in Fig. 1.1 carries out aerobic respiration.

Name **one** chemical that diffuses into an animal cell **and** one chemical that diffuses out of a cell during aerobic respiration.

chemical that diffuses in Oxygen

chemical that diffuses out Carbondioxide

[2]

Both answers are correct.

Mark awarded for 1(b) = 2 out of 2

(c) The process of active transport occurs in some cells.

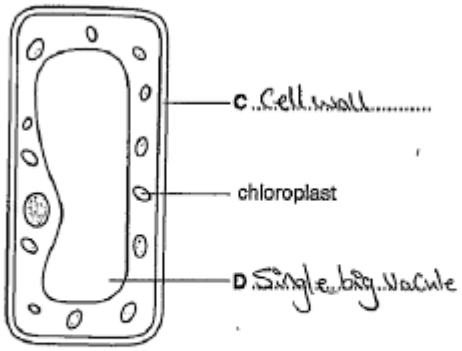
Outline **one** way in which diffusion is different to active transport.

Diffusion is movement of molecules & movement of molecules down concentration gradient while active active/visible, is movement of molecules against concentration gradient [1]

transport

The candidate clearly states one of the differences between diffusion and active transport, and so gains the mark.

Mark awarded for 1(c) = 1 out of 1

Example Candidate Response – Question 1, High	Examiner comments
Fig. 1.2 shows a cell from the palisade mesophyll layer of a leaf.  Fig. 1.2 (d) (i) Name the features labelled **C** and **D**. Write your answers on Fig. 1.2. [2] (ii) Name the process carried out by the chloroplasts **and** explain why all animal life depends on this process. name of process Photosynthesis explanation Chloroplasts contain green pigments which absorb sunlight and change the light energy into chemical energy and make photosynthesist to produce (take carbondioxide, water and light) to produce glucose for their food and and oxygen. all animals depend on plants for nutrition plants are the producers of all food chains (for any food chain) so they are essential, also plants gives out oxygen during photosynthesis, oxygen is responsible for respiration of all animals instead of carbondioxide [5] [Total: 13]	Two correct labels are given. The misspelling of vacuole is allowed. **Mark awarded for 1(d)(i) = 2 out of 2** Marks are awarded for the following points: photosynthesis; absorption of sunlight; takes in carbon dioxide; produces glucose; and plants are producers. **Mark awarded for 1(d)(ii) = 5 out of 5** **Total mark awarded = 12 out of 13**

How the candidate could have improved the answer

(a)(ii) The candidate named the structure that carries DNA, rather than naming the chemical as requested. As this response is from a candidate who gained very high marks overall, it is most likely that they misread the question.

(b) The candidate gave two correct responses and was awarded full marks. However, their response could be improved by writing *carbon dioxide* correctly as two separate words (rather than 'carbondioxide').

(d)(i) The candidate gave two correct responses and was awarded full marks. However, their answer could have been improved by spelling 'vacuole' correctly.

(d)(ii) The candidate was awarded full marks but an improvement would be for the candidate to say that animals need oxygen to carry out respiration (rather than oxygen is responsible for respiration).

Example Candidate Response – Question 1, Middle	Examiner comments

1 Fig. 1.1 shows an animal cell.

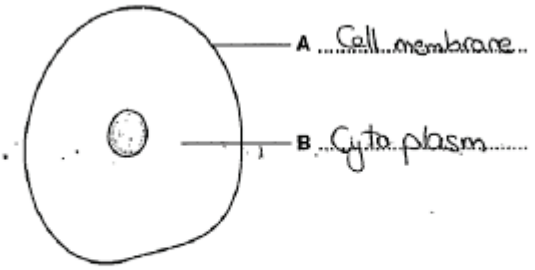


Fig. 1.1

(a) (i) Name the features labelled **A** and **B**.

Write your answers on Fig. 1.1. [2]

Both parts of the cell are labelled accurately.

Mark awarded for 1(a)(i) = 2 out of 2

(ii) The nucleus of living cells contains genetic material.

Name the **chemical** that this genetic material is made from.

~~cell sap~~ DNA [1]

An incorrect answer has been crossed out and replaced with the correct answer. It is important that incorrect answers are clearly crossed out. If two conflicting answers are given, no marks are awarded.

Mark awarded for 1(a)(ii) = 1 out of 1

(b) The cell in Fig. 1.1 carries out aerobic respiration.

Name **one** chemical that diffuses into an animal cell and one chemical that diffuses out of a cell during aerobic respiration.

chemical that diffuses in water

chemical that diffuses out glycogen [2]

Glycogen is an incorrect response. However, water is allowed because the question does not stipulate that the chemicals must be those involved in aerobic respiration (although this is implied). Therefore, any chemical that might diffuse into a cell was accepted.

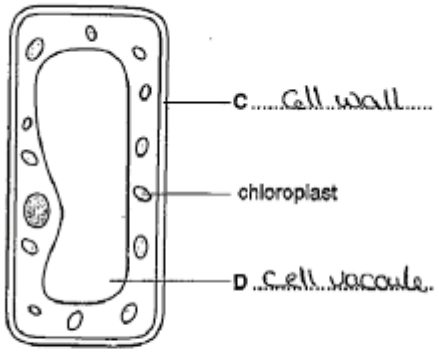
Mark awarded for 1(b) = 1 out of 2

(c) The process of active transport occurs in some cells.

Outline **one** way in which diffusion is different to active transport.

diffusion is movement of gas particles from high Concentration gradient to low concentration gradient [1]

This answer is incorrect for several reasons: it refers only to diffusion and does not state how active transport differs from diffusion; the candidate appears to be unclear about the meaning of a 'diffusion gradient'; and diffusion is not restricted to

Example Candidate Response – Question 1, Middle	Examiner comments
Fig. 1.2 shows a cell from the palisade mesophyll layer of a leaf.  Fig. 1.2 (d) (i) Name the features labelled **C** and **D**. Write your answers on Fig. 1.2. [2] (ii) Name the process carried out by the chloroplasts **and** explain why all animal life depends on this process. name of process Photo thensis explanation when Photo thensis is produced in plant herbivours eat it and then Carnivours eat the herbivours so it is the main food supply because if it wasn't present herbivours and Omnivours would decrease in number Kea tea Leading to decrease in number of Carnivours and Photothensis. Ok [5] [Total: 13]	gases as stated in the response. **Mark awarded for 1(c) = 0 out of 1** Two correct labels are given. The misspelling of vacuole is allowed. **Mark awarded for 1(d)(i) = 2 out of 2** One mark is awarded for correctly naming the process. The other two marks are awarded for: herbivores eat plants, and carnivores eat herbivores. **Mark awarded for 1(d)(ii) = 3 out of 5** **Total mark awarded = 9 out of 13**

How the candidate could have improved the answer

(b) The candidate needed to give a correct example of a chemical that diffuses out of a cell (not necessarily as a result of aerobic respiration). Carbon dioxide would be acceptable, for example.

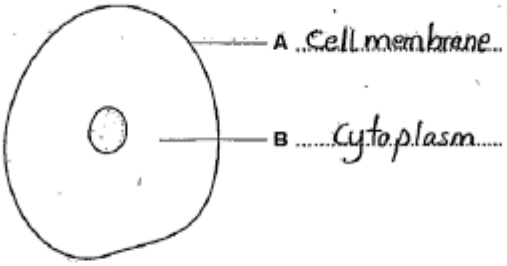
(c) The candidate could have improved by answering the question that was asked. When a question such as this asks for a difference between two processes, the difference must be stated in relation to the other process. Also, it appeared as though the candidate did not fully understand the process of diffusion.

(d)(i) The candidate was awarded full marks but could have improved by spelling ‘vacuole’ correctly.

(d)(ii) The answer could have been improved by:

- giving an outline of photosynthesis
- explaining that oxygen is needed to release energy from the nutrients eaten.

These additions would have given the candidate maximum marks.

Example Candidate Response – Question 1, Low	Examiner comments
1 Fig. 1.1 shows an animal cell.  **Fig. 1.1** **(a) (i)** Name the features labelled **A** and **B**. Write your answers on Fig. 1.1. [2]	Both parts of the cell are labelled accurately. **Mark awarded for 1(a)(i) = 2 out of 2**
(ii) The nucleus of living cells contains genetic material. Name the **chemical** that this genetic material is made from. protein [1]	The response is incorrect correct, so no mark is awarded. **Mark awarded for 1(a)(ii) = 0 out of 1**
(b) The cell in Fig. 1.1 carries out aerobic respiration. Name **one** chemical that diffuses into an animal cell **and** one chemical that diffuses out of a cell during aerobic respiration. chemical that diffuses in glucose + oxygen chemical that diffuses out water / carbon dioxide [2]	In each case, the candidate gives two correct answers. **Mark awarded for 1(b) = 2 out of 2**
(c) The process of active transport occurs in some cells. Outline **one** way in which diffusion is different to active transport. Diffusion is movement from high Concentration to low Concentration that different to active transport. [1]	Even though the statement about diffusion is correct, the candidate is not awarded the mark because the statement that active transport is different is insufficient; the candidate needed to say that 'active transport is the opposite.' **Mark awarded for 1(c) = 0 out of 1**

Example Candidate Response – Question 1, Low	Examiner comments

Fig. 1.2 shows a cell from the palisade mesophyll layer of a leaf.

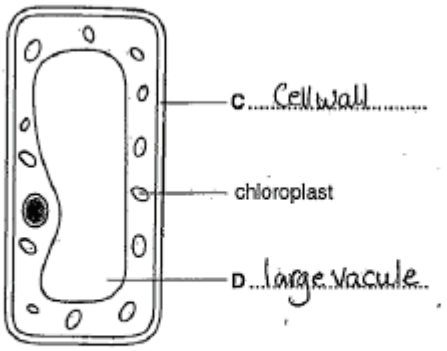


Fig. 1.2

(d) (i) Name the features labelled **C** and **D**.

Write your answers on Fig. 1.2. [2]

Both labels are correct. The misspelling of vacuole is allowed.

Mark awarded for 1(d)(i) = 2 out of 2

(ii) Name the process carried out by the chloroplasts **and** explain why all animal life depends on this process.

name of process Energy / protein / glucose

explanation Animal life take more energy from the chloroplasts and more protein which help in growth and development, take high persentage of glucose.

[5]

[Total: 13]

The candidate does not know that chloroplasts carry out photosynthesis, so is not awarded the mark for naming the process.

In the explanation, the candidate refers to the dependence of animals on photosynthesis, but provides insufficient detail to be awarded any marks.

If the last sentence had referred to animals eating glucose that the plant had produced, then one mark could have been awarded.

Mark awarded for 1(d)(ii) = 0 out of 5

Total mark awarded = 6 out of 13

How the candidate could have improved the answer

(a)(ii) The question asks for the chemical name of the genetic material in the nucleus. DNA was the expected answer. (Note that it is not necessary to give the full chemical name at this level.) The candidate stated 'protein' as the answer and although protein is present in a chromosome, it does not constitute the genetic material.

(c) The candidate gave a brief definition of diffusion and then said the active transport was different. This was not sufficient. The answer could have been improved by stating specifically that in active transport the movement of the chemical is from high concentration to low concentration (or, at the very least, the chemical movement is in the opposite direction to that found in diffusion).

(d)(i) The candidate was awarded full marks but the answer could have been improved by spelling 'vacuole' correctly'.

(d)(ii) The answer could be improved by the candidate knowing that chloroplasts carry out photosynthesis. In the explanation, the candidate refers to animals obtaining glucose and protein from chloroplasts. The answer could have been improved by saying that animals (herbivores) have to eat plants in order to obtain these nutrients and the energy they contain. Another improvement would be to state that the nutrients are obtained from the entire plant, and not solely from the chloroplasts.

Common mistakes candidates made in Question 1

For parts (a), (b), (d)(i) and the first part of (d)(ii), the examiner was expecting single word answers. The request to 'name' requires the candidate to provide the correct biological term.

(a)(i) This was answered correctly by most candidates. The most common error was to identify the cell membrane as the cell wall.

(a)(ii) Many candidates of all abilities could not name DNA. The most frequently given answers were protein, chromosome and gene.

(b) The majority of candidates answered correctly. Some weaker responses stated that carbon dioxide diffused in and oxygen diffused out.

(c) The examiner was expecting a brief description of one difference between the processes of active transport and diffusion. The use of the term 'outline' implies that brevity is required.

Many candidates gave a definition of diffusion but left the response incomplete as they did not say how active transport was different.

(d)(i) The most common error was to label the cell wall as the cell membrane, but more candidates answered correctly here than in part (a)(i). A large number of candidates could not spell vacuole correctly (but were not penalised for this).

(d)(ii) In the second part of (d)(ii) the question asks candidates to 'explain'. The examiner is expecting the candidate to give reasons for the fact that all animal life depends on photosynthesis.

The majority of candidates named photosynthesis as the process. The most common error was the failure to address the question. Many candidates outlined photosynthesis, but then did not explain why animals are dependent on this process. A significant number of candidates who attempted an explanation stated that oxygen was needed for breathing, as opposed to respiration.

Question 2

Example Candidate Response – Question 2, High	Examiner comments
2 Fig. 2.1 shows a gorilla with her baby.  **Fig. 2.1** **(a)** Gorillas are mammals and have characteristics that are **only** found in mammals, and not any other vertebrate group. State: **(i)** **one** mammalian characteristic visible in Fig. 2.1 Fur **(ii)** **two** mammalian characteristics **not** visible in Fig. 2.1 1 suckle the babies 2 External ears [2]	The answer give is correct. **Mark awarded for 2(a)(i) = 1 out of 1** The first answer the candidate gives is correct. The question stipulates that the characteristics must **not** be visible in Fig. 2.1 and external ears are visible on the baby, so the second mark is not awarded. **Mark awarded for 2(a)(ii) = 1 out of 2**

Example Candidate Response – Question 2, High

Examiner comments

(b) Fig. 2.2 shows the average body mass and Table 2.1 shows the average lifespan of males in six species of mammal.

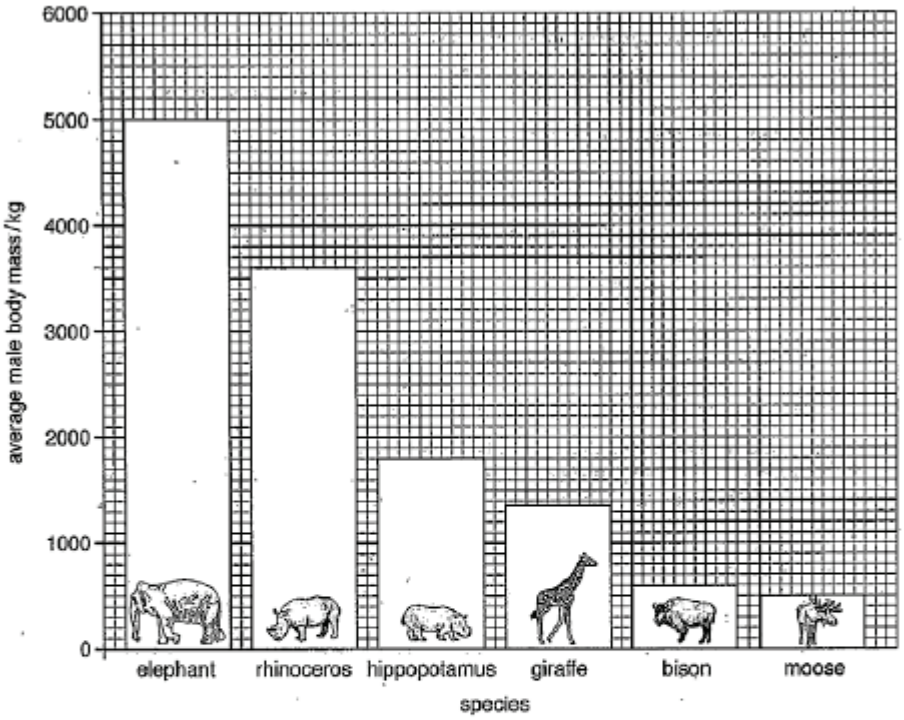


Fig. 2.2

Table 2.1

species	average male lifespan / years
elephant	70
rhinoceros	48
hippopotamus	42
giraffe	25
bison	23
moose	21

(i) Name the mammal that has an average lifespan of 23 years.

Bison [1]

(ii) State the average body mass of a male rhinoceros.

3600 kg [1]

(iii) State the average body mass of the mammal that has an average lifespan of 25 years.

1350 kg [1]

Bison is correctly identified.

Mark awarded for 2(b)(i) = 1 out of 1

The correct figure is extracted from the graph.

Mark awarded for 2(b)(ii) = 1 out of 1

The candidate gives a body mass within the accepted range.

Mark awarded for 2(b)(iii) = 1 out of 1

The candidate identifies the correct relationship

Example Candidate Response – Question 2, High	Examiner comments
(iv) Describe the relationship between average body mass and average lifespan shown in Fig. 2.2 and Table 2.1. As the average body mass increases, the average lifespan increases. [1] (c) The average lifespan of a human male can vary from 40 years to 85 years. The lifespan partly depends on the things available in the country where the man lives. Suggest **three** things that would increase the chance of a man having a longer lifespan. 1 Increased food supply 2 less diseases 3 Increased health care [3] **[Total: 10]**	between the two sets of figures. **Mark awarded for 2(b)(iv) = 1 out of 1** The first and last answers are worth of one mark each. The candidate does not gain a mark for 'less diseases.' The response requires a method of achieving this, such as increased availability of immunisations. **Mark awarded for 2(c) = 2 out of 3** **Total mark awarded = 8 out of 10**

How the candidate could have improved the answer

(a)(ii) A more detailed study of the photograph would have shown that external ears are visible on the baby and so another mammalian characteristic could have been given, such as giving birth to live young.

(c) The response could have been improved by a more precise answer to number 2. The answer *'less disease'* by itself is insufficient. The candidate needed to say how this could be achieved. The increased availability of immunisations, for example, would have been acceptable.

Example Candidate Response – Question 2, Middle	Examiner comments
2 Fig. 2.1 shows a gorilla with her baby.  Fig. 2.1 (a) Gorillas are mammals and have characteristics that are **only** found in mammals, and not in any other vertebrate group. State: (i) **one** mammalian characteristic visible in Fig. 2.1 Fur. [1] (ii) **two** mammalian characteristics **not** visible in Fig. 2.1 1 1 Pair of legs 2 ..... [2]	The candidate gives a correct answer. **Mark awarded for 2(a)(i) = 1 out of 1** The candidate gives one answer only, and the one given is not a mammalian characteristic. **Mark awarded for 2(a)(ii) = 0 out of 2**

Example Candidate Response – Question 2, Middle	Examiner comments

(b) Fig. 2.2 shows the average body mass and Table 2.1 shows the average lifespan of males in six species of mammal.

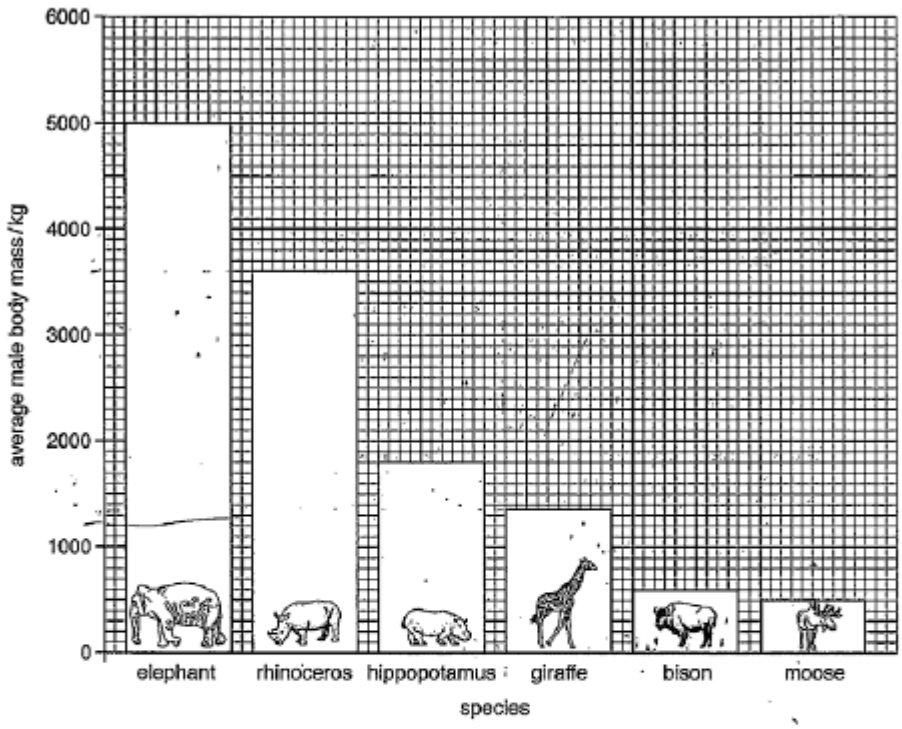


Fig. 2.2

Table 2.1

species	average male lifespan / years
elephant	70
rhinoceros	48
hippopotamus	42
giraffe	25
bison	23
moose	21

(i) Name the mammal that has an average lifespan of 23 years.

bison [1]

The correct animal is identified.

Mark awarded for 2(b)(i) = 1 out of 1

(ii) State the average body mass of a male rhinoceros.

3600 kg [1]

The candidate extracts the right information from the graph.

Mark awarded for 2(b)(ii) = 1 out of 1

(iii) State the average body mass of the mammal that has an average lifespan of 25 years.

1850 kg [1]

The candidate gives an answer within the acceptable range.

Mark awarded for 2(b)(iii) = 1 out of 1

Example Candidate Response – Question 2, Middle	Examiner comments
(iv) Describe the relationship between average body mass and average lifespan shown in Fig. 2.2 and Table 2.1. as average body mass decreases average lifespan decrease. They are directly proportional [1]	The candidate is correct in stating that as the average body mass decreases, so does the average life-span, but the relationship is not directly proportional. The latter statement negates the first one, and so no mark is awarded. **Mark awarded for 2(b)(iv) = 0 out of 1**
(c) The average lifespan of a human male can vary from 40 years to 85 years. The lifespan partly depends on the things available in the country where the man lives. Suggest **three** things that would increase the chance of a man having a longer lifespan. 1 No Pollution 2 balanced diet 3 [3] **[Total: 10]**	The two suggestions given are acceptable. **Mark awarded for 2(c) = 2 out of 3** **Total mark awarded = 6 out 10**

How the candidate could have improved the answer

(a)(ii) The candidate could have improved their answer by stating two mammalian characteristics that are not visible in the photograph.

(b)(iv) The candidate could have improved their answer by not including the statement that the body mass and the average lifespan are directly proportional. This is incorrect. They have a positive correlation.

(c) The candidate should have given a third suggestion. Additionally, the first suggestion of *'no pollution'* could have been improved by including more detail by adding a way in which pollution might be reduced, such as restrictions on the burning of fossil fuels or organised collections of household rubbish.

Example Candidate Response, Question 2, Low	Examiner comments
2 Fig. 2.1 shows a gorilla with her baby.  **Fig. 2.1** **(a)** Gorillas are mammals and have characteristics that are **only** found in mammals, and not in any other vertebrate group. State: **(i)** **one** mammalian characteristic visible in Fig. 2.1 Have hair [1] **(ii)** **two** mammalian characteristics **not** visible in Fig. 2.1 1 fingers toes 2 flappy ears [2]	Correct response. **Mark awarded for 2(a)(i) = 1 out of 1** The possession of fingers and toes is not a mammalian characteristic. The candidate might have written 'flappy ears' to indicate external ears, but this cannot be awarded a mark as external ears are visible on the baby in Fig. 2.1. **Mark awarded for 2(a)(ii) = 0 out of 2**

Example Candidate Response, Question 2, Low	Examiner comments

(b) Fig. 2.2 shows the average body mass and Table 2.1 shows the average lifespan of males in six species of mammal.

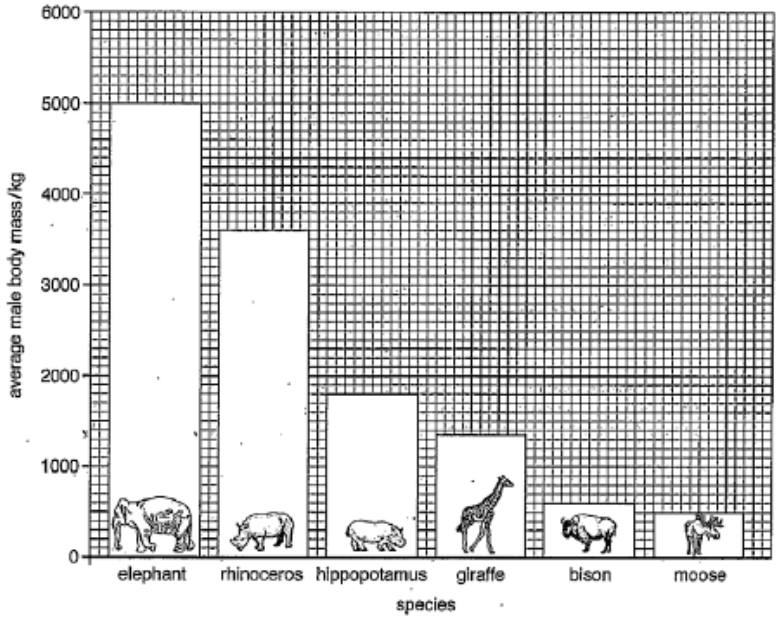


Fig. 2.2

Table 2.1

species	average male lifespan/years
elephant	70
rhinoceros	48
hippopotamus	42
giraffe	25
bison	23
moose	21

(i) Name the mammal that has an average lifespan of 23 years.

Bison [1]

The candidate correctly identifies the animal.

Mark awarded for 2(b)(i) = 1 out of 1

(ii) State the average body mass of a male rhinoceros.

3060 kg [1]

Incorrect information is extracted from the graph.

Mark awarded for 2(b)(ii) = 0 out of 1

(iii) State the average body mass of the mammal that has an average lifespan of 25 years.

1035 kg [1]

This is incorrect.

Mark awarded for 2(a)(iii) = 0 out of 1

The answers to parts (ii) and (iii) indicates that the candidate experienced difficulties working with the scale on the *y*-axis.

Example Candidate Response, Question 2, Low	Examiner comments
(iv) Describe the relationship between average body mass and average lifespan shown in Fig. 2.2 and Table 2.1. Directly proptional as by increasing the average life span of years, the average body mass increases [1] (c) The average lifespan of a human male can vary from 40 years to 85 years. The lifespan partly depends on the things available in the country where the man lives. Suggest **three** things that would increase the chance of a man having a longer lifespan. 1 NO disease spread 2 ~~NO problems~~ Having clean water and food and eating healthy food 3 Exercising [3] **[Total: 10]**	The candidate is not awarded a mark for this response as the relationship is not directly proportional. **Mark awarded for 2(b)(iv) = 0 out of 1** The candidate is awarded a mark for identifying the importance of clean water. 'Eating healthy food' cannot be considered as it is the second response in this space. 'Exercising' is also awarded a mark. The first answer is not credited with a mark as the candidate does not state how spread of disease is to be reduced. **Mark awarded for 2(c) = 2 out 3** **Total mark awarded = 4 out of 10**

How the candidate could have improved the answer

(a)(ii) The answer could have been improved by stating two mammalian characteristics that are not visible in the photograph. 'Floppy ears' would be an acceptable description of external ears, but this feature was not allowed as the external ears are visible on the baby.

(b)(ii)(iii)

The answers could have been improved by reading the figures from the axes accurately. It seemed that the candidate had trouble interpreting the scale on the *y*-axis.

(c) The first suggestion needed to be expanded to suggest a way in which the spread of disease might be reduced, such as increase availability of vaccinations. Note that the second suggestion made by the candidate contained two answers; the protocol for this situation is that the first suggestion is marked and subsequent one is ignored.

Common mistakes candidates made in Question 2

(a) The examiner was expecting candidates to state some characteristics of mammals: one which was visible in the photograph, and two which were not visible.

Candidates of all abilities had very little knowledge of mammalian characteristics, apart from the possession of fur.

(b) The examiner was expecting candidates to extract some answers directly from the information provided, and then to describe the general relationship between body mass and average life span shown in the graph.

A common mistake made in weaker responses was a statement such as 'the more you weigh the longer you live.' This was not awarded marks because individual age has been confused with average life span of a species. Other candidates stated that the relationship between average age and life span was directly proportional, which is not accurate.

(c) The examiner was expecting the candidate to make three suggestions that would contribute towards an increased human lifespan.

Frequently, insufficient detail was given.

Question 3

Example Candidate Response – Question 3, High	Examiner comments

3 Fig. 3.1 shows a section through the skin.

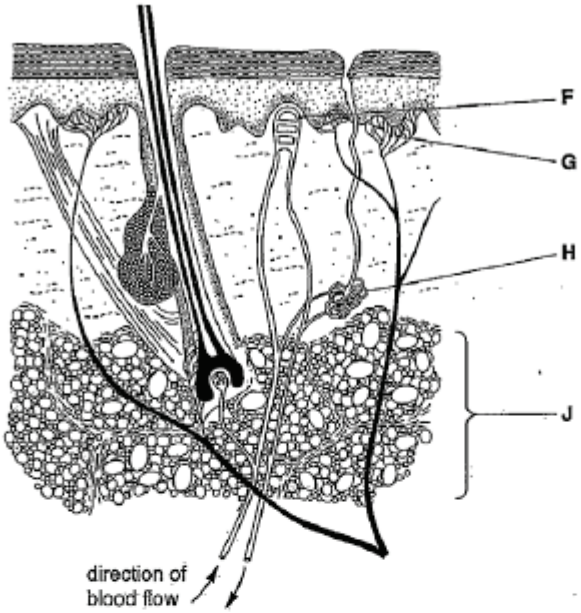


Fig. 3.1

(a) Name the structures labelled in Fig. 3.1 and outline a function in the skin for each one.

Write your answers in Table 3.1.

An example has been done for you.

Table 3.1

structure	name of structure	function in the skin
F	Capillary loop	dilates and constricts to control the blood flow
G	sensory neurones	detects stimulus
H	sweat gland	produces sweat for cooling the body
J	fatty tissue	insulation for the skin

The candidate identifies all three structures and correctly states the functions for two of them. The function for the capillary is incorrect as it is the arteriole leading to the capillary that can regulate the blood flow.

The role of the arteriole in vaso-constriction and vaso-dilation is understood by very few candidates and is obviously an area of understanding that needs reinforcing.

Mark awarded for 3(a) = 5 out of 6

Example Candidate Response – Question 3, High

Examiner comments

(b) In an investigation the volume of sweat produced by a student was measured when running while carrying different masses in a back-pack.

The results are shown in Fig. 3.2.

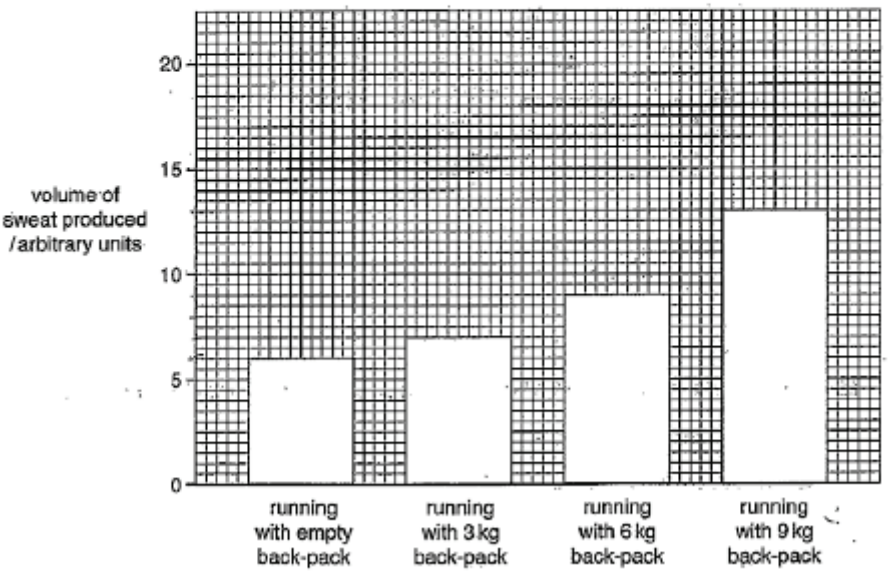


Fig. 3.2

(i) Use Fig. 3.2 to state:

the volume of sweat produced when running with an empty back-pack

6 arbitrary units

the volume of sweat produced when running with a 9 kg back-pack

13 arbitrary units

Use these two volumes to calculate the percentage increase in sweat production when running with a 9 kg back-pack.

Give your answer to the nearest whole number.

Show your working.

Percentage increase = $\frac{\text{increase}}{\text{original}} \times 100$

Percentage increase = $\frac{(13-6)}{13} \times 100$ = 53.846... ≈ 54%

54 %

[3]

The candidate gives the correct figures for the volumes of sweat produced, and gains two marks. The formula for working out the percentage is given correctly but the candidate has substituted the incorrect figures into the formula.

Mark awarded for 3(b)(ii) = 2 out of 3

Example Candidate Response – Question 3, High	Examiner comments
(ii) This investigation was carried out when the air temperature was 10 °C. Predict the effect of carrying out the same investigation if the air temperature was 15 °C. The volume of sweat produced will increase. [1]	The candidate gives an accurate prediction. **Mark awarded for 3(b)(ii) = 1 out of 1**
(c) When the student was at rest the volume of sweat produced was 2 arbitrary units. The volume increases during exercise as the body needs to keep cool. Explain how this cooling takes place. Sweat is released at the top of the skin, the water in the sweat evaporates, evaporation needs heat energy from the body so heat energy is removed from the body so the body cools. [3] **[Total: 13]**	A coherent explanation is provided. The candidate is awarded marks for: water in sweat evaporates and (this) takes heat energy from the body. **Mark awarded for 3(c) = 3 out of 3** **Total mark awarded = 11 out of 13**

How the candidate could have improved the answer

(a) The candidate should have given a function of a blood capillary, such as it being the place where oxygen diffuses out to the cells. It is the arterioles that have the ability to constrict or relax.

(b)(i) The candidate could have improved their answer by using the correct numbers for calculating the percentage.

Example Candidate Response – Question 3, Middle	Examiner comments

3 Fig. 3.1 shows a section through the skin.

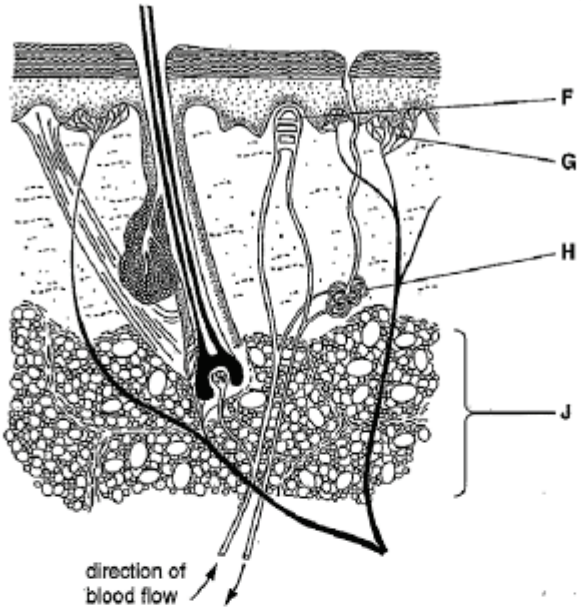


Fig. 3.1

(a) Name the structures labelled in Fig. 3.1 and outline a function in the skin for each one.

Write your answers in Table 3.1.

An example has been done for you.

Table 3.1

structure	name of structure	function in the skin
F	blood capillaries	take in and out blood.
G	receptors	transport signals.
H	sweat gland	produces sweat for cooling the body
J	Spongy mesophyll	for gas exchange

[6]

The candidate gains marks for identifying the capillaries and stating their function. The receptors are also named correctly, but their function is to detect changes and not to transmit impulses, so there is no mark awarded for the function. They incorrectly identify the adipose layer as spongy mesophyll, so no marks are awarded for either structure or function.

Mark awarded for 3(a) = 3 out of 6

Example Candidate Response – Question 3, Middle	Examiner comments

(b) In an investigation the volume of sweat produced by a student was measured when running while carrying different masses in a back-pack.

The results are shown in Fig. 3.2.

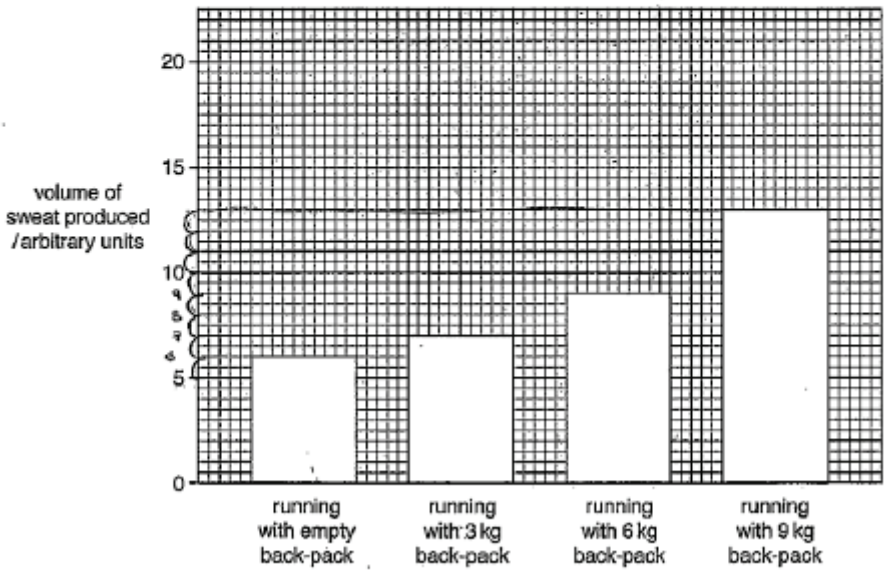


Fig. 3.2

(i) Use Fig. 3.2 to state:

the volume of sweat produced when running with an empty back-pack

6 arbitrary units

the volume of sweat produced when running with a 9kg back-pack

13 arbitrary units

Use these two volumes to calculate the percentage increase in sweat production when running with a 9kg back-pack.

Give your answer to the nearest whole number.

Show your working.

$\frac{6}{9} \times 100$

66 %

[3]

The candidate states the two volumes of sweat accurately. The percentage formula is incorrect and it is unclear where the figure '9' originated.

Mark awarded for 3(b)(ii) = 2 out of 3

Example Candidate Response – Question 3, Middle	Examiner comments
(ii) This investigation was carried out when the air temperature was 10 °C. Predict the effect of carrying out the same investigation if the air temperature was 15 °C. Different volumes of sweat produced. .....[1]	It is insufficient to state that the volumes of sweat would be different. The candidate needs to say that the volume would be greater at a higher temperature. **Mark awarded for 3(b)(ii) = 0 out of 1**
(c) When the student was at rest the volume of sweat produced was 2 arbitrary units. The volume increases during exercise as the body needs to keep cool. Explain how this cooling takes place. Cooling takes space by evaporating of water muscles need more energy to contract, more loss of sweat and sweat goes out to keep the body temperature cool and ~~sweat~~ constant .....[3] [Total: 13]	The candidate is awarded two marks for identifying that water evaporates. The explanation is incomplete as there is no reference to the energy for evaporation being provided by the body. **Mark awarded for 3(c) = 2 out of 3** **Total mark awarded = 7 out 13**

How the candidate could have improved the answer

(a) The candidate could have improved their response by stating the function of the blood capillary more clearly. The receptors detect changes in the external environment; they do not transmit impulses, as the candidate indicated. The candidate needed to interpret the skin diagram more effectively and be able to give functions for each part.

(b)(i) The candidate could have improved their answer by using the correct numbers for calculating the percentage.

(b)(ii) The response needed to be more specific and state that the volumes of sweat would be larger.

(c) The candidate could have improved their answer by explaining that the energy for evaporation is provided by the body.

Example Candidate Response – Question 3, Low

Examiner comments

3 Fig. 3.1 shows a section through the skin.

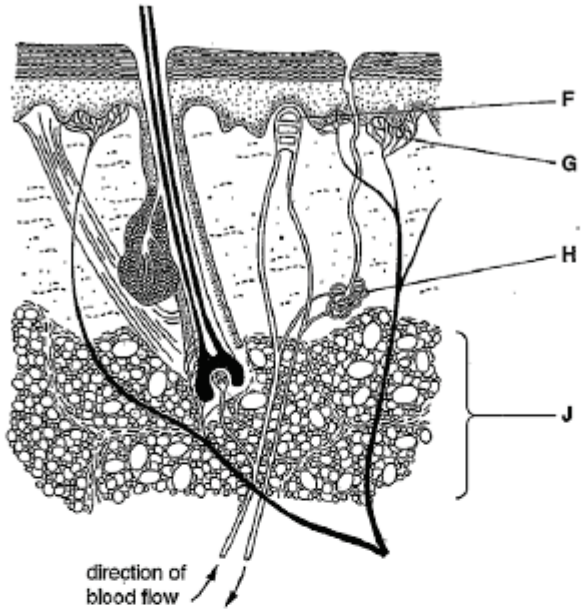


Fig. 3.1

(a) Name the structures labelled in Fig. 3.1 and outline a function in the skin for each one.

Write your answers in Table 3.1.

An example has been done for you.

Table 3.1

structure	name of structure	function in the skin
F	Vein	Support skin with blood Blood supply
G	Nervs	control movement
H	sweat gland	produces sweat for cooling the body
J	Tissue (group of cells)	Respiration in skin

[6]

The candidate has not identified any of the structures correctly. The mark scheme stipulates that the mark for the function cannot be awarded if the structure itself is not correctly identified.

Mark awarded for 3(a) = 0 out of 6

Example Candidate Response – Question 3, Low	Examiner comments

(b) In an investigation the volume of sweat produced by a student was measured when running while carrying different masses in a back-pack.

The results are shown in Fig. 3.2.

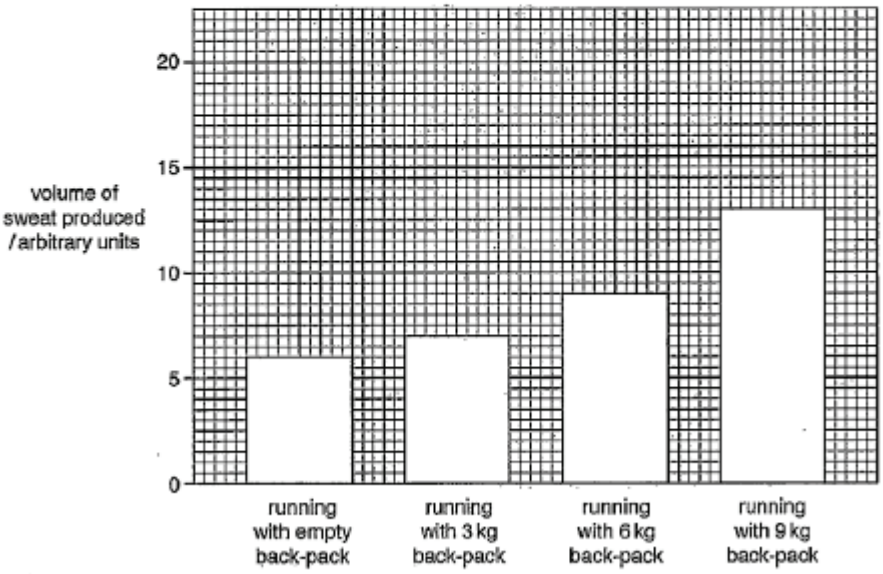


Fig. 3.2

(i) Use Fig. 3.2 to state:

the volume of sweat produced when running with an empty back-pack

6 arbitrary units

the volume of sweat produced when running with a 9 kg back-pack

13 arbitrary units

Use these two volumes to calculate the percentage increase in sweat production when running with a 9 kg back-pack.

Give your answer to the nearest whole number.

Show your working. Number / Total x 100 $\frac{6}{13} \times 100$

46 %

[3]

The candidate correctly extracts the two figures required from the graph. The word formula for the percentage is not clear and the incorrect figures have been substituted, so the third mark is not awarded.

Mark awarded for 3(b)(i) = 2 out of 3

Example Candidate Response – Question 3, Low	Examiner comments
(ii) This investigation was carried out when the air temperature was 10 °C. Predict the effect of carrying out the same investigation if the air temperature was 15 °C. volume of sweat produced increase .....[1]	An increase in sweat production is predicted accurately. **Mark awarded for 3(b)(ii) = 1 out of 1**
(c) When the student was at rest the volume of sweat produced was 2 arbitrary units. The volume increases during exercise as the body needs to keep cool. Explain how this cooling takes place. By sweating more as when sweat volume increases that means that the body is working an maintaining a certain temperature. .....[3] **[Total: 13]**	The candidate has not answered the question and so is not awarded any marks. **Mark awarded for 3(c) = 0 out of 3** **Total mark awarded = 3 out of 13**

How the candidate could have improved the answer

(a) The candidate could have improved their answer by having a better understanding of the structure and function of the skin; they clearly did not know the structure or function of the skin and were unable to answer the question. The structure and function had to match, therefore, the candidate could not be given credit for the poorly expressed function for J as the structure was not identified correctly.

(b)(i) The candidate could have improved their answer by using the correct numbers for calculating the percentage. The word formula for the percentage was not clear, so it might be that they did not understand how to calculate the percentage increase.

(c) The candidate did not answer the question asked, so could not be awarded any marks. It is necessary for the candidate to learn the how sweat lowers the body temperature.

Common mistakes candidates made in Question 3

(a) The examiner was expecting the candidate to name the three structures in the skin and to state briefly a function for each one.

Most candidates were unable to identify skin structures and give the functions; it is clear that the structure of the skin was not well known. There were frequent instances of the adipose tissue being identified as a structure that is not found in the skin. In some cases, plant structures were named.

(b) The examiner expected the candidate to extract some figures from a graph and to use these in a simple calculation. The candidate was also asked in (b)(ii) to give a prediction based on the information in the graph.

Many candidates were not capable of calculating the required percentage. It appeared that incorrect numbers were used in their calculations.

(c) The examiner expected the candidate to explain how sweat cools the body.

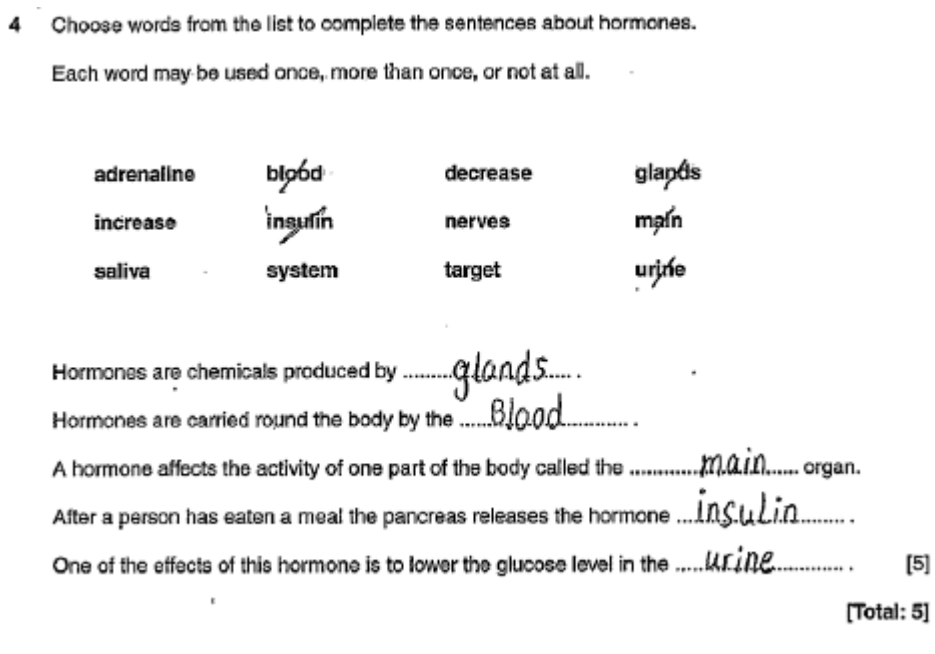
The majority of candidates could not explain how sweat lowers the body temperature; most candidates find the explanation of how sweat cools the body very difficult.

Question 4

Example Candidate Response – Question 4, High	Examiner comments
4 Choose words from the list to complete the sentences about hormones. Each word may be used once, more than once, or not at all. adrenaline blood decrease glands increase insulin nerves main saliva system target urine Hormones are chemicals produced by adrenaline glands Hormones are carried round the body by the blood . A hormone affects the activity of one part of the body called the target organ. After a person has eaten a meal the pancreas releases the hormone insulin . One of the effects of this hormone is to lower the glucose level in the blood . [5] [Total: 5]	The candidate selects four of the required words. Hormones are produced by glands not by the adrenal glands, so one mark is not awarded here. **Mark awarded for 4 = 4 out of 5** **Total mark awarded = 4 out of 5**

How the candidate could have improved the answer

The candidate could have improved their answer by appreciating that there are many glands that produce hormones. One such gland is the adrenal gland, which secretes adrenaline. Other glands secrete the other hormones.

Example Candidate Response – Question 4, Middle	Examiner comments
	The candidate selects the words 'glands', 'blood' and 'insulin' accurately and so is awarded three marks. **Mark awarded for 4 = 3 out of 5** **Total mark awarded = 3 out of 5**

4 Choose words from the list to complete the sentences about hormones.

Each word may be used once, more than once, or not at all.

adrenaline	blood	decrease	glands
increase	insulin	nerves	main
saliva	system	target	urine

Hormones are chemicals produced by ..glands.. .

Hormones are carried round the body by the ..Blood.. .

A hormone affects the activity of one part of the body called the ..main.. organ.

After a person has eaten a meal the pancreas releases the hormone ..insulin.. .

One of the effects of this hormone is to lower the glucose level in the ..urine.. . [5]

[Total: 5]

How the candidate could have improved the answer

Firstly the candidate needed to appreciate that insulin lowers the glucose level in the blood. Secondly, that the general term for any organ that is affected by the action of a hormone is the *target organ.* This is the term stated in the syllabus.

Example Candidate Response – Question 4, Low	Examiner comments
4 Choose words from the list to complete the sentences about hormones. Each word may be used once, more than once, or not at all. **adrenaline** **blood** **decrease** **glands** **increase** **insulin** **nerves** **main** **saliva** **system** **target** **urine** Hormones are chemicals produced by ..blood.. . Hormones are carried round the body by the ..blood glands.. . A hormone affects the activity of one part of the body called the ..main.. organ. After a person has eaten a meal the pancreas releases the hormone ..insulin.. . One of the effects of this hormone is to lower the glucose level in the ..urine.. . [5] **[Total: 5]**	The candidate is awarded one mark for selecting insulin for the fourth response. All the other words selected are inaccurate. **Mark awarded for 4 = 1 out of 5** **Total mark awarded = 1 out of 5**

How the candidate could have improved the answer

The candidate needed to know the material more thoroughly as most of the answers given appear to be chosen at random. The only fact given correctly by the candidate was that after a meal the pancreas releases insulin.

Common mistakes candidates made in Question 4

Many candidates did not appear to be familiar with the term ‘target organ’.

Question 5

Example Candidate Response – Question 5, High

5 Fig. 5.1 shows some apparatus used to investigate transpiration.

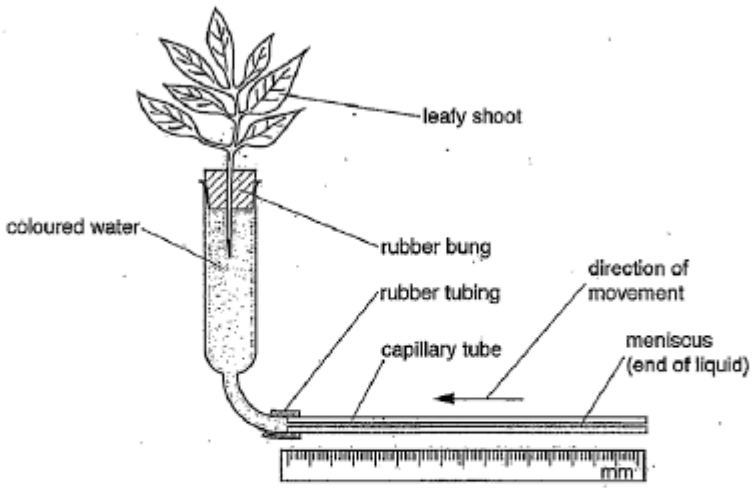


Fig. 5.1

The rate of transpiration can be calculated by measuring how far the meniscus moves five minutes.

(a) Name the tissue that transports water from the roots to the leaves in a plant.

Xylem

(b) The investigation was carried out at five different temperatures.
All other conditions were kept constant.

Table 5.1 shows the results recorded using the apparatus shown in Fig. 5.1.

Table 5.1

temperature/°C	distance moved by meniscus in five minutes/mm
10	28
20	32
30	37
40	44
50	53

(i) State **one** conclusion that can be drawn from the results in Table 5.1 about the effect of temperature on the rate of transpiration.

when the temperature increase, the rate of transpiration increases [1]

Examiner comments

The tissue is correctly named. The incorrect spelling is allowed.

Mark awarded for 5(a) = 1 out of 1

The candidate draws the correct conclusion from the results.

Mark awarded for 5(b)(i) = 1 out of 1

Example Candidate Response – Question 5, High	Examiner comments
(ii) Suggest why the investigation was not continued at temperatures above 50 °C. because the enzymes in the plant will be denatured from high temperature. [2]	There are two marks for this response and a sufficient number of lines have been supplied. The candidate gains one mark for stating that the enzymes would denature, but the second mark is not awarded as the response is incomplete. A second statement saying that the plant would die would have gained the second mark available. **Mark awarded for 5(b)(ii) = 1 out of 2**
(c) The investigation was repeated using the leafy shoot shown in Fig. 5.2.  Fig. 5.2 (i) Predict how these results would be different to the results shown in Table 5.1. The results will be less than the results in table 5.1 [1]	The candidate is not awarded the mark for stating that the results would be less as this is imprecise. A statement relating to *this* experiment is required, such as, there would be less water loss or that the meniscus would move more slowly. **Mark awarded for 5(c)(i) = 0 out of 1**
(ii) Give **two** reasons why the results would be different. because this leafy shoot is smaller than the other and has less leaves than the other, so the amount of water moved will be less [2]	Two marks are awarded for two correct reasons. An improvement would be to clarify whether '*less leaves*' means smaller leaves or a lower number of leaves. **Mark awarded for 5(c)(ii) = 2 out of 2**
	One mark is awarded for a correct response. **Mark awarded for 5(d) = 1 out of 1** **Total mark awarded = 6 out of 8**

Example Candidate Response – Question 5, High	Examiner comments
(d) State **one** factor, other than temperature, that can affect the rate of transpiration. humidity .....[1] **[Total: 8]**	

How the candidate could have improved the answer

(a) The candidate could have improved the answer by spelling xylem correctly.

(b)(ii) The answer could have been improved by including a second statement saying that the plant would die; or that water loss would be greater than water intake; or that there would be difficulty in achieving this temperature in a laboratory, to be awarded the second mark. The candidate needed to realise that where two marks are available, it is necessary to make two distinct points in the answer.

(c)(i) A statement needed to be made relating to the experiment described. Saying that the results would be 'less', is imprecise. The candidate needed to say that the rate of transpiration would be less, or that there would be less water loss, or that the meniscus would move more slowly.

(c)(ii) An improvement would be to clarify whether 'less leaves' means smaller leaves or fewer leaves. The candidate had already been credited with saying that the entire shoot was smaller, so was given the benefit-of-the-doubt over the meaning of 'less leaves'.

Example Candidate Response – Question 5, Middle	Examiner comments

5 Fig. 5.1 shows some apparatus used to investigate transpiration.

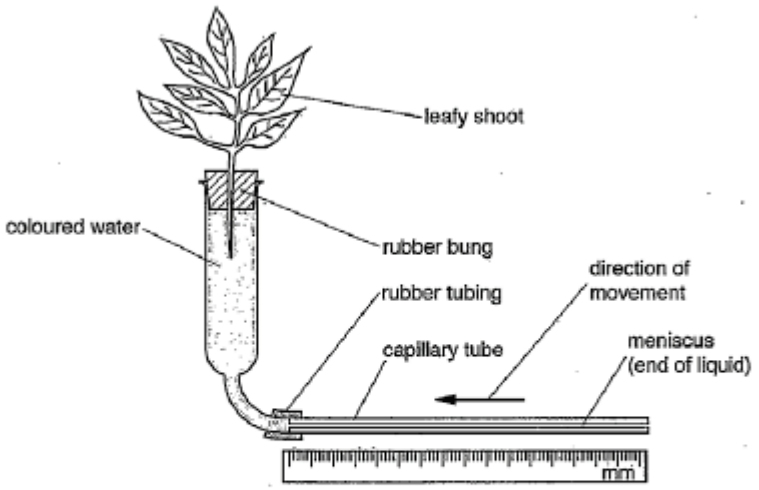


Fig. 5.1

The rate of transpiration can be calculated by measuring how far the meniscus moves in five minutes.

(a) Name the tissue that transports water from the roots to the leaves in a plant.

Xylem tissue [1]

One mark is awarded for a correct response.

Mark awarded for 5(a) = 1 out of 1

(b) The investigation was carried out at five different temperatures.
All other conditions were kept constant.

Table 5.1 shows the results recorded using the apparatus shown in Fig. 5.1.

Table 5.1

temperature/°C	distance moved by meniscus in five minutes/mm
10	28
20	32
30	37
40	44
50	53

(i) State one conclusion that can be drawn from the results in Table 5.1 about the effect of temperature on the rate of transpiration.

As temperature increase, the rate of transpiration increase. [1]

The candidate is awarded mark for stating the correct relationship.

Mark awarded for 5(b)(i) = 1 out of 1

(ii) Suggest why the investigation was not continued at temperatures above 50 °C.

Because above 50°C causes the air to be saturated with water vapour (humidity) so the rate of transpiration will decrease. [2]

A high ambient temperature does not mean that the humidity will increase. If the candidate had thought about the answer to the previous question, then a different response may have been elicited here.

Mark awarded for 5(b)(ii) = 0 out of 2

Example Candidate Response – Question 5, Middle	Examiner comments
(c) The investigation was repeated using the leafy shoot shown in Fig. 5.2.  **Fig. 5.2** **(i)** Predict how these results would be different to the results shown in Table 5.1. The distance moved by the meniscus in 5 minute will decrease. [1]	The candidate makes the correct prediction. **Mark awarded for 5(c)(i) = 1 out of 1**
(ii) Give **two** reasons why the results would be different. (1) Because few leaves are used (2) Because the rate of transpiration will decrease. [2]	One mark is awarded for the fact that the plant possesses fewer leaves. The decrease in the rate of transpiration is merely a restatement of the answer to part(c)(i) and so does not merit a mark. **Mark awarded for 5(c)(ii) = 1 out of 2**
(d) State **one** factor, other than temperature, that can affect the rate of transpiration. humidity [1] **[Total: 8]**	One mark is awarded for a correct response. **Mark awarded for 5(d) = 1 out of 1** **Total mark awarded = 5 out of 8**

How the candidate could have improved the answer

(b)(ii) The answer given is not logical. The candidate could have improved their answer by considering the results of the investigation in part (i) as a starting point.

(c)(i) The candidate could have improved their response by giving a second reason for the difference in the results (as decrease in transpiration has already been stated in (c)(i)). This could have been that the leaves were smaller, or that the total surface area of the leaves was smaller.

Example Candidate Response – Question 5, Low	Examiner comments

5 Fig. 5.1 shows some apparatus used to investigate transpiration.

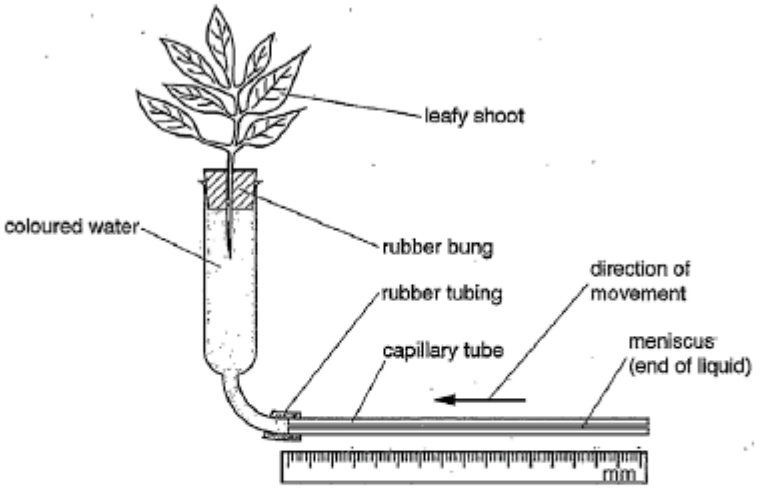


Fig. 5.1

The rate of transpiration can be calculated by measuring how far the meniscus moves in five minutes.

(a) Name the tissue that transports water from the roots to the leaves in a plant.

Xylem [1]

One mark is awarded for a correct response.

Mark awarded for 5(a) = 1 out of 1

(b) The investigation was carried out at five different temperatures.
All other conditions were kept constant.

Table 5.1 shows the results recorded using the apparatus shown in Fig. 5.1.

Table 5.1

temperature / °C	distance moved by meniscus in five minutes / mm
10	28
20	32
30	37
40	44
50	53

(i) State **one** conclusion that can be drawn from the results in Table 5.1 about the effect of temperature on the rate of transpiration.

As ~~temp~~ temprature increases the distance moved by meniscus increases [1]

The candidate is awarded a mark for stating the correct relationship.

Mark awarded for 5(b)(i) = 1 out of 1

(ii) Suggest why the investigation was not continued at temperatures above 50 °C.

because it would have been too hot for the meniscus to move and the thermometer wouldn't record because it has reached the end of its scale [2]

Neither suggestion is correct.

Mark awarded for 5(b)(ii) = 0 out of 2

Example Candidate Response – Question 5, Low	Examiner comments
(c) The investigation was repeated using the leafy shoot shown in Fig. 5.2.  **Fig. 5.2** **(i)** Predict how these results would be different to the results shown in Table 5.1. the answer it would be less accurate [1] **(ii)** Give **two** reasons why the results would be different. different conditions. different apparatus used. [2] **(d)** State **one** factor, other than temperature, that can affect the rate of transpiration. humiclity and amount of rain fall [1] **[Total: 8]**	No mark is awarded for this response. **Mark awarded for 5(c)(i) = 0 out of 1** The candidate does not appear to understand the difference between the two investigations. **Mark awarded for 5(c)(ii) = 0 out of 2** The candidate is awarded one mark for a correct answer. **Mark awarded for 5(d) = 1 out of 1** **Total mark awarded = 3 out of 8**

How the candidate could have improved the answer

(b)(ii) Both of the suggestions made by the candidate are illogical. The candidate could improve their answer by considering the results of the investigation in part (i) as a starting point.

(c)(i) The candidate could have improved their answer by being specific and stating that either the rate of transpiration would be less, or give a result from the experiment that would support this, such as the meniscus would move more slowly.

(c)(ii) The candidate should have compared the shoots in Figs. 5.1 and 5.2 and considered what effect the differences would have on transpiration rates.

Common mistakes candidates made in Question 5

(b)(ii) The examiner was expecting a suggestion to be made about a continuation of the investigation.

Many candidates gave an answer containing only one point. There are two marks available, which should indicate to candidates that they must expand their first response or think of a second factor to suggest.

(c) The examiner was expecting a prediction made about a modification of the previous investigation and two reasons stated to support this prediction.

(c)(ii) Many candidates gave only one reason for the difference in results. They were specifically asked for two reasons, and two marks were available. Candidates must follow instructions if they are to access all of the available marks.

Question 6

Example Candidate Response – Question 6, High	Examiner comments

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

removal of a certain gene from chromosomes of a species and inserting it into another different species to obtain desirable characteristis

[2]

(b) State **two** examples of genetic engineering.

For each example, outline how it benefits humans.

Write your answers in Table 6.1.

Table 6.1

example	benefit to humans
taking genes of production of insulin from humans and inserting it to bacteria	insulin produced by bacteria will be taken and prescribed to people who have problems with secretion of insulin in body
taking genes from a micro-organism that is not affected by insecticides and adding it to plants	plant crops will not be harmed by insecticides to have healthier crops if insecticide affect soil.

[4]

[Total: 6]

The candidate is awarded two marks for a sound definition.

Mark awarded for 6(a) = 2 out of 2

All four marks are awarded. The second example involving the insecticides is more theoretical, but perfectly feasible.

Mark awarded for 6(b) = 4 out of 4

Total mark awarded = 6 out of 6

How the candidate could have improved the answer

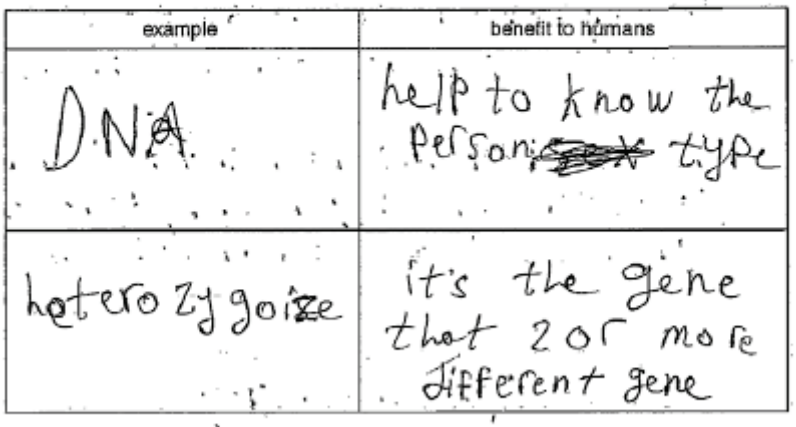
The candidate gained full marks for all parts and there are no specific ways that the responses could have been improved.

Example Candidate Response – Question 6, Middle	Examiner comments
6 (a) Define the term *genetic engineering*. take a gene from a species and put it in another species by bacteria as it produce rapidly to develop it's characteristics. [2] (b) State **two** examples of genetic engineering. For each example, outline how it benefits humans. Write your answers in Table 6.1. **Table 6.1** example: Selective breeding — benefit to humans: having cattles with more meet and milk example: insulin — benefit to humans: taking insulin and put with bacteria where bacteria divide and insulin increase. [4] **[Total: 6]**	Two marks are awarded for an acceptable description, although the last clause is rather muddled. **Mark awarded for 6(a) = 2 out of 2** Selective breeding is not an example of genetic engineering, so the candidate cannot be awarded any marks for the first response. The candidate is not awarded marks for the second example as it is incorrectly described. **Mark awarded for 6(b) = 0 out of 4** **Total mark awarded = 2 out 6**

How the candidate could have improved the answer

(a) The candidate gained the two marks here, but the definition could have been improved. The last clause is muddled and what the candidate seems to be saying does not constitute part of the definition. It is advisable for candidates to learn some definitions by rote. When candidates try to express a definition in their own words it is not usually successful.

(b) The candidate needed to learn the examples of genetic engineering given in the syllabus. Genetic engineering is involved in insulin production, but the candidate does not demonstrate an understanding of the process.

Example Candidate Response – Question 6, Low	Examiner comments
6 (a) Define the term *genetic engineering*. it's genes which show the DNA of the person if he is boy or girl and show it it's homozygous or heterozygous [2] (b) State **two** examples of genetic engineering. For each example, outline how it benefits humans. Write your answers in Table 6.1. **Table 6.1**  [4] **[Total: 6]**	The response does not answer the question. **Mark awarded for 6(a) = 0 out of 2** No marks can be awarded as the candidate does not understand the topic. **Marks awarded for 6(b) = 0 out of 4** **Total mark awarded = 0 out of 6**

How the candidate could have improved the answer

(a) The candidate needed to learn the definition of '*genetic engineering*'.

(b) The candidate did not seem to be familiar with the topic of genetic engineering; more understanding was required.

Common mistakes candidates made in Question 6

(a) The examiner was expecting a clear definition of 'genetic engineering'.

Many candidates could not give a definition of genetic engineering. A substantial number had an idea, but trying to explain this in their own words was not successful.

(b) The examiner was expecting candidates to state two examples of genetic engineering, and an outline of the benefits to humans of each example stated.

A large number of candidates gave an example of selective breeding as their response to this question. Obviously, selective breeding is not an example of genetic engineering. The other frequently stated example was some type of fertility treatment in humans. Genetic engineering is an area of the syllabus that needs to be reinforced.

Question 7

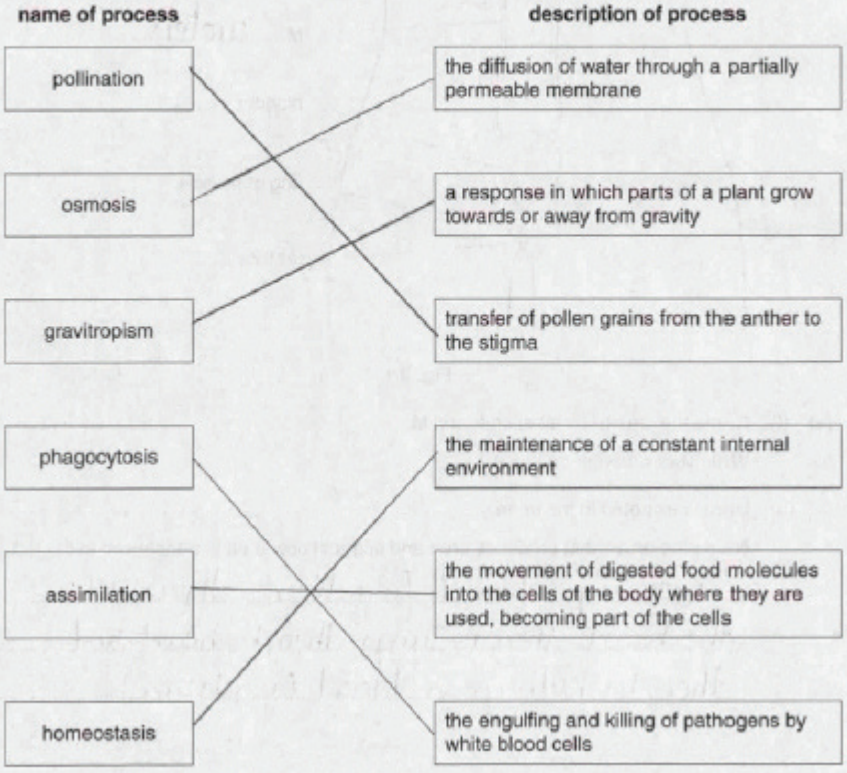
Example Candidate Response – Question 7, High	Examiner comments

7 The boxes on the left contain the names of some processes taking place in living organisms.

The boxes on the right contain descriptions of these processes.

Draw **one** straight line from each box on the left to a box on the right to link the name of the process with its description.

An example has been done for you.



[4]

[Total: 4]

All answers are correct.

Note that even though five lines have to be drawn, the maximum mark awarded is 4. This is because if a candidate makes four correct connections, the fifth one must also be correct.

Mark awarded for 7 = 4 out of 4

Total mark awarded = 4 out of 4

How the candidate could have improved the answer

The candidate gained full marks and there are no specific ways that the responses could have been improved.

Example Candidate Response – Question 7, Middle / Low	Examiner comments
7 The boxes on the left contain the names of some processes taking place in living organisms. The boxes on the right contain descriptions of these processes. Draw **one** straight line from each box on the left to a box on the right to link the name of the process with its description. An example has been done for you. **name of process** / **description of process** pollination → transfer of pollen grains from the anther to the stigma osmosis → the diffusion of water through a partially permeable membrane gravitropism → a response in which parts of a plant grow towards or away from gravity phagocytosis → the engulfing and killing of pathogens by white blood cells assimilation → the movement of digested food molecules into the cells of the body where they are used, becoming part of the cells homeostasis → the maintenance of a constant internal environment [4] **[Total: 4]**	The candidate does not know the meaning of homeostasis and assimilation, as these have been linked to the wrong definitions. **Mark awarded for 7 = 3 out of 4** **Total mark awarded = 3 out of 4**

Most candidates performed well on this question, even those who did not perform well overall. Therefore, there isn't really a 'low' response.

How the candidate could have improved the answer

The candidate could improve by learning the descriptions of homeostasis and assimilation.

Common mistakes candidates made in Question 7

The examiner was expecting 5 straight lines to be drawn between the boxes to link each process to its definition. Note that even though five lines have to be drawn, the maximum mark awarded is 4. This is because if a candidate makes four correct connections, the fifth one must also be correct.

This question was answered correctly by almost all candidates. The few who did not achieve full marks tended to link assimilation to the description of homeostasis and vice versa.

Question 8

Example Candidate Response – Question 8, High

8 Fig. 8.1 shows the structures that produce urine and excrete it from the body.

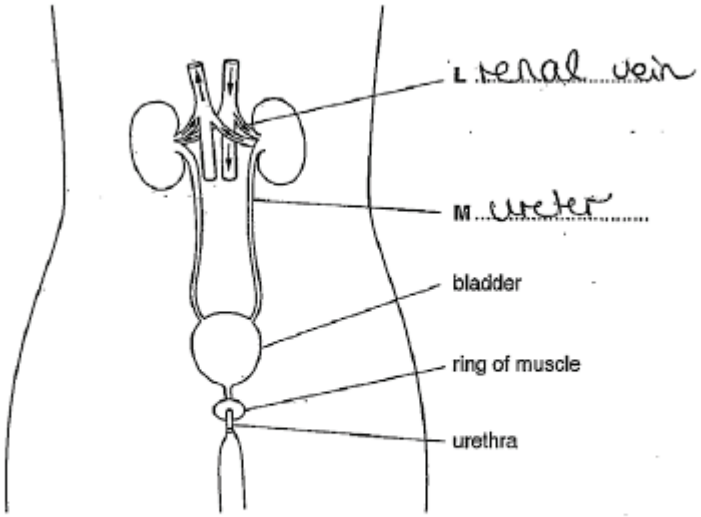


Fig. 8.1

(a) (i) Name the structures labelled **L** and **M**.

Write your answers on Fig. 8.1.

[2]

(ii) Urea is excreted in the urine.

Name the organ that produces urea and suggest how urea is transferred to the kidneys.

Urea is made in the liver

Urea is ~~transfer~~ transferred to the kidneys by in the blood [2]

Examiner comments

The candidate is awarded one mark for labelling the ureter (spelt correctly). The blood vessel has been identified as the renal vein instead of the renal artery, so is not credited with a mark.

Mark awarded for 8(a)(i) = 1 out of 2

Both statements are correct.

Mark awarded for 8(a)(ii) = 2 out of 2

Example Candidate Response – Question 8, High

(b) In an investigation, the volume of urine produced by a student each day is measured.

The results are shown in Table 8.1.

Table 8.1

day	volume of urine /cm^3 per day
1	1440
2	1510
3	1410
4	1445
5	910
6	1445
7	1500

Suggest **three** possible reasons for the lower volume of urine produced by the student on day 5.

1 Low water intake

2 High temperature

3 Large amount of sweat produced

[3]

(c) Outline **three** processes used in the treatment of sewage to make the water it contains safe for human use.

1 Filtering for removal of insoluble particles

2 Adding chlorine to kill bacteria and pathogens (chlorination)

3 Distillation

[3]

[Total: 10]

Examiner comments

The candidate is awarded three marks. The answer could be improved by stating if the high temperature referred to, applied to the ambient temperature or the student's body temperature. As both these alternatives would result in a lower urine output, the candidate was awarded the mark.

Mark awarded for 8(b) = 3 out of 3

The candidate has outlined the filtration process and chlorination, so achieves two marks. The third mark is not awarded as sewage is never distilled.

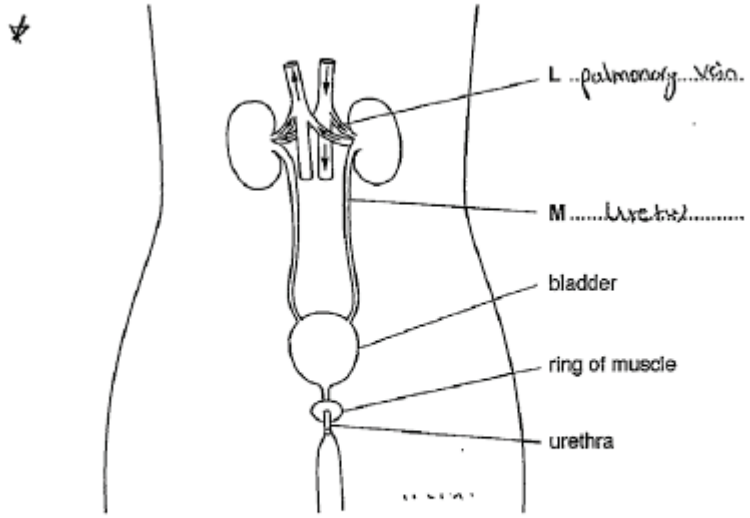
Mark awarded for 8(c) = 2 out of 3

Total mark awarded = 8 out of 10

How the candidate could have improved the answer

(a)(i) The candidate named the renal artery as the renal vein. There is an arrow on the diagram denoting the direction of blood flow.

(b) The answer could be improved by stating whether the 'high temperature' applied to the ambient temperature or the student's body temperature. Since both these alternatives would result in a lower urine output, the candidate was awarded the mark.

Example Candidate Response – Question 8, Middle	Examiner comments
8 Fig. 8.1 shows the structures that produce urine and excrete it from the body.  Fig. 8.1 (a) (i) Name the structures labelled L and M. Write your answers on Fig. 8.1. [2]	The candidate identifies the blood vessel as a vein, but does not state its correct name.The ureter has to be spelt accurately to be awarded the mark, and the word used seems to be a cross between ureter and uterus, so is not awarded a mark. **Mark awarded for 8(a)(i) = 0 out of 2**
(ii) Urea is excreted in the urine. Name the organ that produces urea and suggest how urea is transferred to the kidneys. urea is produced in the liver and the urea is transfers to the Kidney by the .....[2]	The candidate achieves a mark for knowing where urea is produced, but clearly does not know how urea travels from the liver to the kidney. **Mark awarded for 8(a)(ii) = 1 out of 2**

Example Candidate Response – Question 8, Middle

(b) In an investigation, the volume of urine produced by a student each day is measured.

The results are shown in Table 8.1.

Table 8.1

day	volume of urine /cm^3 per day
1	1440
2	1510
3	1410
4	1445
5	910
6	1445
7	1500

Suggest **three** possible reasons for the lower volume of urine produced by the student on day 5.

1 The Student ~~experienced~~ Patience exercise very hard on that day.

2 The Student got a problem in his Kidney on that day

3 The day was very hot. temperature in that

[3]

(c) Outline **three** processes used in the treatment of sewage to make the water it contains safe for human use.

1 bacteriacides are used to remove any bacteria found in water.

2 Chlorine is used for the chlorination of water which removes impurities and microbes to produce pure water.

3

[3]

[Total: 10]

Examiner comments

The first and last suggestions are acceptable and so two marks are awarded. The suggestion that the student had a kidney problem for one day only is not acceptable.

Mark awarded for 8(b) = 2 out of 3

The candidate is awarded one mark for chlorination (even though removal of impurities is assigned to the process as well as removal of microbes). There is no mark for addition of bacteriocides as it would be the same marking point as chlorination; moreover it is inaccurate, as general bacteriocides are not used in sewage treatment as they would probably be harmful.

Mark awarded for 8(c) = 1 out of 3

Total mark awarded = 4 out of 10

How the candidate could have improved the answer

(a)(i) The candidate needed to know that the blood vessel is the renal artery. The label for the ureter was not allowed as ureter is one of the words that has to be spelt correctly because there are other similar words. Here, it is not clear if the candidate meant to write ureter or uterus.

(a)(ii) The candidate needed to state that urea is transferred from the liver to the kidney in the blood stream.

(b) It is not plausible that the student concerned suffered from a kidney problem on one day only. The candidate needed to consider other possible reasons for the decrease, such as a lower than normal water intake.

(c) The candidate needed to learn how sewage is treated in more detail.

Example Candidate Response – Question 8, Low

8 Fig. 8.1 shows the structures that produce urine and excrete it from the body.

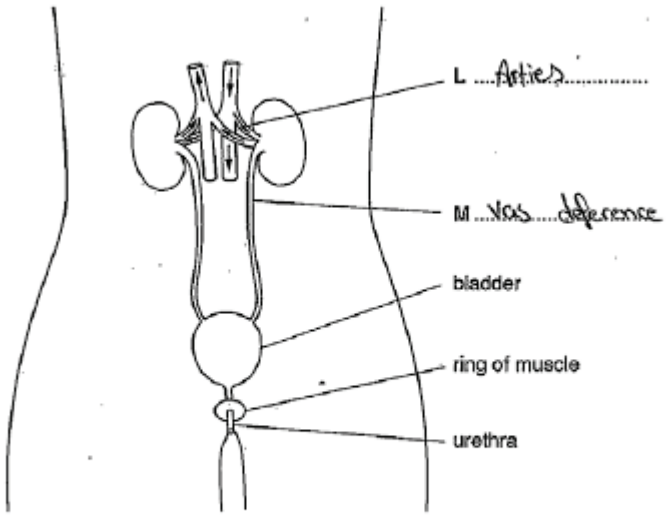


Fig. 8.1

(a) (i) Name the structures labelled L and M.

Write your answers on Fig. 8.1. [2]

(ii) Urea is excreted in the urine.

Name the organ that produces urea and suggest how urea is transferred to the kidneys.

liver, the bile (with ~~the~~) from liver will deliver the urea to the pancreas and the pancreatic juice deliver it to the kidney [2]

(c) Outline **three** processes used in the treatment of sewage to make the water it contains safe for human use.

1 put chlorine in water

2 pass it through pipes to filter it

3

[3]

[Total: 10]

Examiner comments

Neither label is correct so the candidate is not awarded any marks.

Mark awarded for 8(a)(i) = 0 out of 2

The candidate identifies the liver as being the organ producing urea, but does not know how the urea reaches the kidneys.

Mark awarded for 8(a)(ii) = 1 out of 2

Example Candidate Response – Question 8, Low	Examiner comments

(b) In an investigation, the volume of urine produced by a student each day is measured.

The results are shown in Table 8.1.

Table 8.1

day	volume of urine /cm^3 per day
1	1440
2	1510
3	1410
4	1445
5	910
6	1445
7	1500

Suggest **three** possible reasons for the lower volume of urine produced by the student on day 5.

1 Due to the low (a) amount of water in the body

2 Sulight

3

[3]

The candidate identifies that if the body has a reduced water content, the volume of urine produced will be smaller. However, this idea needs to be taken further and suggestions made about the causes of the lowered water content.

Mark awarded for 8(b) = 0 out of 3

(c) Outline **three** processes used in the treatment of sewage to make the water it contains safe for human use.

1 put chlorine in water

2 Pass it through pipes to filter it

3

[3]

[Total: 10]

The candidate is awarded two marks here, but both are responses are very weak. Each answer could be improved by further detail.

Mark awarded for 6(c) = 2 out of 3

Total mark awarded = 3 out of 10

How the candidate could have improved the answer

(a)(i) The candidate needed to know the names of structures in the renal system.

(a)(ii) The candidate could have improved their answer by knowing that urea is transported in the blood.

(b) The candidate should have thought about the reasons for reduced urine production more carefully. The answers given also needed contain more detail.

(c) The candidate needed to know more about sewage treatment and, as before, the answers given should have contained more detail.

Common mistakes candidates made in Question 8

(a)(i) The examiner was expecting two structures in the renal system to be named.

The names of structures in the renal system were not well known.

(c) The examiner was expecting three processes in sewage treatment.

Many candidates knew relatively little about sewage treatment. Filtration and chlorination appeared fairly frequently, but often no third process was outlined. Candidates were asked to outline each process and this means that a brief description is required. Many candidates gave one-word answers.

Question 9

Example Candidate Response – Question 9, High	Examiner comments

9 (a) (i) Table 9.1 contains examples of components of a balanced diet and foods that contain a high proportion of the component.

Complete Table 9.1 by filling in the blank spaces.

Table 9.1

component of balanced diet	food containing a high proportion of the component
fat	olive oil
protein	meat
carbohydrat	pasta
fibre (roughage)	unpolished rice

[3]

Three marks are awarded for three correct answers.

Mark awarded for 9(a)(i) = 3 out of 3

(ii) Name **two** other components of a balanced diet that are not listed in Table 9.1.

vitamine c

calcium

iron

[2]

Examples of the dietary components are accepted, so the candidate is awarded two marks. The answer could be improved by stating the components as being vitamins and minerals.

Mark awarded for 9(a)(ii) = 2 out of 2

Example Candidate Response – Question 9, High	Examiner comments

(b) Fig. 9.1 shows a picture of food production on a modern farm.

Fig. 9.1

The use of modern technology has increased the amount of food produced.

State **two** examples of modern technology **and** explain how each has contributed to the amount of **plants** grown for food.

example	explanation of technology
watering by dropping droplets of water	small pipes in the a pipe over the crops that, water plants without alot of water and this the saves water and money
chemical fertiliser	substances containing potassium, nitrogen, phosphorus that increase crop yield and size. Make soil more fertile

[4]

Two marks are awarded for the example of fertiliser and its explanation. The first answer is awarded only one mark as there is no explanation of how this method of watering will increase crop yields.

Mark awarded for 9(b) = 3 out of 4

(c) On modern farms crop plants can be grown as large-scale monocultures.

Suggest **two** negative impacts on an ecosystem for this method of food production.

1 animals habitats which was living there will not find place. Food chains and webs will be distructed

2 animals they could die as lack of food and for the effect of pestsides on them

[2]

[Total: 11]

The candidate is awarded two marks as both suggestions are correct.

Mark awarded for 9(c) = 2 out of 2

Total mark awarded = 10 out of 11

How the candidate could have improved the answer

(a)(i) The answer was awarded full marks but the answer could have been improved by spelling carbohydrate accurately.

(a)(ii) Although full marks were awarded, it would be preferable to state ‘minerals’ as a group rather than give two examples of minerals.

(b) The candidate could have improved their answer by giving an explanation for why watering a crop in the manner stated would increase the yield.

Example Candidate Response – Question 9, Middle

9 (a) (i) Table 9.1 contains examples of components of a balanced diet and foods that contain a high proportion of the component.

Complete Table 9.1 by filling in the blank spaces.

Table 9.1

component of balanced diet	food containing a high proportion of the component
fat	olive oil
Protein	meat
Carbohydrates ~~Starch~~	pasta
fibre (roughage)	Carrot

[3]

(ii) Name **two** other components of a balanced diet that are not listed in Table 9.1.

~~Vitamin~~ Water

Minerals [2]

(b) Fig. 9.1 shows a picture of food production on a modern farm.

Fig. 9.1

The use of modern technology has increased the amount of food produced.

State **two** examples of modern technology **and** explain how each has contributed to the amount of **plants** grown for food.

example	explanation of technology
Fertilisers	It increased the amount of ~~food~~ grown food production.
herbicides	~~It is sprayed on the~~ Herbicides are poured over the farm which increase the food production and kill insects.

[4]

Examiner comments

All three answers are correct.

Mark awarded for 9(a)(i) = 3 out of 3

Two correct answers are stated.

Mark awarded for 9(a)(ii) = 2 out of 2

Both of the examples listed are correct, so the candidate is awarded two marks. In both cases, the explanations are insufficient as the candidate does not say how they contribute to the amount of food produced. Also, the candidate incorrectly states that herbicides kill insects.

Mark awarded for 9(b) = 2 out of 4

Example Candidate Response – Question 9, Middle	Examiner comments
(c) On modern farms crop plants can be grown as large-scale monocultures. Suggest **two** negative impacts on an ecosystem for this method of food production. 1 ~~It is very hard to control a large scale farms~~ Crop plants crop plants on large area dont grow well. 2 ~~if the~~ the ~~plant~~ may get harmed by insects and other animals. [2] **[Total: 11]**	No marks are awarded as the candidate is not addressing the question asked. **Mark awarded for 9(c) = 0 out of 2** **Total mark awarded = 7 out of 11**

How the candidate could have improved the answer

(b) The candidate could have improved their answer by giving explanations of how the two examples stated contribute towards increased yields.

(c) The candidate could have improved their response by reading the question more carefully and answering the question asked. The candidate has not suggested how the wider ecosystem would be affected by a monoculture.

Example Candidate Response – Question 9, Low

9 (a) (i) Table 9.1 contains examples of components of a balanced diet and foods that contain a high proportion of the component.

Complete Table 9.1 by filling in the blank spaces.

Table 9.1

component of balanced diet	food containing a high proportion of the component
fat	olive oil
protien	meat
carbohydrate	pasta
fibre (roughage)	fruits

[3]

(ii) Name **two** other components of a balanced diet that are not listed in Table 9.1.

*calcium and *vitamins

[2]

(b) Fig. 9.1 shows a picture of food production on a modern farm.

Fig. 9.1

The use of modern technology has increased the amount of food produced.

State **two examples** of modern technology **and** explain how each has contributed to the amount of **plants** grown for food.

example	explanation of technology
Tcuck machine	It throws seeds and fertilizers in the whole farm

[4]

Examiner comments

Three marks are awarded for three correct answers.

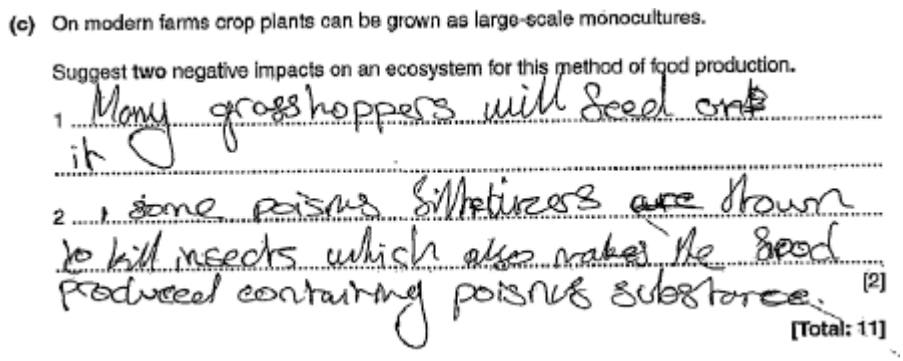
Mark awarded for 9(a)(i) = 3 out of 3

Vitamins is correct and calcium is accepted as an example of the dietary component minerals.

Mark awarded for 9(a)(ii) = 2 out of 2

The candidate is awarded one mark for the example, but no mark for the explanation as it does not state how machinery contributes to an increased crop yield. The candidate does not attempt a second response.

Mark awarded for 9(b) = 1 out of 4

Example Candidate Response – Question 9, Low	Examiner comments
	The responses do not address the question, so no marks are awarded. **Mark awarded for 9(c) = 0 out of 2** **Total mark awarded = 6 out of 11**

How the candidate could have improved the answer

(a)(i) The candidate was awarded full marks but could have improved their answer by spelling 'protein' correctly.

(a)(ii) The candidate was awarded full marks but could have improved their answer by giving the group name 'minerals' rather than an example of a mineral.

(b) The candidate could have improved their answer by providing a second example, and better explaining how machinery can improve crop yields.

(c) The candidate did not answer the question asked. They needed to suggest how monocultures can impact the wider ecosystem.

Common mistakes candidates made in Question 9

(b) The examiner was expecting two examples of modern farming technology to be stated, with a brief explanation of how each has contributed to the increase in the amount of plants grown for food.

Many candidates did not explain how the example they had chosen would improve the crop yield. Also, many candidates did not appear to appreciate the difference between fertilisers, insecticides and herbicides.

(c) The examiner was expecting a suggestion of two negative impacts of monocultures on the surrounding ecosystem.

The majority of candidates did not answer the question fully. Some did not attempt an answer at all.

Cambridge Assessment International Education
The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA, United Kingdom
t: +44 1223 553554
e: info@cambridgeinternational.org www.cambridgeinternational.org

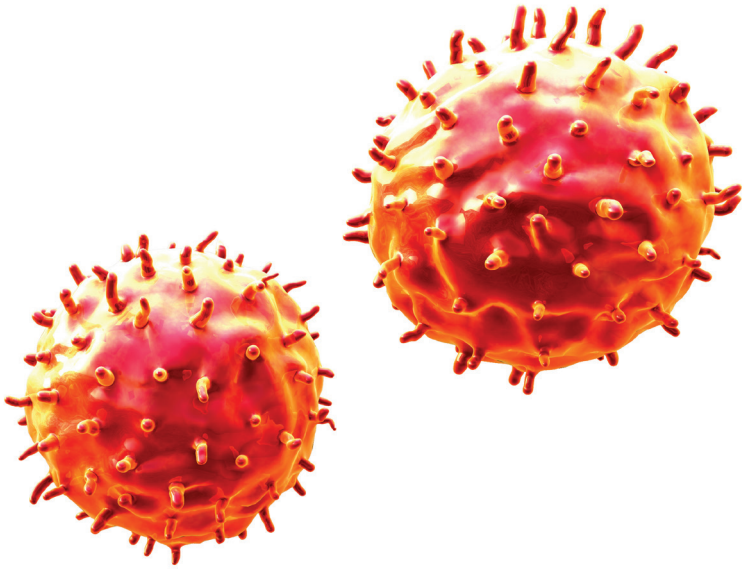
Cambridge Assessment International Education

Example Candidate Responses

Paper 4

Cambridge IGCSE™

Biology 0610



Version 2.0

Cambridge Pathway

In order to help us develop the highest quality resources, we are undertaking a continuous programme of review; not only to measure the success of our resources but also to highlight areas for improvement and to identify new development needs.

We invite you to complete our survey by visiting the website below. Your comments on the quality and relevance of our resources are very important to us.

www.surveymonkey.co.uk/r/GL6ZNJB

Would you like to become a Cambridge International consultant and help us develop support materials?

Please follow the link below to register your interest.

www.cambridgeinternational.org/cambridge-for/teachers/teacherconsultants/

Contents

Introduction

The main aim of this booklet is to exemplify standards for those teaching Cambridge IGCSE Biology (0610), and to show how different levels of candidates' performance (high, middle and low) 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 High, Middle and Low responses. Each response is accompanied by a brief commentary explaining the strengths and weaknesses of the answers.

For each question, the response is annotated with clear explanation of where and why marks were awarded or omitted. This is followed by examiner comments on how the answer could have been improved. In this way, it is possible for you to understand what candidates have done to gain their marks and what they could do to improve their answers. At the end of the booklet, there is a list of common mistakes candidates made in their answers for each question.

This document provides illustrative examples of candidate work with examiner commentary. These help teachers to assess the standard required to achieve marks beyond the guidance of the mark scheme. Therefore, in some circumstances, such as where exact answers are required, there will not be much comment.

The questions, mark schemes and pre-release material used here are available to download as a zip file from the School Support Hub as the Example Candidate Responses Files. The papers used in this booklet are:

Question Paper 4, June 2016	
Question paper	June 2016 Question Paper 41 (0610_s16_qp_41.pdf)
Mark scheme	June 2016 Paper 41 Mark Scheme (0610_s16_ms_41.pdf)

Other past papers, Examiner Reports and other teacher support materials are available on the School Support Hub www.cambridgeinternational.org/support

How to use this booklet

This booklet goes through the paper one question at a time, showing you the high-, middle- and low-level response for each question. The candidate answers are set in a table. In the left-hand column are the candidate answers, and in the right-hand column are the examiner comments.

Example Candidate Response – Question 1, High	Examiner comments

function	letter on Fig. 1.1	name
structure that separates oxygenated and	F	septum
	D	~~also~~ ~~atrioventri~~ atrioventricular valve
	A	aorta
	H, B	vena cava, pulmonary artery
	K	semilunar valve
chamber of the heart that contains oxygenated blood	C, E	left atrium, left ventricle
chamber of the heart that contains deoxygenated blood	J, G	right atrium, right ventricle.

The candidate completed the table correctly, giving the correct letter for each function and naming each structure correctly.

Answers are by real candidates in exam conditions. These show you the types of answers for each level.

Discuss and analyse the answers with your learners in the classroom to improve their skills.

Examiner comments are alongside the answers. These explain where and why marks were awarded. This helps you to interpret the standard of Cambridge exams so you can help your learners to refine their exam technique.

How the candidate could have improved the answer

(b) (ii) To improve further, the candidate could have explained that the release of adrenaline during the race would stimulate an increase in pulse rate.

This section explains how the candidate could have improved each answer. This helps you to interpret the standard of Cambridge exams and helps your learners to refine their exam technique.

Common mistakes candidates made in this question

(b) (i) *This part required candidates to **use** data to **describe**. The examiner was expecting an extended prose response, in which candidates state the changes that occurred in the pulse rate over time. They needed to quote data and units, e.g. pulse rate in bpm, from Fig. 2.1.*

Many candidates did not use the data from the graph as instructed, so did not gain full credit for otherwise valid descriptions. Other candidates did use data from the graph, but sometimes they did not use the full unit (beats per minute or bpm).

Often candidates lose marks because they misread or misinterpret the questions.

Lists the common mistakes candidates made in answering each question. This will help your learners to avoid these mistakes and give them the best chance of achieving the available marks.

Assessment at a glance

All candidates take three papers. Candidates who have studied the Core subject content, or who are expected to achieve a grade D or below, should be entered for Paper 1, Paper 3 and either Paper 5 or Paper 6. These candidates will be eligible for grades C to G. Candidates who have studied the Extended subject content (Core and Supplement), and who are expected to achieve a grade C or above, should be entered for Paper 2, Paper 4 and either Paper 5 or Paper 6. These candidates will be eligible for grades A* to G.

Core candidates take:

Paper 1 45 minutes
Multiple Choice 30%
40 marks
40 four-choice multiple-choice questions
Questions will be based on the Core subject content
Assessing grades C–G
Externally assessed

Extended candidates take:

Paper 2 45 minutes
Multiple Choice 30%
40 marks
40 four-choice multiple-choice questions
Questions will be based on the Extended subject content (Core and Supplement)
Assessing grades A*–G
Externally assessed

and Core candidates take:

Paper 3 1 hour 15 minutes
Theory 50%
80 marks
Short-answer and structured questions
Questions will be based on the Core subject content
Assessing grades C–G
Externally assessed

and Extended candidates take:

Paper 4 1 hour 15 minutes
Theory 50%
80 marks
Short-answer and structured questions
Questions will be based on the Extended subject content (Core and Supplement)
Assessing grades A*–G
Externally assessed

All candidates take either:

Paper 5 1 hour 15 minutes
Practical Test 20%
40 marks
Questions will be based on the experimental skills in Section 4
Assessing grades A*–G
Externally assessed

or:

Paper 6 1 hour
Alternative to Practical 20%
40 marks
Questions will be based on the experimental skills in Section 4
Assessing grades A*–G
Externally assessed

Teachers are reminded that the latest syllabus is available on our public website at www.cambridgeinternational.org and the School Support Hub at www.cambridgeinternational.org/support

Paper 4 – Theory (Extended)

Question 1

Example Candidate Response – Question 1, High	Examiner comments

1 (a) Fig. 1.1 shows the human heart and the main blood vessels. The functions of the parts of the heart and some of the blood vessels are given in Table 1.1.

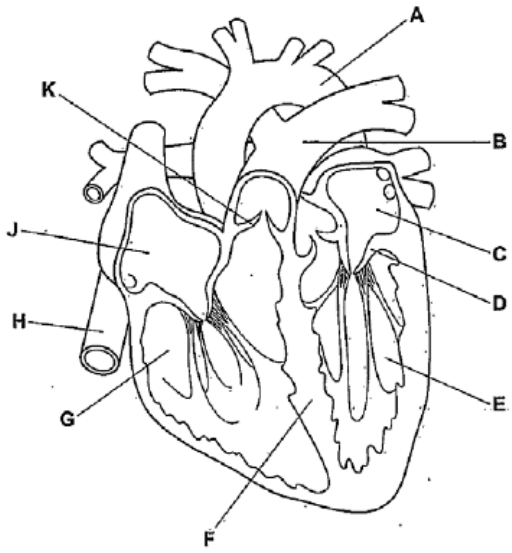


Fig. 1.1

Complete Table 1.1.

One row has been done for you.

Table 1.1

function	letter on Fig. 1.1	name
structure that separates oxygenated and deoxygenated blood	F	septum
structure that prevents backflow of blood from ventricle to atrium	D	~~atrio~~ ~~atrioventri~~ atrioventricular valve
blood vessel that carries oxygenated blood	A	aorta
blood vessel that carries deoxygenated blood	H, B	vena cava, pulmonary artery
structure that prevents backflow of blood from pulmonary artery to right ventricle	K	semilunar valve
chamber of the heart that contains oxygenated blood	C, E	left atrium, left ventricle
chamber of the heart that contains deoxygenated blood	J, G	right atrium, right ventricle.

[6]

The candidate completed the table correctly, giving the correct letter for each function and naming each structure correctly.

They have given two letters and corresponding names for three of the functions. This is unnecessary, and could cause confusion. Only one letter and name is required for each function.

Mark awarded for 1(a) = 6 out of 6

Example Candidate Response – Question 1, High	Examiner comments

(b) A group of students used a heart monitor to record the pulse rate of an athlete during a 5000 metre race. The recordings started just before the race began and ended just after it had finished, as shown in Fig. 1.2.

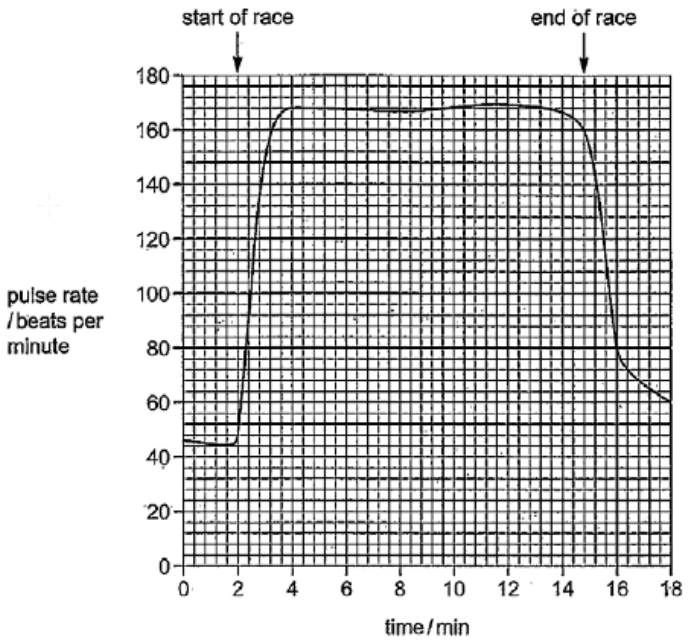


Fig. 1.2

(i) Use data from Fig. 1.2 to describe the effect of exercise on the pulse rate of the athlete.

Pulse rate steeply increases from 44 ~~to~~ beats per minute to 168 beats per minute in the first 2 minutes of the race. It remains constant at 168 beats per minute for the next 10 minutes ~~before gradu a~~ till the end of the race. After race is over, it begins to decrease. [3]

The candidate provided a correct explanation. The use of data from the graph is required for full marks. The description of the rate after the race was finished is not required.

Mark awarded for 1(b)(i) = 3 out of 3

Example Candidate Response – Question 1, High	Examiner comments
(ii) Explain the change in pulse rate between 2 minutes and 3 minutes after the recordings started. During exercise, muscles need more energy for contraction so aerobic respiration increases. Pulse rate increases to increase blood flow to the muscles to supply them with oxygen fast enough for increased respiration, remove carbon dioxide that is being produced as a result of respiration and prevent anaerobic respiration and the build up of lactic acid. CO_2 lowers blood pH which is detected by receptors in the brain and it increases frequency of impulses to the heart [4]. [Total: 13]	The candidate has covered all the major points and gains full marks. **Mark awarded for 1(b)(ii) = 4 out of 4** **Total mark awarded = 13 out of 13**

How the candidate could have improved the answer

(a) The candidate gave two letters and structures for three of the functions, where only one letter and structure were required. The candidate has not made it explicitly clear which structure matches to which letter in these boxes. The examiner has given the candidate the benefit of the doubt here and assumed correct matching. In other cases, the examiner could take this to mean the candidate isn't sure of their answer.

(b) (i) The candidate also described what happens to the pulse rate after the race has finished. This was unnecessary as the question only asked for a description of changes to the pulse rate during exercise.

(b) (ii) To improve further, the candidate could have explained that the release of adrenaline during the race would stimulate an increase in pulse rate.

Example Candidate Response – Question 1, Middle

1 (a) Fig. 1.1 shows the human heart and the main blood vessels. The functions of the parts of the heart and some of the blood vessels are given in Table 1.1.

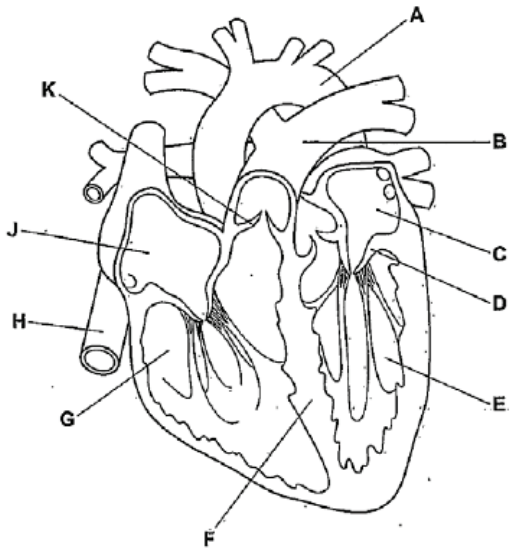


Fig. 1.1

Complete Table 1.1.

One row has been done for you.

Table 1.1

function	letter on Fig. 1.1	name
structure that separates oxygenated and deoxygenated blood	F	Septum
structure that prevents backflow of blood from ventricle to atrium	~~K~~ D	Atrioventicular valve
blood vessel that carries oxygenated blood	A	aorta
blood vessel that carries deoxygenated blood	~~J~~ H	Vena cava
structure that prevents backflow of blood from pulmonary artery to right ventricle	~~K~~ G	Semi-lunar valves
chamber of the heart that contains oxygenated blood	E ~~F~~ E	Left chamber
chamber of the heart that contains deoxygenated blood	G	Right chamber

2 1

[6]

Examiner comments

The candidate has given all the correct letters but not all of the structure names are correct.

1 For E and G, 'chamber' is not specific enough. 'Left ventricle' and 'right ventricle' is required for each respective mark. A mark is only awarded when **both** the letter and corresponding name are correct.

2 Notice that when the candidate has changed their mind, they have put a line through the answer they do **not** want to be marked. This makes it very clear to the examiner which answers they should be looking at.

Mark awarded for 1(a) = 4 out of 6

Example Candidate Response – Question 1, Middle

(b) A group of students used a heart monitor to record the pulse rate of an athlete during a 5000 metre race. The recordings started just before the race began and ended just after it had finished, as shown in Fig. 1.2.

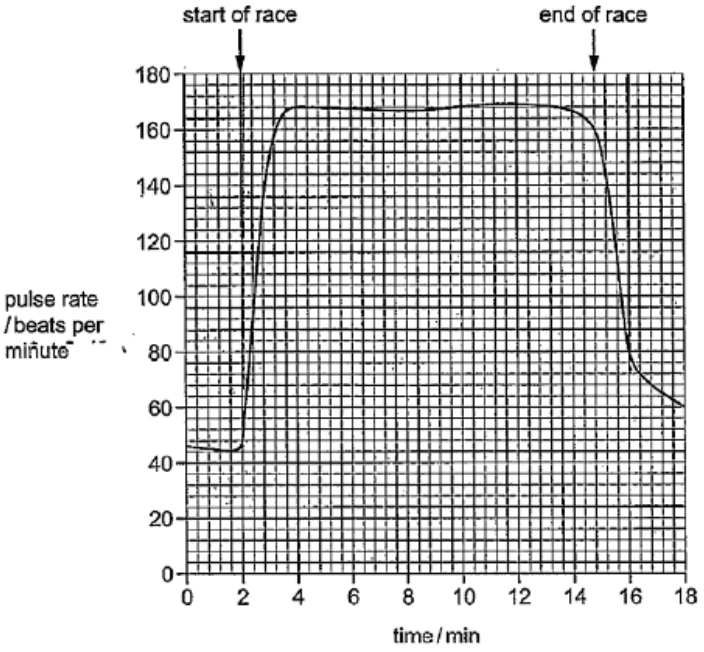


Fig. 1.2

(i) Use data from Fig. 1.2 to describe the effect of exercise on the pulse rate of the athlete.

When the athlete was at rest his pulse rate was about "44.5 pulse/minute." When the race started the pulse rate started ~~peaking at regular at an average of 20 pulse r~~ increasing until it peaked at about "168 pulse per minute."

[3]

Examiner comments

The candidate has provided a simple description, enough to gain one mark.

The mark is awarded for the description of the increase from 44.5 pulse/minute to 168 pulse/ minute.

The benefit of the doubt is given that 'pulse/minute' is equivalent to beats per minute. Candidates should be encouraged to use the correct terminology.

Mark awarded for 1(b)(i) = 1 out of 3

Example Candidate Response – Question 1, Middle	Examiner comments
(ii) Explain the change in pulse rate between 2 minutes and 3 minutes after the recordings started. The athlete's breathing rate was increasing as he was applying effort and so needed more blood to be ~~pa~~ supplied to his body so that more oxygen could be used ~~for~~ for respiration to provide him with sufficient energy to ~~re~~ run during the race. The ~~heart~~ rate ~~pumped~~ at which the oxygen was used up was increasing and so to compensate the heart was beating faster. [4] [Total: 13]	The candidate has provided a partial explanation; they explain the increased need for oxygen for respiration, which is the only part that is creditworthy. Only 1 mark is awarded. There are some inaccuracies in the response with reference to more blood supplied to the body. **Mark awarded for part (b) (ii) = 1 out of 4** **Total mark awarded = 6 out of 13**

How the candidate could have improved the answer

(a) To be awarded the last two marks, the candidate should have been more specific when naming the two structures. They should have stated that E was the left ventricle (not the left chamber) and G the right ventricle (not the right chamber).

(b) (i) The candidate needed to describe the pulse rate during the race, not just at the start. The candidate could also have improved their answer by first describing the general trend and then describing what is happening in more detail, quoting the pulse rate with the units and the time of the changes.

(b) (ii) The candidate could have provided a more complete explanation by referring to the increase in carbon dioxide, which needs to be removed by the lungs, and the effect of carbon dioxide on the acidity of the blood. The candidate could have also referred to the increase in muscle contraction, and energy requirements of the muscles as well as the effect of adrenaline.

Example Candidate Response – Question 1, Low

Examiner comments

1 (a) Fig. 1.1 shows the human heart and the main blood vessels. The functions of the parts of the heart and some of the blood vessels are given in Table 1.1.

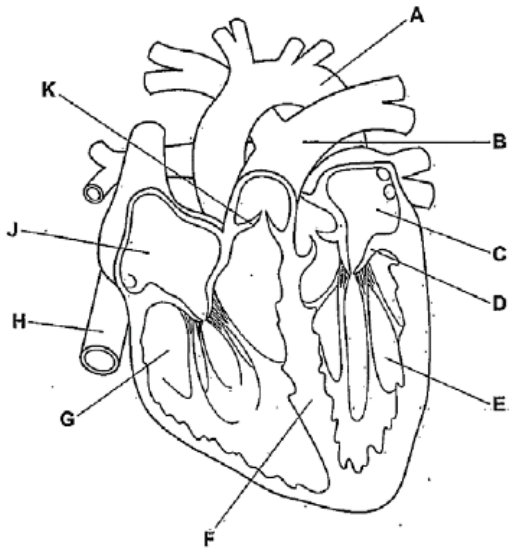


Fig. 1.1

Complete Table 1.1.

One row has been done for you.

Table 1.1

function	letter on Fig. 1.1	name
structure that separates oxygenated and deoxygenated blood	F	Septum
structure that prevents backflow of blood from ventricle to atrium	C	Tricuspid valve
blood vessel that carries oxygenated blood	A	aorta
blood vessel that carries deoxygenated blood	H	vena cava
structure that prevents backflow of blood from pulmonary artery to right ventricle	K	Bicuspid valve
chamber of the heart that contains oxygenated blood	B	left Atrium
chamber of the heart that contains deoxygenated blood	J	Right Atrium

[6]

The candidate does not know the names of the valves of the heart in sufficient detail. Structure D (atrioventricular valve) and K (semilunar valve) are incorrectly named.

The left atrium is incorrectly matched with the letter B, so no mark is awarded here since both the letter and the name have to be correct to gain the mark.

Mark awarded for 1(a) = 3 out of 6

Example Candidate Response – Question 1, Low

(b) A group of students used a heart monitor to record the pulse rate of an athlete during a 5000 metre race. The recordings started just before the race began and ended just after it had finished, as shown in Fig. 1.2.

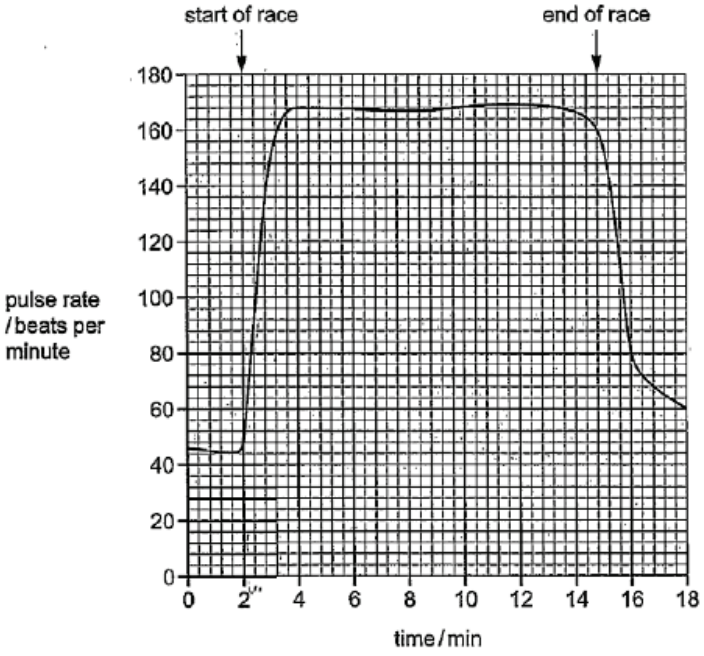


Fig. 1.2

(i) Use data from Fig. 1.2 to describe the effect of exercise on the pulse rate of the athlete.

As you ~~can~~ can See on the graph the studen ~~kept on ran~~ had a fast speed for about 50 seconds and than he got slow ~~at~~ & slow and as he went on he kept on reducing hals speed.

[3]

The candidate has incorrectly interpreted the graph and refers to the runners speed rather than the pulse rate.

Mark awarded for 1(b)(i) = 0 out of 3

Example Candidate Response – Question 1, Low	Examiner comments
(ii) Explain the change in pulse rate between 2 minutes and 3 minutes after the recordings started. The Pulse rate on 3 minutes was high that than it was at 2 minutes this is because he ran and as he ran he took deef breaths and that's the reason to why hes pulse rate got high. [4] [Total: 13]	The candidate has provided a very simple description, which does not explain *why* there has been an increase in pulse rate. **Mark awarded for 1(b)(ii) = 0 out of 4** **Total mark awarded = 3 out of 13**

How the candidate could have improved the answer

(a) The candidate needed to know the names of the different structures of the heart and their function. The candidate appeared to lack the required knowledge.

(b) (i) The candidate misunderstood what the graph was showing. When questions ask for a description of data from a graph, candidates should refer to the data using the heading and units given on the axes to help them. It is good practise to first describe the general trend and then to describe what is happening in more detail, quoting the pulse rate with the units and the time of the changes.

(b) (ii) The candidate needed to explain *why* the pulse rate changed. They needed to relate the increase in pulse rate to the increase in muscle contraction, demand for oxygen, respiration and the increase in production of carbon dioxide that needs to be removed from the body.

Common mistakes candidates made in Question 1

(a) *This part required candidates to **complete** Table 1.1. The examiner was expecting candidates to fill in the gaps in the table. Candidates needed to look carefully at the contents of the table to understand what they needed to do. An example is given to demonstrate what is expected, i.e., only one named heart structure from Fig. 1.1 for each function, and its corresponding letter.*

Some candidates named incorrect valves for the prevention of backflow from ventricle to atrium, and prevention of backflow from pulmonary artery to right ventricle, and some were unsure about the blood vessel that carries deoxygenated blood.

A few candidates named the correct structure for a given function but identified it with the incorrect letter and vice versa.

A few candidates got the right side and the left side of the heart confused.

Some candidates provided two letters and names for one function.

(b) (i) *This part required candidates to **use** data to **describe**. The examiner was expecting an extended prose response, in which candidates stated the changes that occurred in the pulse rate over time. They needed to quote data and units, e.g. pulse rate in b/p/m, from Fig. 2.1.*

Many candidates did not use the data from the graph as instructed, so did not gain full credit for otherwise valid descriptions. Other candidates did use data from the graph, but sometimes they did not use the full unit (beats per minute or bpm).

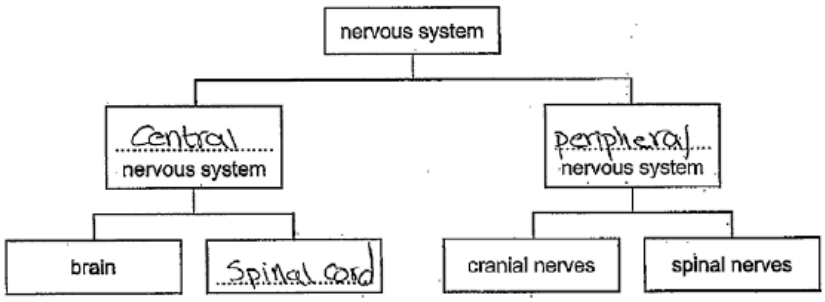
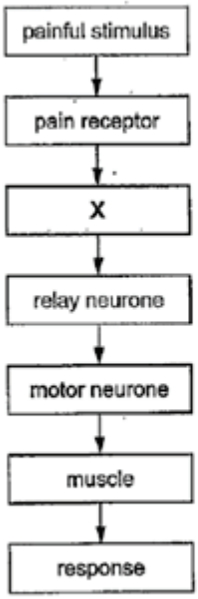
(b) (ii) *The candidates were expected to give an answer that **explains**. The examiner will be expecting an extended prose response, in which candidates use their scientific knowledge to state **why** the pulse rate increases between 2 and 3 minutes. It is not enough to state that it increases, they need to give reasons for the increase.*

Some candidates were confused between the instruction to ‘describe’ and ‘explain’, giving descriptions rather than the required explanation.

Some candidates attempted to explain the whole graph rather than the part between 2 and 3 minutes stated in the question.

Some responses were vague, referring to the body working harder rather than an increase in muscle contraction.

Question 2

Example Candidate Response – Question 2, High	Examiner comments
2 The nervous system coordinates the responses of animals to changes in their environment. (a) Fig. 2.1 shows the arrangement of the nervous system in a mammal. Complete Fig. 2.1 by writing the names of the missing parts of the mammalian nervous system in the boxes.  Fig. 2.1 [3] (b) Fig. 2.2 is a flow chart that shows how an involuntary action is controlled.  Fig. 2.2 (i) State the structure found at X. Sensory neurone [1]	The candidate correctly completes the figure using the required answers. **Mark awarded for 2(a) = 3 out of 3** The candidate gives the only valid response. **Mark awarded for 2(b)(i) = 1 out of 1**

Example Candidate Response – Question 2, High

(ii) State the type of involuntary action shown by the flow chart.

reflex action [1]

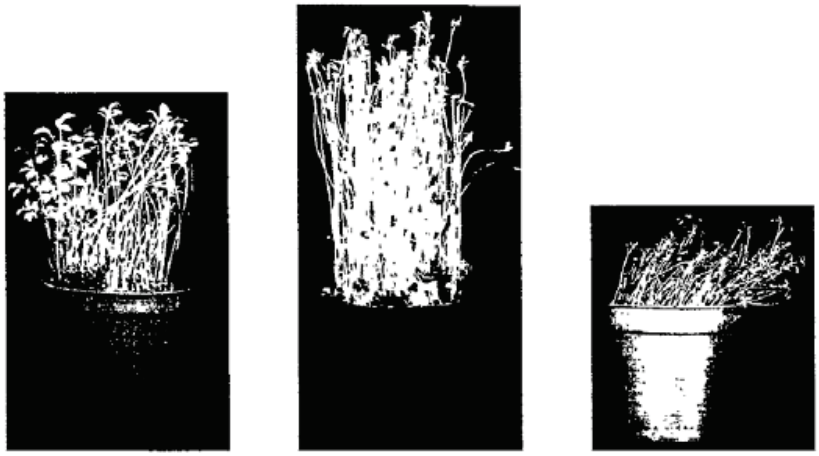
(iii) State **two** ways in which a voluntary action differs from an involuntary action.

1 Voluntary action happens under conscious control involving the brain in its initiation

2 Involuntary actions are faster than voluntary actions

[2]

(c) Fig. 2.3 shows three pots of seedlings that have been kept in different conditions.



pot **P** pot **Q** pot **R**

Fig. 2.3

(i) State the conditions in which pots **P** and **Q** were kept.

P ~~light~~ plenty of light upwards

Q dark conditions

[1]

(ii) State the name of the growth response shown by the seedlings in pot **R**.

positive phototropism [2]

Examiner comments

'Reflex' or 'simple reflex' is sufficient for the mark.

Mark awarded for 2(b)(ii) = 1 out of 1

The candidate makes two valid statements.

Mark awarded for 2(b)(iii) = 2 out of 2

An answer of 'light' for pot P and 'dark' for pot Q is sufficient for the mark. Alternatively, candidates could gain the mark if they state that pot P was given magnesium and pot Q was not.

Mark awarded for part (c) (i) = 1 out of 1

The candidate gains full marks as they mention 'positive' as well as '(photo)tropism'.

Example Candidate Response – Question 2, High	Examiner comments
(iii) Explain the advantage to the seedlings of this growth response. Positive phototropism helps the shoots to move and grow to the direction of light. This helps the cells to be exposed to more light which is trapped by Chloraplay. in Chloroplast, which is essential for photosynthesis. This leads to higher rate of photosynthesis and thus more growth [2] (iv) Auxins control the growth responses of seedlings. due to the formation of more glucose. Explain how auxins control the growth response of the seedlings in pot R. * ~~As light falls one si~~ * One side of the shoot is exposed to light * Auxin from the tip diffuse more to the shaded side than the one exposed to light. * They accumulate on the shaded side causing the cells to absorb more water than the other side and became more elongated * The uneven growth causes the shoot to bend towards the direction of the light [4] [Total: 16]	**Mark awarded for 2(c)(ii) = 2 out of 2** The candidate gains marks for stating the plant gains more light and so more photosynthesis occurs (1 mark); and then stating that this leads to more growth (1 mark). **Mark awarded for (c)(iii) = 2 out of 2** The candidate's response is clear and organised, making it easier for the examiner to spot all the valid points. **Mark awarded for (c)(iv) = 4 out of 4** **Total mark awarded = 16 out of 16**

How the candidate could have improved the answer

The candidate did very well, scoring full marks for each question.

(c) (iii) The candidate gained full marks. However, they could have improved the detail of their response by being more precise and referring to the plant absorbing more light **energy**.

(c) (iv) The candidate gained full marks but they could also have stated where auxins are made.

Example Candidate Response – Question 2, Middle

2 The nervous system coordinates the responses of animals to changes in their environment.

(a) Fig. 2.1 shows the arrangement of the nervous system in a mammal.

Complete Fig. 2.1 by writing the names of the missing parts of the mammalian nervous system in the boxes.

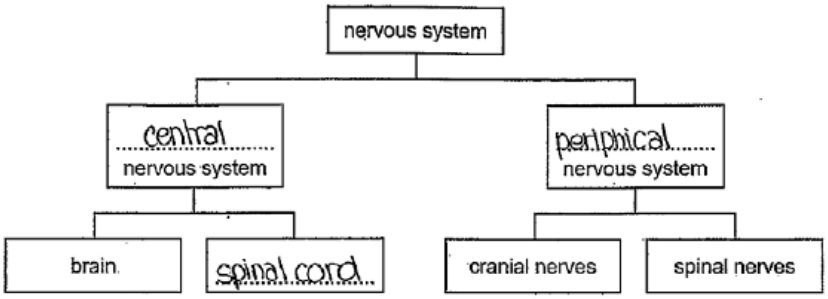


Fig. 2.1

[3]

(b) Fig. 2.2 is a flow chart that shows how an involuntary action is controlled.

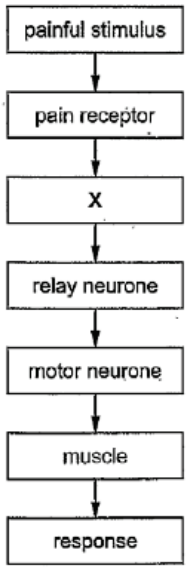


Fig. 2.2

(i) State the structure found at **X**.

coordinator ..... [1]

(ii) State the type of involuntary action shown by the flow chart.

reflex arc ..... [1]

Examiner comments

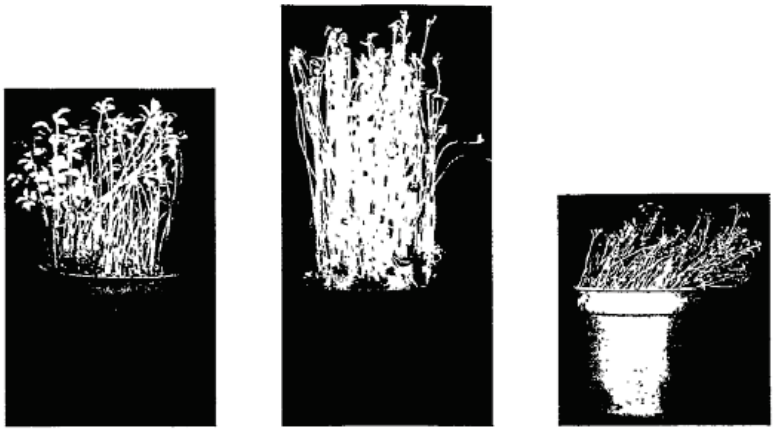
The candidate gains full credit despite the misspelling of peripheral.

Mark awarded for 2(a) = 3 out of 3

The correct answer is sensory neurone.

Mark awarded for 2(b)(i) = 0 out of 1

Reflex arc is credited. The *action* was asked for, so the response 'reflex' is sufficient to be awarded the mark.

Example Candidate Response – Question 2, Middle	Examiner comments
	Mark awarded for 2(b)(ii) = 1 out of 1
(iii) State **two** ways in which a voluntary action differs from an involuntary action. 1 It can be controlled - you can choose to do it which you can't in involuntary action 2 You think about voluntary actions but you don't think about involuntary action, it just happens [2]	Both of the candidate's statements give the same difference just worded differently, so their response is only awarded one mark. Two distinct differences are required for both marks. **Mark awarded for 2(b)(iii) = 1 out of 2**
(c) Fig. 2.3 shows three pots of seedlings that have been kept in different conditions.  pot **P** pot **Q** pot **R** **Fig. 2.3**	
(i) State the conditions in which pots **P** and **Q** were kept. P Dark Q Light [1]	The candidate has got the conditions reversed so no mark is awarded. **Mark awarded for 2(c)(i) = 0 out of 1**
(ii) State the name of the growth response shown by the seedlings in pot **R**. phototropism [2]	The candidate needed to state that the phototropism was 'positive' in order to be awarded full marks. **Mark awarded for 2(c)(ii) = 1 out of 2**

Example Candidate Response – Question 2, Middle	Examiner comments
(iii) Explain the advantage to the seedlings of this growth response. It grows towards the light so the whole plant has an access to light (1) and grow better. (2) It's also good for the plant because it gets all the nutrients needed from the sun. [2]	The candidate's answer is not specific enough in places. The examiner gives the benefit of the doubt where possible, for examp (1) the 'whole plant' having 'access to light' is taken to mean the plant gets 'more light'. However, in other cases, the answer is too vague to be earn credit. For instance, (2) 'grow better' is **not** taken to mean 'more growth'. The candidate also does not relate this to photosynthesis. **Mark awarded for 2(c)(iii) = 2 out of 2**
(iv) Auxins control the growth responses of seedlings. Explain how auxins control the growth response of the seedlings in pot **R**. As you can see, the seedling in pot R are slightly bend towards the right side. This means that the light is coming from the right. This also means that the right side of the seedlings does recieve light but the left side does not. That's why a plant hormone, auxin, collects on the side of the seedling that is reached by light and weights it down so the ~~left side~~ seedling bends under it's weight (to the right) and the left side elongate and is now exposed to the light. [4] and can grow. [Total: 16]	The candidate does not make any valid points. **Mark awarded for (c)(iv) = 0 out of 4** **Total mark awarded = 8 out of 16**

How the candidate could have improved the answer

(a) The candidate could have improved their answer by spelling **peripheral** correctly. Key terms, such as peripheral, should always be spelt correctly; though here the candidate was given the benefit of the doubt.

(b) (i) The incorrect part of the reflex arc was given. The correct answer is sensory neurone.

(b) (ii) The action was asked for, so the response 'reflex' would have sufficed.

(b) (iii) The candidate could have improved their answer by providing a second difference. Their response contained two statements but they both related to the same difference, which was not enough to get full marks.

(c) (i) The candidate has got the conditions reversed. They need to read the questions more carefully.

(c) (ii) The answer could be improved by qualifying the phototropism as positive to get the second mark.

(c) (iii) To improve their response the candidate should have been more specific, for example, stating 'more growth' rather than 'grow better'. 'Grow better' isn't explicit as it's not clear what is meant by 'better'. They should also have related the growth to photosynthesis.

(c) (iv) The response contains a number of errors: the candidate has mistakenly stated that auxin collects on the light side; and they do not correctly explain the action of auxin, how it moves or the correct effect it has on the plant cells. They have not described where auxin is produced. Fixing these issues would improve the response.

Example Candidate Response, Question 2, Low

2 The nervous system coordinates the responses of animals to changes in their environment.

(a) Fig. 2.1 shows the arrangement of the nervous system in a mammal.

Complete Fig. 2.1 by writing the names of the missing parts of the mammalian nervous system in the boxes.

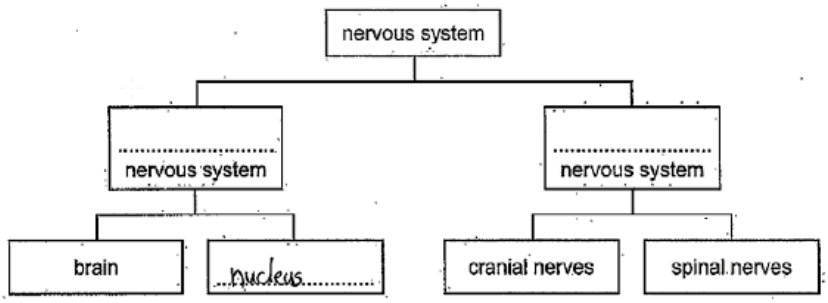


Fig. 2.1

[3]

(b) Fig. 2.2 is a flow chart that shows how an involuntary action is controlled.

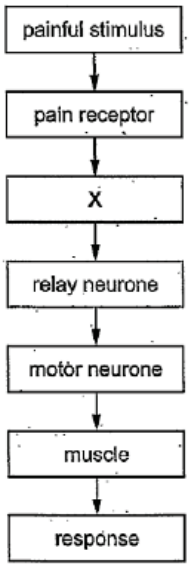


Fig. 2.2

(i) State the structure found at **X**.

Spinal cord. [1]

(ii) State the type of involuntary action shown by the flow chart.

Uncontrolled reaction. [1]

Examiner comments

No responses are given for the top two boxes and an incorrect response in the bottom box.

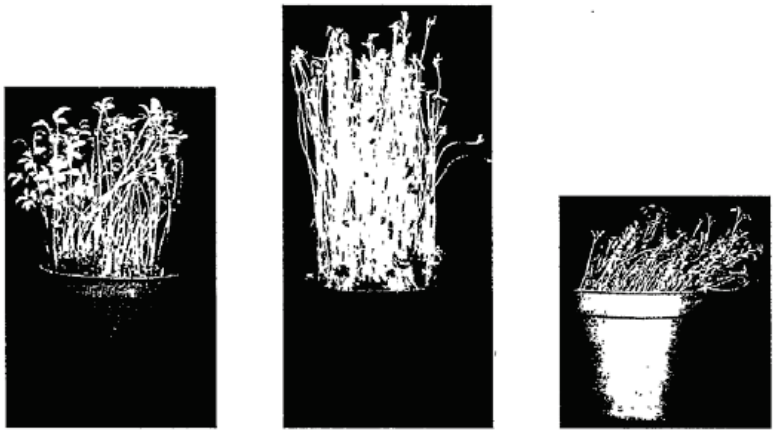
Mark awarded for 2(a) = 0 out of 3

The correct answer is sensory neurone.

Mark awarded for 2(b)(i) = 0 out of 1

The candidate has the right idea but should use the term ‘reflex’.

Mark awarded for 2(b)(ii) = 0 out of 1

Example Candidate Response, Question 2, Low	Examiner comments
(iii) State **two** ways in which a voluntary action differs from an involuntary action. 1 It comes from the spinal cord not for the brain for faster reaction. 2 you donot control the reaction. [2]	The candidate describes how an involuntary action differs from a voluntary action rather than the other way round, and so does not answer the question. **Mark awarded for 2(b)(iii) = 0 out of 2**
(c) Fig. 2.3 shows three pots of seedlings that have been kept in different conditions.  pot **P** pot **Q** pot **R** **Fig. 2.3**	Although 'sunlight' for pot P is correct, 'dim light' is not equivalent to 'dark conditions' for pot Q; both parts of the answer need to be correct to be awarded the mark. **Mark awarded for 2(c)(i) = 0 out of 1**
(i) State the conditions in which pots **P** and **Q** were kept. P Sunlight Q Dimlight and too much water [1]	
(ii) State the name of the growth response shown by the seedlings in pot **R**. It's cells were not exposed to light from same place. [2]	The required response is the specific name of the growth response. No marks are awarded for the candidate's answer, which explains the *cause* of the growth response. **Mark awarded for 2(c)(ii) = 0 out of 2**

Example Candidate Response, Question 2, Low	Examiner comments
(iii) Explain the advantage to the seedlings of this growth response. The Plant ~~Sun~~ was exposed to the sun from only one side so it grew ~~[illegible]~~ towards the Sun. And it grew longer roots and it is easier for spreading pollen grains for reproduction of ~~[illegible]~~ of other plants and even other plant species. [2]	The candidate does not make any valid points. **Mark awarded for 2(c)(iii) = 0 out of 2**
(iv) Auxins control the growth responses of seedlings. Explain how auxins control the growth response of the seedlings in pot R. Pot one was partially exposed to the Sun and bearly watered so the ~~[illegible]~~ auxin hormone ~~[illegible]~~ supported the plant in growing leaves and helped it maintain it's root [4] [Total: 16]	The candidate does not make any valid points. **Mark awarded for 2(c)(iv) = 0 out of 4** **Total mark awarded = 0 out of 16**

How the candidate could have improved the answer

In general, the candidate could improve each answer by having a greater depth of knowledge and understanding of the syllabus content in order to answer each question accurately.

(a) No responses were given for the top two boxes and an incorrect response was given in the bottom box. The candidate should not have left questions unanswered; an attempt at a response could score some marks whereas blank spaces cannot.

(b) (i) The part at X was mistaken for the spinal cord instead of the correct answer of the sensory neurone.

(b) (ii) The candidate has the right idea but needs to use the correct term of 'reflex'. It is important for candidates to learn scientific names and terminology.

(b) (iii) The candidate describes how an involuntary action differs from a voluntary action rather than the other way round, and so has not answered the question being asked. It is important for candidates to read the question carefully.

(c) (i) Dim light was not considered the equivalent to dark conditions. Both parts of the answer needed to be correct to be awarded the mark.

(c) (ii) The candidate could have improved their answer by looking carefully at the instruction 'state', to determine that they needed to write down the *name* of the growth response, and not to *explain* the cause of the growth response.

(c) (iii) The response is full of errors. The candidate refered to the sun rather than light, and tried to relate growth to increased reproduction. The candidate has not linked the ideas of more light with the energy needed for photosynthesis for growth of more biomass. Fixing these issues would improve the answer.

(c) (iv) There is no correct description of where auxin is produced, how it is transported, where it accumulates or an explanation of its effect on plants and how this is related to exposure to light. Fixing these issues would improve the answer.

Common mistakes candidates made in Question 2

(a) *The candidate needed to complete Fig. 2.1. The examiner was expecting the candidate to write the correct names in the boxes on the figure.*

Most candidates knew the 'central' nervous system and the 'spinal cord', but many did not know the 'peripheral' nervous system and left it blank.

Some gave 'central' for both of the top two boxes.

Spellings of peripheral were rarely correct, but credit was given if the word was recognisable.

(b) (i) *The candidates needed to state the structure. The examiner was expecting an exact response that identified the structure.*

A few candidates gave the 'central nervous system' or the 'brain' for this answer.

(b) (ii) *The questions required candidates to state the type of involuntary action. The examiner was expecting an exact response that identifies the type of the action.*

Many candidates gave examples of simple reflexes, such as 'moving hand away from a hot object' or simply 'pain'. The question did not ask for an example, so these answers were not creditworthy.

(b) (iii) *The candidates needed to state **two** ways in which a voluntary action differs from an involuntary action. The examiner was expecting two distinct statements/differences.*

Many candidates reversed the question, giving ways in which involuntary actions differ from voluntary actions. If candidates made it clear which difference related to which action, then credit was awarded.

Some candidates wrote about one difference using all four answer lines. The question clearly asked for two differences.

References to control did not gain any credit since the nervous system controls both involuntary and voluntary actions.

(c) (i) *The examiner was expecting a response that correctly stated the conditions the pots in the figure were kept in.*

Candidates often suggested a string of different conditions of light, water, minerals, temperature and humidity. Another common error was to suggest pot P was kept in the dark and pot Q in the light, rather than the reverse.

(c) (ii) *The examiner was expecting a specific answer giving the name of the growth response.*

Phototropism was the most common answer seen, but few candidates realised that this was insufficient for a two-mark question and that they needed to qualify their answer with the word 'positive'.

Answers that contained '-trophic', for example 'phototrophic', were rejected as this implies a method of feeding.

Other incorrect responses seen included geotropism or gravitropism.

(c) (iii) *Candidates needed to explain the advantage of the growth response. The examiner was expecting a detailed extended prose response in which candidates used their scientific knowledge to state **why** the growth response is beneficial to the seedlings.*

The most common error was to not recognise that the plant would get **more** light for **more** photosynthesis. Some candidates simply stated that plants need light for photosynthesis but did not relate it to the advantage provided by the growth response.

(c) (iv) *The examiner was expecting an extended prose response in which candidates used their scientific knowledge to give reasons (explain how). They needed to relate the production, movement and accumulation of auxins to the changes that occur in the shoots of the plant during the growth response.*

Many candidates had little knowledge of how auxins control growth responses. Many thought that they become concentrated on the side exposed to light, rather than in the shaded side.

Question 3

Example Candidate Response – Question 3, High

3 Catalase is an enzyme that breaks down hydrogen peroxide inside cells. Red blood cells contain catalase.

Some dogs have an inherited condition in which catalase is not produced. This condition is known as acatalasia and it is caused by a mutation in the gene for catalase.

(a) Define the terms *gene* and *gene mutation*.

gene a length of DNA that codes for a protein.

gene mutation a change in base sequence of DNA.

[2]

(b) A geneticist was asked to investigate the inheritance of acatalasia in dogs.

The normal allele is represented by **B** and the mutant allele is represented by **b**.

The geneticist made the diagram in Fig. 3.1 to show the inheritance of acatalasia in a family of dogs. The shaded symbols indicate the dogs with acatalasia.

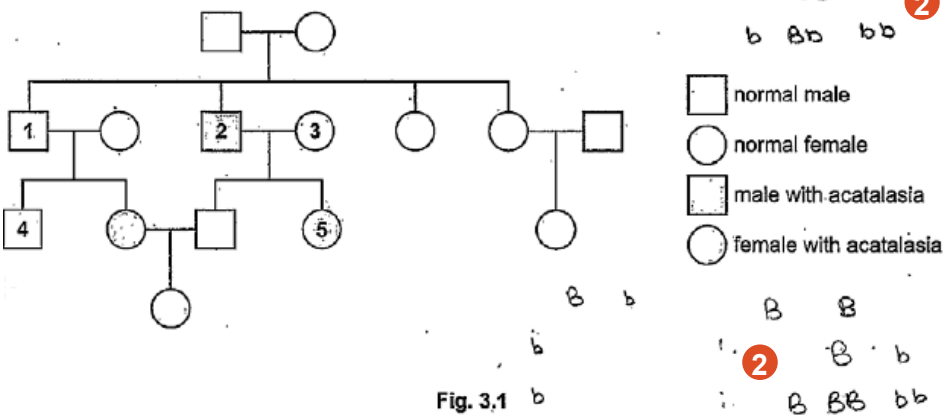


Fig. 3.1

(i) State the genotypes of the dogs identified as **1**, **2** and **3** in Fig. 3.1.

1 ~~bb~~ Bb

2 bb

3 Bb

[3]

Examiner comments

The candidate provides clear and accurate statements for each term.

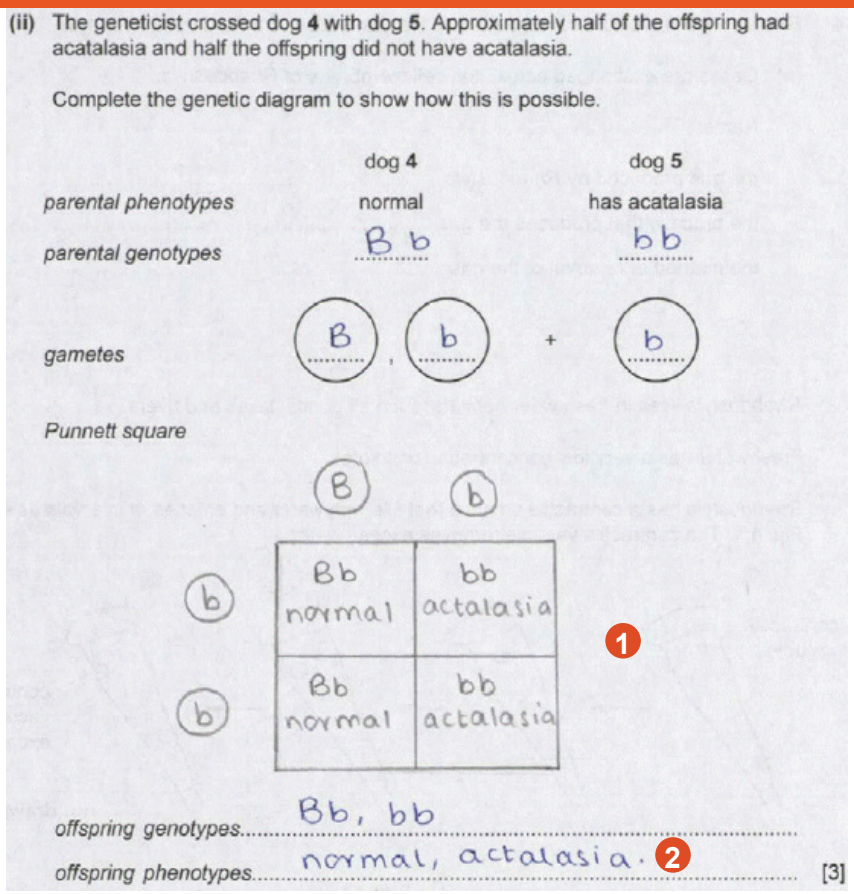
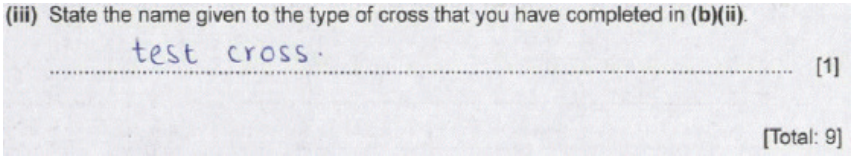
Mark awarded for 3(a) = 2 out of 2

1 The candidate provides correct genotypes for each.

2 Notice the use of jottings on the page to help them with their answer.

3 Also notice that the candidate crossed out an answer and clearly wrote their replacement answer. This makes it very clear to the examiner which answer to mark.

Mark awarded for 3(b)(i) = 3 out of 3

Example Candidate Response – Question 3, High	Examiner comments
	1 The candidate has drawn a very clear Punnett square to help them. They have accurately written their answers in the appropriate answer spaces. 2 Note that 'carrier' is a suitable alternative to 'normal' here. **Mark awarded for 3(b)(ii) = 3 out of 3**
	Note that 'test' on its own is sufficient to be awarded the mark. **Mark awarded for 3(b)(iii) = 1 out of 1** **Total mark awarded = 9 out of 9**

How the candidate could have improved the answer

The candidate gained full marks and all points are covered clearly so there are no specific ways they could have improved their response.

Example Candidate Response – Question 3, Middle

This question Is unusual in that candidates can either do genetics or they can't, so it is difficult to find a mid-level response on this topic.

3 Catalase is an enzyme that breaks down hydrogen peroxide inside cells. Red blood cells contain catalase.

Some dogs have an inherited condition in which catalase is not produced. This condition is known as acatalasia and it is caused by a mutation in the gene for catalase.

(a) Define the terms *gene* and *gene mutation*.

gene 1 a strand of DNA that codes for protein.

gene mutation a copy of a gene that is different to the orginal

[2]

(b) A geneticist was asked to investigate the inheritance of acatalasia in dogs.

The normal allele is represented by **B** and the mutant allele is represented by **b**.

The geneticist made the diagram in Fig. 3.1 to show the inheritance of acatalasia in a family of dogs. The shaded symbols indicate the dogs with acatalasia.

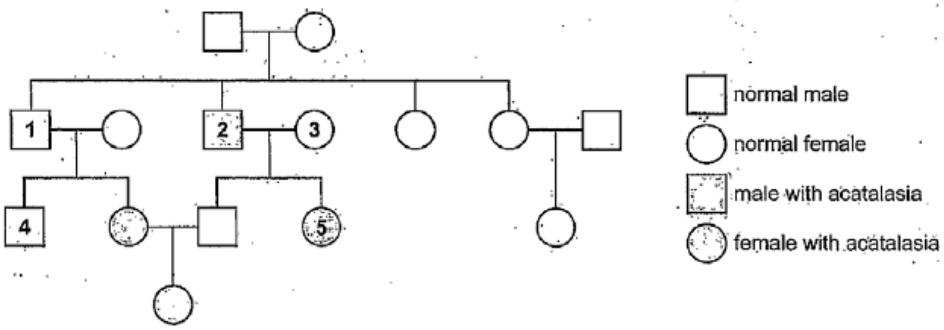


Fig. 3.1

(i) State the genotypes of the dogs identified as **1**, **2** and **3** in Fig. 3.1.

1 BB ; normal male

2 b ; male with acatalsia

3 BB ; normal female [3]

Examiner comments

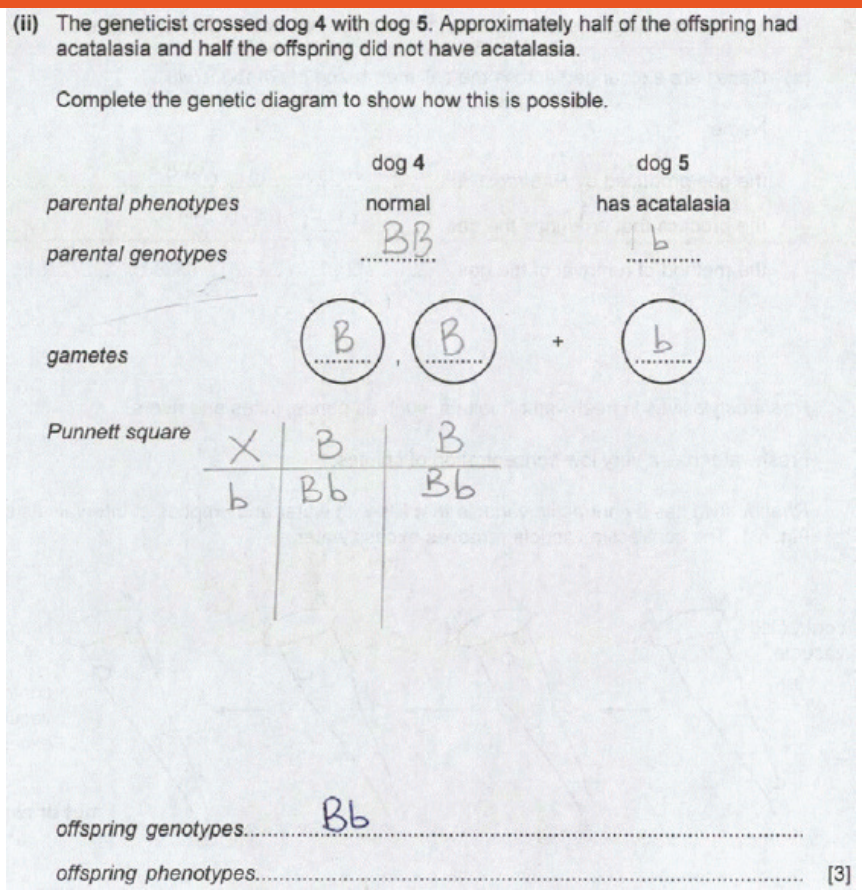
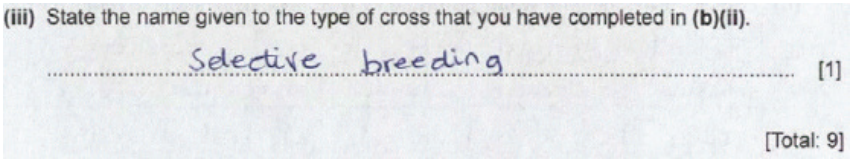
1 The mark is awarded for the definition of a gene.

The definition given for gene mutation is **not** correct.

Mark awarded for 3(a) = 1 out of 2

None of the given genotypes are correct for the dogs. The correct phenotype for each dog is given using the key provided, but this was not requested and cannot be awarded any marks.

Mark awarded for 3(b)(i) = 0 out of 3

Example Candidate Response – Question 3, Middle	Examiner comments
	One mark is awarded for the correct offspring genotype derived from the gametes, with error carried forward applied. **Mark awarded for 3(b)(ii) = 1 out of 3**
	The required term is not given. **Mark awarded for 3(b)(iii) = 0 out of 1** **Total mark awarded = 2 out of 9**

How the candidate could have improved the answer

In general, the candidate could have improved their response by having a greater depth of knowledge and understanding of the course content in order to be able to answer each question accurately.

(a) The definition the candidate gave for gene mutation should have been more specific; they should have mentioned a change in the base sequence. The candidate should not have used the word they were trying to define in their definition, in this case, 'gene'.

(b) (i) The candidate has given the wrong genotypes for dogs 1 and 3. The genotype given for dog 2 was not awarded marks because genotypes should consist of two letters. The candidate has provided the phenotype for each dog using the key provided but this was not requested and so was not rewarded marks.

(b) (ii) The candidate has the wrong initial parental genotypes (BB and b) but is given credit for the correct offspring genotype, Bb, since this answer demonstrates the correct understanding of the offspring that would result from their incorrect parental genotypes. To improve the answer, candidates should be encouraged to clearly and logically lay out their answers and attempt every question par

(iii) The answer required is a specific term, which was not given

Example Candidate Response – Question 3, Low

Examiner comments

3 Catalase is an enzyme that breaks down hydrogen peroxide inside cells. Red blood cells contain catalase.

Some dogs have an inherited condition in which catalase is not produced. This condition is known as acatalasia and it is caused by a mutation in the gene for catalase.

(a) Define the terms *gene* and *gene mutation*.

gene features transported ~~form~~ from parants

gene mutation features transported from parents the get changed

[2]

Vague references to inherited features are not awarded marks.

Mark awarded for 3(a) = 0 out of 2

(b) A geneticist was asked to investigate the inheritance of acatalasia in dogs.

The normal allele is represented by **B** and the mutant allele is represented by **b**.

The geneticist made the diagram in Fig. 3.1 to show the inheritance of acatalasia in a family of dogs. The shaded symbols indicate the dogs with acatalasia.

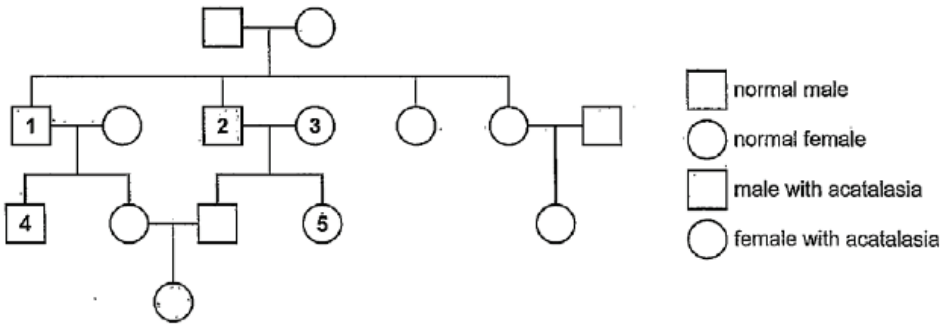


Fig. 3.1

(i) State the genotypes of the dogs identified as **1**, **2** and **3** in Fig. 3.1.

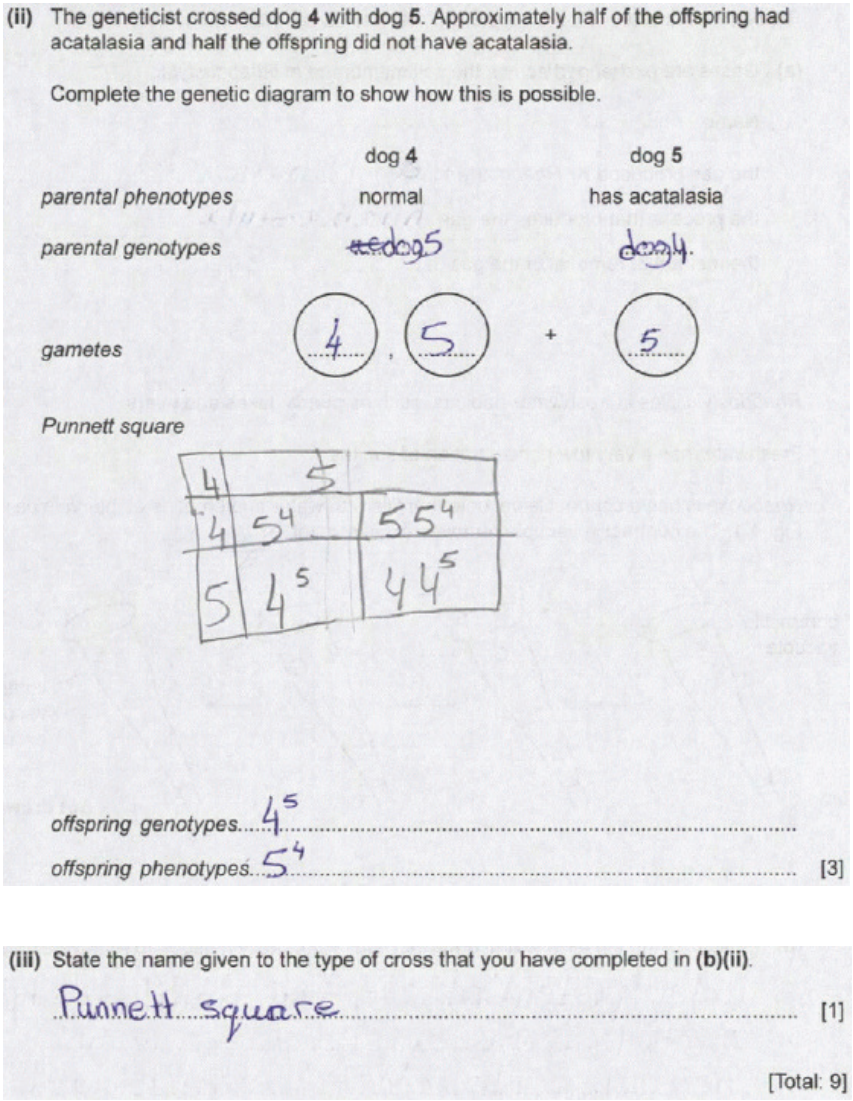
1 normal male

2 male with acatalasia

3 ~~me~~ normal female [3]

The candidate has given the phenotypes that are identified by the key, rather than the genotypes.

Mark awarded for 3(b)(i) = 0 out of 3

Example Candidate Response – Question 3, Low	Examiner comments
	The candidate has not made a good attempt to deduce the offspring genotypes or phenotypes. **Mark awarded for 3(b)(ii) = 0 out of 3** The required term was not given. **Mark awarded for 3(b)(iii) = 0 out of 1** **Total mark awarded = 0 out of 9**

How the candidate could have improved the answer

In general, the candidate could have improved their response by having a greater depth of knowledge and understanding of the course content in order to be able to answer each question accurately.

(a) Vague references to inherited features are incorrect. The candidate should have learnt the definitions as stated in the syllabus.

(b) (i) The candidate has given the phenotypes that are identified by the key rather than the genotypes. Candidates should know the correct biological terminology and therefore know what is meant by the term genotype.

(b) (ii) The candidate has not made a good attempt to deduce the offspring genotypes or phenotypes. It is clear that the lack of understanding of the terminology involved has hampered this particular candidate.

(b) (iii) The answer required is a specific term, which was not given.

Common mistakes candidates made in Question 3

(a) *Candidates were required to define the terms. The examiner was expecting the candidate to state the meaning of each term using formal statements as given in the syllabus.*

Many definitions of gene were given in the context of a 'unit of inheritance' and not the idea that a gene is a length of DNA that codes for a protein.

Similarly, gene mutations were often defined in terms of a 'spontaneous change in a gene' rather than a change in the *base sequence* of DNA within a gene. Some candidates wrote that a gene mutation is 'a change in the genetic code', which is not correct.

(b) (i) *The candidates were asked to state the genotypes. The examiner was expecting a specific answer for each part, i.e. a single genotype consisting of two letters.*

Many candidates stated incorrectly that at least one of the dogs had the genotype **BB** and sometimes both **1** and **3** were given this genotype.

The question asked for a statement of the genotypes and a few candidates gave a description in terms of homozygous, etc. This was not required but was credited if correct.

Some candidates tried to include the sex chromosomes X and Y, for example, X^BX^B. Examiners ignored any sex chromosomes that appeared and gave credit if the correct genotypes (**Bb**, **bb** and **Bb**) were present.

(b) (ii) *Candidates were asked to complete the genetic diagram. The examiner was expecting the candidate to provide their answers by filling in the gaps. Some scaffolding is given to help the candidate determine what answer is required in each case. The candidate is given space to complete a Punnett square to help them answer, but this is not mandatory. If responses were not given on the appropriate answer line, then candidates could still gain some credit for correct Punnett square-type diagrams.*

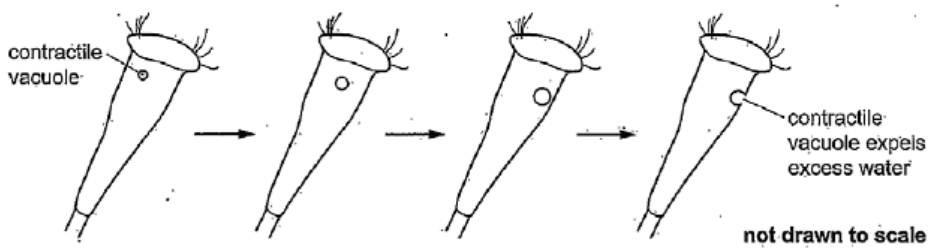
The most common error was to choose the genotype **BB** rather than **Bb** for dog 4. Candidates could still gain some marks for correct application.

A few candidates were unclear of the meaning of terms including *genotype* and *phenotype* as the answers to these were sometimes found reversed.

(b) (iii) *Candidates were asked to state the name of the type of cross. The examiner was expecting a specific response.*

Very few candidates could state the name of this cross and most candidates gave no response to this question.

Question 4

Example Candidate Response – Question 4, High	Examiner comments
4 *Rhabdostyla* is a single-celled organism that has no cell wall and no chlorophyll. **(a)** Gases are exchanged across the cell membrane of *Rhabdostyla*. Name: the gas produced by *Rhabdostyla* ..... CO_2 ..... the process that produces the gas ..... respiration ..... the method of removal of the gas ..... ~~diffusion~~ diffusion ..... [3] *Rhabdostyla* lives in freshwater habitats, such as ponds, lakes and rivers. Freshwater has a very low concentration of solutes. *Rhabdostyla* has a contractile vacuole that fills with water and empties at intervals as shown in Fig. 4.1. The contractile vacuole removes excess water.  Fig. 4.1 **(b)** Explain, using the term **water potential**, why *Rhabdostyla* needs to remove excess water. If Rhabdostyla did not remove excess it would get filled up with water until it burst as it has no cell wall to hold its shape. It would fill up as the ~~freshwater~~ water has a high water potential and Rhabdostyla has a low water potential so water moves down the ~~the~~ water Potential gradient through a Partially Permeable membrane into the cell by osmosis. [3]	The candidate provides the correct name for each part of the question. **Mark awarded for 4(a) = 3 out of 3** The candidate successfully gives reasons why. **Mark awarded for 4(b) = 3 out of 3**

Example Candidate Response – Question 4, High	Examiner comments

In an investigation, individual *Rhabdostyla* were placed into different concentrations of sea water. The rate of water excreted by the contractile vacuole of each organism was determined. The results are shown in Fig. 4.2.

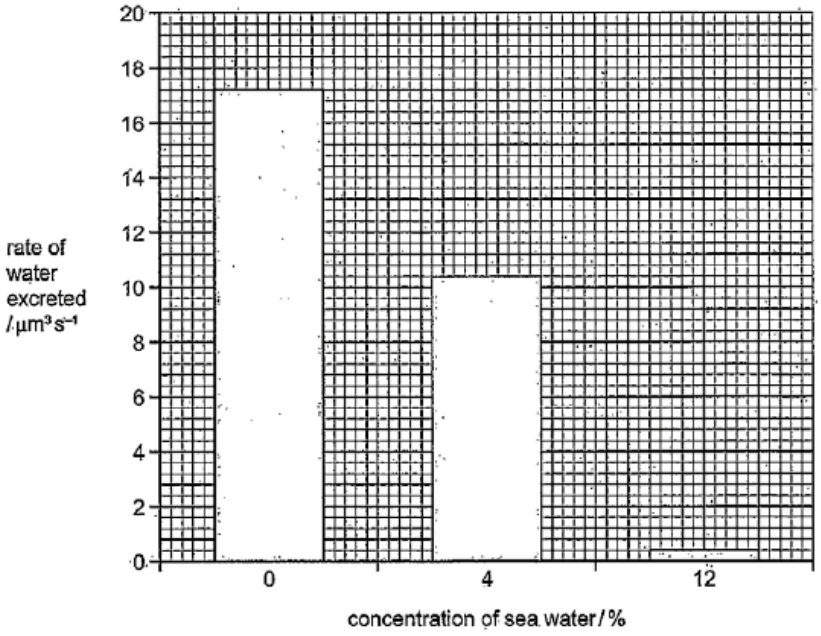


Fig. 4.2

(c) Explain the results shown in Fig. 4.2.

When there is just water a high amount of water is excreted due to the large differences in water potential between the cell and the water. when there is a higher concentration of sea water at 4% there are more salts in the water so the difference in water potential is less so less moves into the cell. A 12% Concentration the water potentials are similar so there is little movement of water and so little water needs to by excreted by the cells as there are many salt ions in the water as well as sea water has a high salt content [3]

The candidate successfully gives reasons why.

Mark awarded for 4(c) = 3 out of 3

Example Candidate Response – Question 4, High	Examiner comments
(d) Single-celled organisms with cell walls do not have contractile vacuoles. Suggest why. As a cell wall holds the shape of the organism even when filled with water & it will not burst like those without cell walls. Instead they become turgid when they are filled with water as the cell wall retains the cell's shape unlike the cell membrane so they don't need to be emptied as water by a contractile vacuole so it would be a waste of energy to have a contractile vacuole. [3] [Total: 12]	The candidate successfully gives reasons why. **Mark awarded for 4(d) = 3 out of 3** **Total mark awarded = 12 out of 12**

How the candidate could have improved the answer

The candidate gained full marks and all points are covered clearly so there are no specific ways they could have improved their response, with the exception of the comment below.

(c) Although not required for full marks in this question, it is good practice when explaining results to start with a simple statement describing the results before providing the required explanation.

Example Candidate Response – Question 4, Middle

(4) *Rhabdostyla* is a single-celled organism that has no cell wall and no chlorophyll.

(a) Gases are exchanged across the cell membrane of *Rhabdostyla*.

Name:

the gas produced by *Rhabdostyla* ..... O_2 .....

the process that produces the gas ..... respiration .....

the method of removal of the gas ..... excretion .....

[3]

Rhabdostyla lives in freshwater habitats, such as ponds, lakes and rivers.

Freshwater has a very low concentration of solutes.

Rhabdostyla has a contractile vacuole that fills with water and empties at intervals as shown in Fig. 4.1. The contractile vacuole removes excess water.

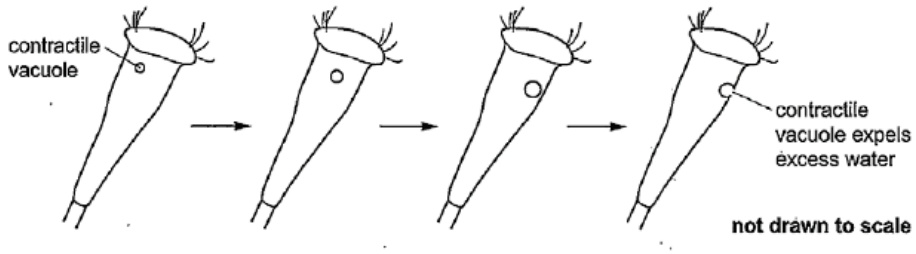


Fig. 4.1

(b) Explain, using the term **water potential**, why *Rhabdostyla* needs to remove excess water.

Rhabdostyla needs to remove excess water to avoid having too high water potential. If it would have too high water potential the cell would swell up and bust as there is no cell wall that would stop it from bursting.

[3]

Examiner comments

'*Oxygen*' is not the correct gas. The answer of '*excretion*' in place of '*diffusion*' is allowed and the mark awarded.

Mark awarded for 4(a) = 2 out of 3

The candidate has described the effect of what would happen if excess water was not removed (it would burst), gaining them one mark, but has not linked this to *how* water enters the *Rhabdostyla* by the process of osmosis down a water potential gradient.

Mark awarded for 4(b) = 1 out of 3

Example Candidate Response – Question 4, Middle	Examiner comments

In an investigation, individual *Rhabdostyla* were placed into different concentrations of sea water. The rate of water excreted by the contractile vacuole of each organism was determined. The results are shown in Fig. 4.2.

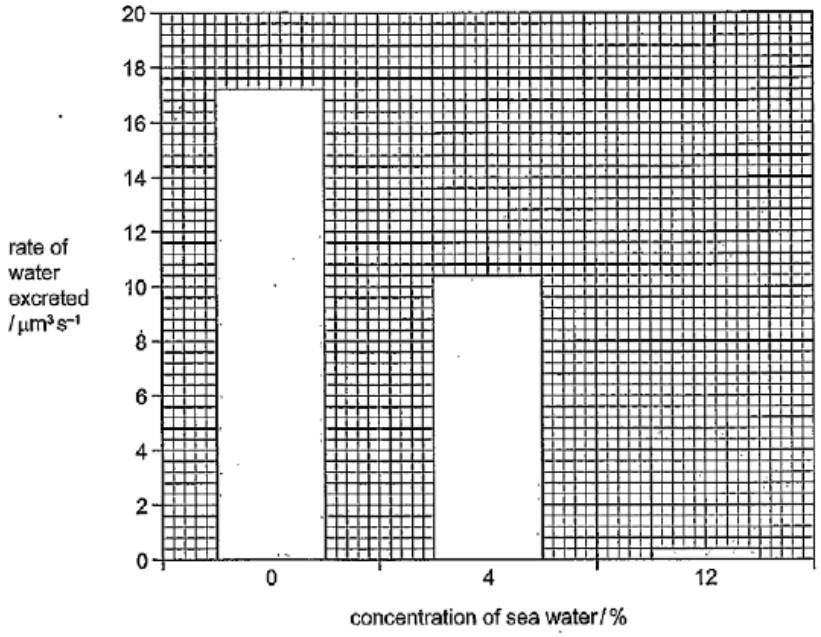


Fig. 4.2

(c) Explain the results shown in Fig. 4.2.

The lower the concentration of sea water, the higher the rate of water excreted. As you can see, at 0 concentration (%) the rate of water excreted was the highest (17.2 $\mu m^3 s^{-1}$) This might be because Rhabdostyles are used to fresh waters and not to salty water. Too much salty water could have made the vacuole ~~have~~ flaccid and dried out from the salt. [3]

The candidate has provided a simple description of the results, gaining them one mark, but has not been able to explain why increasing concentration of sea water decreases the rate of water excretion.

Mark awarded for 4(c) = 1 out of 3

(d) Single-celled organisms with cell walls do not have contractile vacuoles. Suggest why.

Single-celled organisms with cell walls do not need contractile vacuole to empty it's content because these cells cannot burst. The cell wall prevents them from bursting and so there is no need for contractile vacuole and to even out the water potential.

[3]

[Total: 12]

The candidate suggests that the cell wall prevents the cell from bursting, gaining them one mark. But they do not give any further descriptions or explanations of the role of the cell wall.

Mark awarded for 4(d) = 1 out of 3

Total mark awarded = 5 out of 12

How the candidate could have improved the answer

In general, the candidate could have improved their answer by having a greater knowledge and understanding of the content of the course in order to answer the questions more accurately.

(a) Oxygen has been incorrectly given as the gas, the answer is carbon dioxide.

(b) The candidate has described the effect of what would happen if water was not removed but has not provided an explanation by linking this to how water enters the *Rhabdostyla* by the process of osmosis, down a water potential gradient.

(c) The candidate has provided a simple description of the results but has not been able to explain why increasing concentration of sea water decreases the rate of water excretion. Candidates need to link the concentration of sea water increasing with the water potential gradient between the sea water and the organism decreasing, resulting in less water entering the organism and thus less water being excreted from the organism

(d) The candidate has only suggested that the cell wall prevents the cell from bursting, without giving any further descriptions or explanations of the role of the cell wall. References to the rigidity of the cell wall and/or its role in resisting pressure would have improved this response.

Example Candidate Response – Question 4, Low

4 *Rhabdostyla* is a single-celled organism that has no cell wall and no chlorophyll.

(a) Gases are exchanged across the cell membrane of *Rhabdostyla*.

Name: Rhabdostyla

the gas produced by *Rhabdostyla* water vapor

the process that produces the gas contractile vacuole fills and empties with water

the method of removal of the gas contractile vacuole

[3]

Rhabdostyla lives in freshwater habitats, such as ponds, lakes and rivers.

Freshwater has a very low concentration of solutes.

Rhabdostyla has a contractile vacuole that fills with water and empties at intervals as shown in Fig. 4.1. The contractile vacuole removes excess water.

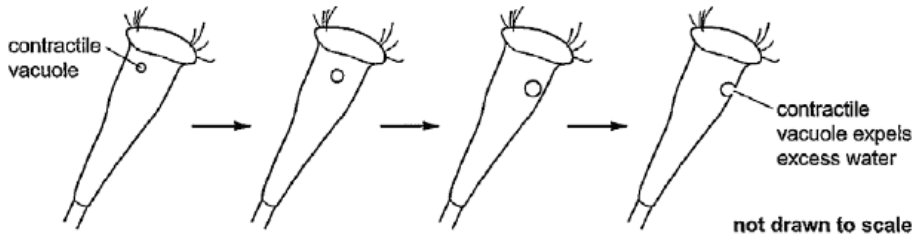


Fig. 4.1

(b) Explain, using the term **water potential**, why *Rhabdostyla* needs to remove excess water.

To make sure your water potential is correct, you need to get rid of all excess water. If you don't remove excess water then you won't be able to produce the gas you want.

[3]

Examiner comments

The incorrect gas '*water vapour*' is given instead of carbon dioxide. The incorrect method and process are given, and the candidate has attempted to give a description for the process rather than stating the name.

Mark awarded for 4(a) = 0 out of 3

The candidate does not have a clear understanding of the term '*water potential*', making it difficult to gain credit for this response.

Mark awarded for 4(b) = 0 out of 3

Example Candidate Response – Question 4, Low	Examiner comments

In an investigation, individual *Rhabdostyla* were placed into different concentrations of sea water. The rate of water excreted by the contractile vacuole of each organism was determined. The results are shown in Fig. 4.2.

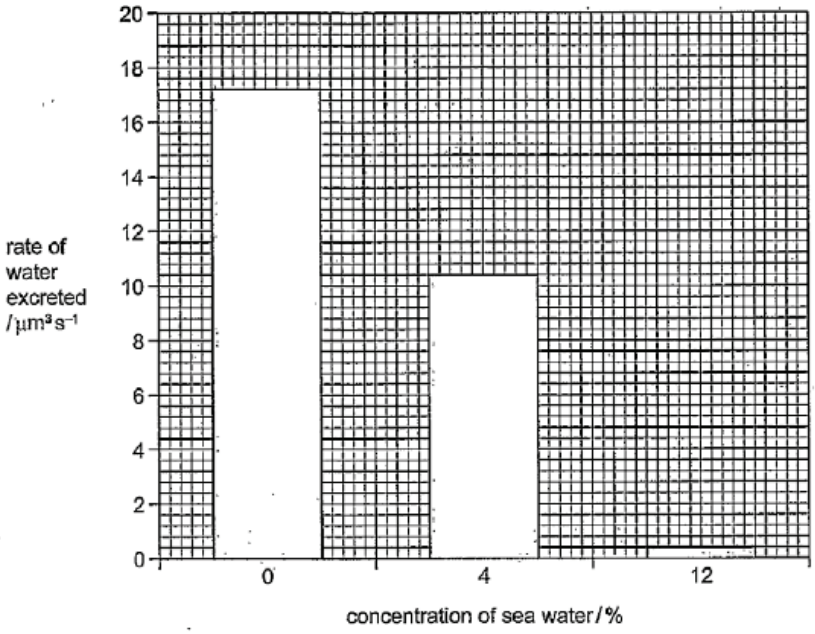


Fig. 4.2

(c) Explain the results shown in Fig. 4.2.

When there is 0% concentration of sea water, the rate of water exretion is about 17 um^3s^{-1}. When there is 4% concentration of sea water, the rater of water exretion is lower at about 10.5 um^3s^{-1}. Lastly, when there is 12% concentration of sea water, there is only about 1 um^3s^{-1} (rate of water excreted). [3]

The candidate gains partial credit for giving a simple description of the results. But no attempt has been made to explain the results.

Mark awarded for 4(c) = 1 out of 3

(d) Single-celled organisms with cell walls do not have contractile vacuoles. Suggest why.

Single-celled organisms ~~only~~ with cell walls dont have contractile vacuoles because they only have 1 cell to ~~to~~ live off of. Organisms with multiple cells ~~to~~ need ~~a~~ contractile vacuoles to help the organisms cells work together to keep the organism alive. [3]

The candidate does not give any valid statements.

Mark awarded for 4(d) = 0 out of 3

[Total: 12]

Total mark awarded = 1 out of 12

How the candidate could have improved the answer

In general, the candidate could have improved their answer by having a greater knowledge and understanding of the content of the course in order to answer the questions more accurately.

(a) The candidate did not give the correct name for each part of the question. The candidate did not take note of the instructions to 'name' and instead provided a description for the process. The candidate should have read the question more carefully.

(b) The candidate does not have a clear understanding of the term '*water potential*', making it difficult to gain credit for this response. Candidates should understand the process of osmosis, be able to accurately describe it using the term '*water potential*', and apply this knowledge.

(c) The candidate has gained partial credit for giving a simple description of the results but no attempt has been made to explain the results. The candidate needed to explain **why** increasing concentration of sea water decreases the rate of water excretion. Candidates need to link the concentration of sea water increasing with the water potential gradient between the sea water and the organism decreasing, resulting in less water entering.

(d) The candidate did not link the ideas of the contractile vacuole removing excess water and the cell wall preventing the cell from bursting due to excess water, meaning that they could not access the available marks.

Common mistakes candidates made in Question 4

(a) *The examiner was expecting a specific response identifying the gas, process and method required.*

Most candidates stated the gas and process correctly.

Some candidates stated '*gas exchange*' as the method, which was not accepted. '*Excretion*' was accepted as an alternative to the correct answer of '*diffusion*', but '*exhaled*', '*expired*' or '*breathed out*' were not accepted, since the organism concerned is single-celled.

(b) *The examiner was expecting a detailed extended prose in which candidates use their scientific knowledge to give the reason why Rhabdostyla needs to remove excess water. The explanation needed to include a full description and explanation of why and how water enters the Rhabdostyla using the term 'water potential' as instructed by the question.*

Many candidates had the water potential gradient going the wrong way.

Some referred to the contractile vacuole bursting when filled with water, rather than the whole organism bursting if the contractile vacuole was not present to remove the excess water.

(c) *The examiner was expecting a detailed prose response in which candidate use their scientific knowledge to explain why the result (a decreased rate of water excretion with increased concentration of sea water) is seen.*

Very few candidates gave detailed enough responses. Most gave a description of an increase in concentration of sea water resulting in a decrease in rate of water excretion, but very few attempted to offer an explanation of why this was the case.

(d) *The examiner was expecting a detailed prose response in which candidates have applied their knowledge and understanding of the function of cell walls, and the information given on the function of contractile vacuoles earlier in the question, to give reasons why contractile vacuoles are*

unnecessary in single-celled organisms with cell walls. The examiner was expecting the candidate to relate the functions of the cell wall to why water does not need to be removed from the cell.

Most candidates gained only partial credit for this part. Many did not provide an adequate number of reasons why single-celled organisms with a cell wall do not need contractile vacuoles. The number of marks available for a question should provide an indication of how many different points the candidates are expected to make.

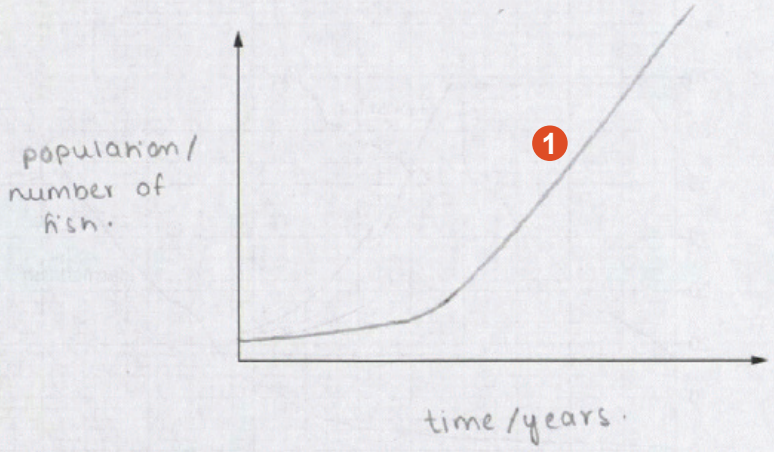
Question 5

Example Candidate Response – Question 5, High	Examiner comments

5 A researcher investigated the population growth of fish for fish farming. The researcher stocked a farmer's lake with a small number of these fish and recorded the number of fish over the next five years. The researcher's results showed that the population of fish had increased exponentially.

(a) (i) Use the axes to show the **exponential growth** in the population of fish.

Label the axes and draw a suitable curve.



[3]

(ii) Explain why the population of fish increased exponentially.

There were few limiting factors. Fish had plenty of food from foodstock. So there was little competition. There were no predators. Spread of disease was controlled by antibiotics. Birth rate was high since there were many individuals to reproduce.

[4]

1 The candidate has drawn the correct shaped curve and correctly labelled the axes.

Mark awarded for 5(a)(i) = 3 out of 3

The candidate makes more than four valid points (only four are required for full marks).

Mark awarded for 5(a)(ii) = 4 out of 4

Example Candidate Response – Question 5, High	Examiner comments

Fig. 5.1 shows the total mass of wild fish caught worldwide between 1950 and 2012 and the mass of farmed fish produced worldwide over the same period.

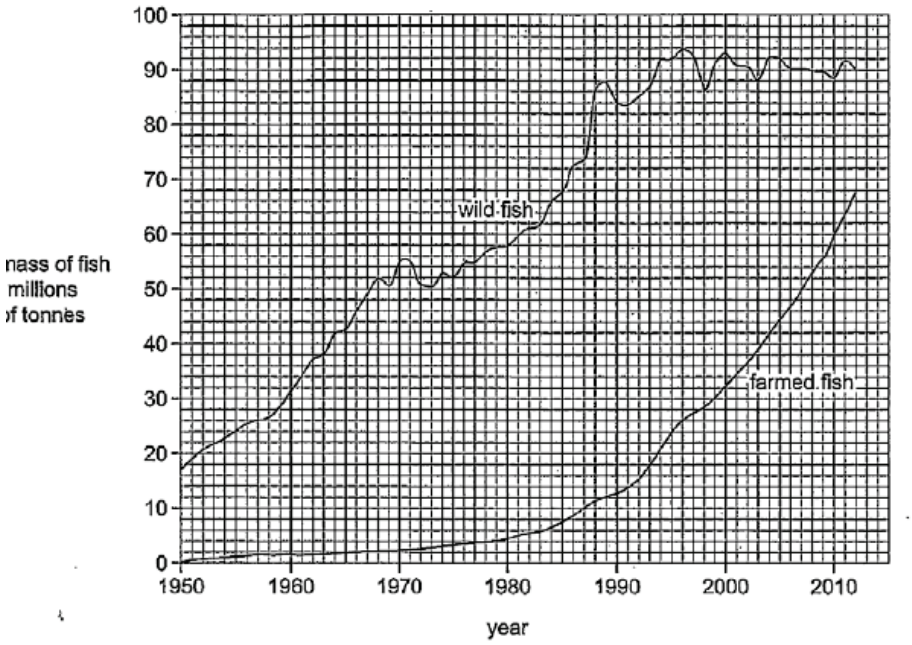


Fig. 5.1

(b) Describe the changes in the mass of **wild fish** caught between 1950 and 2012.

You will gain credit if you use data from Fig. 5.1.

There has been an overall increase in mass between 1950 and 2012 from 17 million tonnes to 90 million tonnes. It increased steeply between 1950 and 1995 and then remained fairly constant around 90 million tonnes. Greatest mass was in 1996. There were small fluctuations throughout ~~the~~ 1950 – 2012. [3]

The candidate provides a good description of the changes shown in the figure. The use of data is required to score full marks.

Mark awarded for 5(b) = 3 out of 3

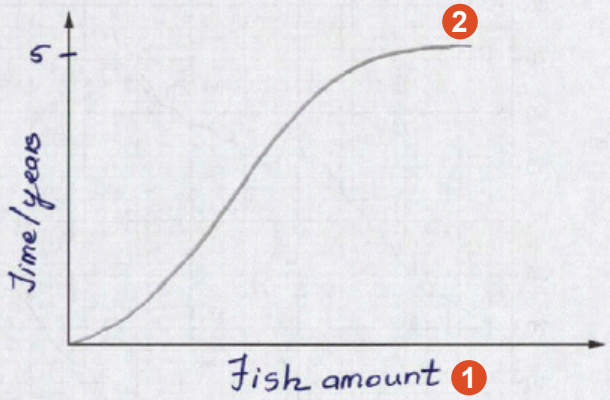
Example Candidate Response – Question 5, High	Examiner comments
(c) It is predicted that wild fish stocks will decrease and become depleted because of overfishing. Suggest ways in which governments can try to maintain the stocks of wild fish. ~~Governments should try to reduce the effect of limiting factors~~ Governments should pass strict laws. Fishing should not be allowed during breeding season; special nets should be provided to fishermen that don't catch baby fish and overseas fishermen should not be allowed to fish in the part of the sea that ~~is~~ belongs to the country. water pollution is due to chemical fertilizers and sewage should be reduced as this causes eutrophication and sewage should be treated before being dumped. Plastics should not be dumped in the sea or rivers. Oil spills should be prevented, Sewage should not contain contraceptives. [6] **(d)** Like fish stocks, forests can be a sustainable resource. Discuss what is meant by the term *sustainable resource*, using forests as an example. Sustainable resource is a resource that can be removed from the environment without it running out. e.g. forests are cut down for agriculture, housing etc. but as long as they are replaced by planting trees elsewhere or some are left, they will not finish and will be available for future generations. and they will also grow back. [3] [Total: 19]	The candidate only achieves some of the available marks. They have outlined some of the ways that governments can maintain wild fish stocks but have spent too many points trying to relate this to pollution. The candidate gains marks for suggesting restricting fishing during breeding seasons; special nets to prevent catching young fish; and reference to international agreements. **Mark awarded for 5(c) = 3 out of 6** The candidate provides a reasonable answer but repeats the fact that the resource will not run out in slightly different ways. The candidate is awarded marks for stating that sustainable resources don't run out and trees could be replanted. **Mark awarded for 5(d) = 2 out of 3** **Total mark awarded = 15 out of 19**

How the candidate could have improved the answer

The candidate gained full marks for parts **(a)** and **(b)**, and all points were covered clearly so there are no specific ways they could have improved their response for these parts.

(c) The candidate only achieved some of the available marks for this response. The candidate has outlined some of the ways that governments can maintain wild fish stocks but has spent too many points trying to relate this to pollution. The candidate has vaguely referred to passing strict laws but it was not specific enough to gain credit; they needed to give more detail by referring to quotas, enforcement of quotas, or international agreements. The candidate has also missed some methods given in the syllabus on maintaining populations, including captive breeding and monitoring populations.

(d) The candidate has provided a reasonable answer but repeats the fact that the resource will not run out in slightly different ways. To improve, the candidate could have used the term ‘renewable’; also, quoting the definition of a sustainable resource would have earned marks directly.

Example Candidate Response – Question 5, Middle	Examiner comments
5 A researcher investigated the population growth of fish for fish farming. The researcher stocked a farmer's lake with a small number of these fish and recorded the number of fish over the next five years. The researcher's results showed that the population of fish had increased exponentially. (a) (i) Use the axes to show the **exponential growth** in the population of fish. Label the axes and draw a suitable curve.  [3] (ii) Explain why the population of fish increased exponentially. The fish ~~were provided with enough~~ may ~~foo~~ have not been within the reproductive age and then when they reached it however, there was an exponential growth as they provided with all the nutrients, the time and conditions for their population to increase. [4]	The candidate has the axes the wrong way round. 1 The use of 'amount' should be avoided. 2 The line drawn begins to level off and so does not show exponential growth. **Mark awarded for 5(a)(i) = 0 out of 3** The candidate gains one mark for the '*provided with … nutrients*' statement. The candidate states that there was exponential growth because they were given the correct conditions but does not say what these conditions are, which is what the question requires. **Mark awarded for 5(a)(ii) = 1 out of 4**

Example Candidate Response – Question 5, Middle	Examiner comments

Fig. 5.1 shows the total mass of wild fish caught worldwide between 1950 and 2012 and the mass of farmed fish produced worldwide over the same period.

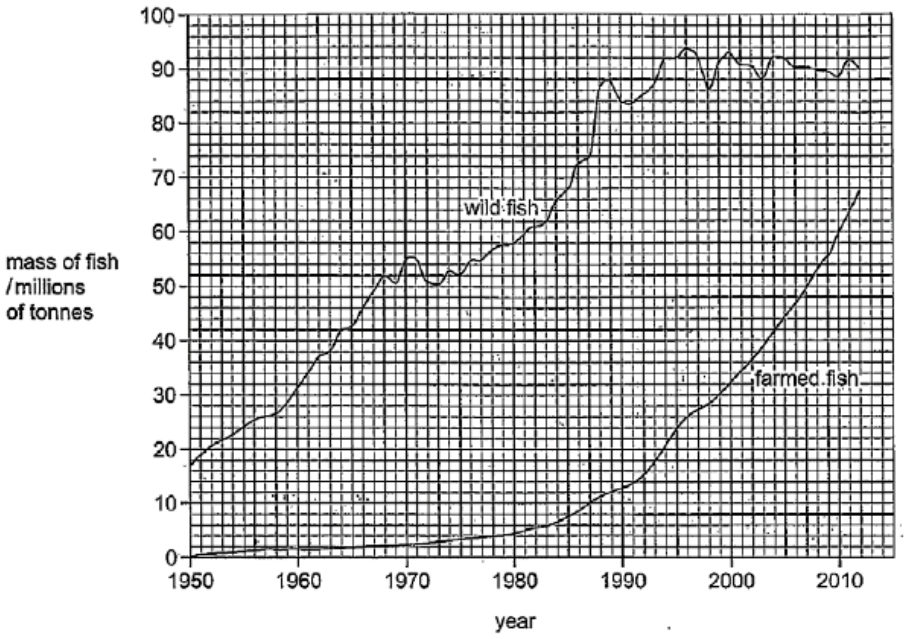


Fig. 5.1

(b) Describe the changes in the mass of **wild fish** caught between 1950 and 2012.

You will gain credit if you use data from Fig. 5.1.

The mass of fish at 1950 was around 19 million tonnes and as the years passed by there was growth but around the year 1985 ~~there~~ – 1990 was a growth spurt until it reached about 88 million tonne and then the growth ~~it~~ increased ~~and decreased normally until 20~~ was almost constant until 2010. [3]

The candidate provides a reasonable description of the general trend but doesn't go on to provide a more detailed description, and does not include examples of data from the figure.

Mark awarded for 5(b) = 1 out of 3

Example Candidate Response – Question 5, Middle	Examiner comments
(c) It is predicted that wild fish stocks will decrease and become depleted because of overfishing. Suggest ways in which governments can try to maintain the stocks of wild fish. The government can contribute in ~~maintaing~~ maintaining the stock of wild fish by:- - Educating fishiers about this issue. - ~~Enf~~ Enforcing laws that ban fishing at breeding seasons. - Fishers should not be allowed to fish the young fishes that have not yet reached reproductive age. - There should be a limit for fishing rate at time intervals. [6]	The candidate does very well on this part but they only make *four* points. The number of marks for a question like this gives an indication of the number of different (valid) points that need to be made, which in this case was **six**. **Mark awarded for 5(c) = 4 out of 6**
(d) Like fish stocks, forests can be a sustainable resource. Discuss what is meant by the term *sustainable resource*, using forests as an example. A sustainable resource is a resource that is renewable or can be produced at the same rate as it is used. We can see this in forests as we cut down a reasonable amount of ~~f~~ wood for example, heating purposes. We can ~~re-grow~~ plant/grow the trees that we cut down again ~~and so repeating this no cycle change in the ecosystem will~~ at the same rate. [3] as we use them ~~and~~ and at this rate the sustainable resource will remain in our ecosystem. [Total: 19]	The candidate provides a reasonable answer but repeats the fact that the resource is renewable in slightly different ways. **Mark awarded for 5(d) = 2 out of 3** **Total mark awarded = 8 out of 19**

How the candidate could have improved the answer

(a) (i) The candidate has the axes the wrong way round. The use of the vague term '*amount*' should be discouraged; the candidate should be referring to '*number*' of fish. The line drawn begins to level off and so does not show exponential growth.

(a) (ii) The candidate gained only one mark for the '*provided with … nutrients*' statement. The candidate has given the reason that the fish had the conditions needed for exponential growth but they needed to specify these conditions. The number of marks available indicates the number of points the candidates should make. The candidate should have provided at least four reasons in a question of this type.

(b) The candidate provided a reasonable description of the general trend but doesn't go on to provide a more detailed description. Examiners were looking for a description of the general trend including reference to the number of fish caught; mention of the fluctuations in the mass and when these fluctuations occur; reference to the maximum catch including the year and the number of tonnes; and when the steepest increases occurred.

(c) The candidate did very well on this part. However, some areas of the syllabus were not covered by the candidate's response: monitoring stocks, captive breeding and international agreements, are examples mentioned in the syllabus. If the candidate had also included these, this response would have achieved full marks.

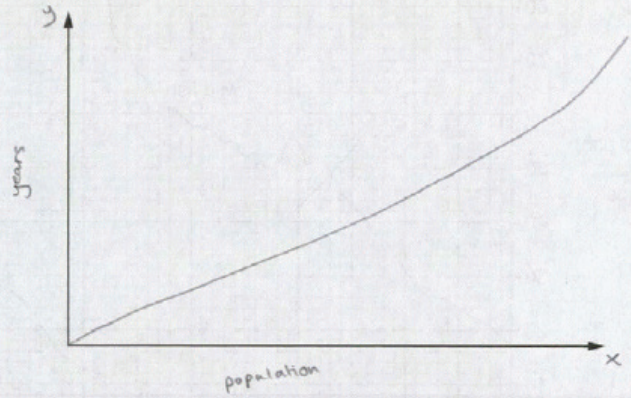
(d) The candidate has provided a reasonable answer but repeats the fact that the resource is renewable in slightly different ways. To improve, the candidate could have stated that a renewable resource does not run out ('*remains in our ecosystem*' was considered too vague to be equivalent). Quoting the definition of a sustainable resource would have earned marks directly.

Example Candidate Response – Question 5, Low	Examiner comments

5 A researcher investigated the population growth of fish for fish farming. The researcher stocked a farmer's lake with a small number of these fish and recorded the number of fish over the next five years. The researcher's results showed that the population of fish had increased exponentially.

(a) (i) Use the axes to show the **exponential growth** in the population of fish.

Label the axes and draw a suitable curve.



[3]

The candidate has the axes the wrong way round.

One mark was given for the curve as it is beginning to curve upwards and so could resemble the start of an exponential curve.

Mark awarded for 5(a)(i) = 1 out of 3

(ii) Explain why the population of fish increased exponentially.

Good environment, more offspring. ~~are made~~ The right amount of Sunlight. ~~the~~ The lake is pure water no additional compounds. More oxygen.

[4]

The candidate has the right idea but is not specific enough; they should state what conditions make it a good environment and thus enables the fish population to grow exponentially. One mark is awarded for '*more oxygen*'.

Mark awarded for 5(a)(ii) = 1 out of 4

Example Candidate Response – Question 5, Low	Examiner comments

Fig. 5.1 shows the total mass of wild fish caught worldwide between 1950 and 2012 and the mass of farmed fish produced worldwide over the same period.

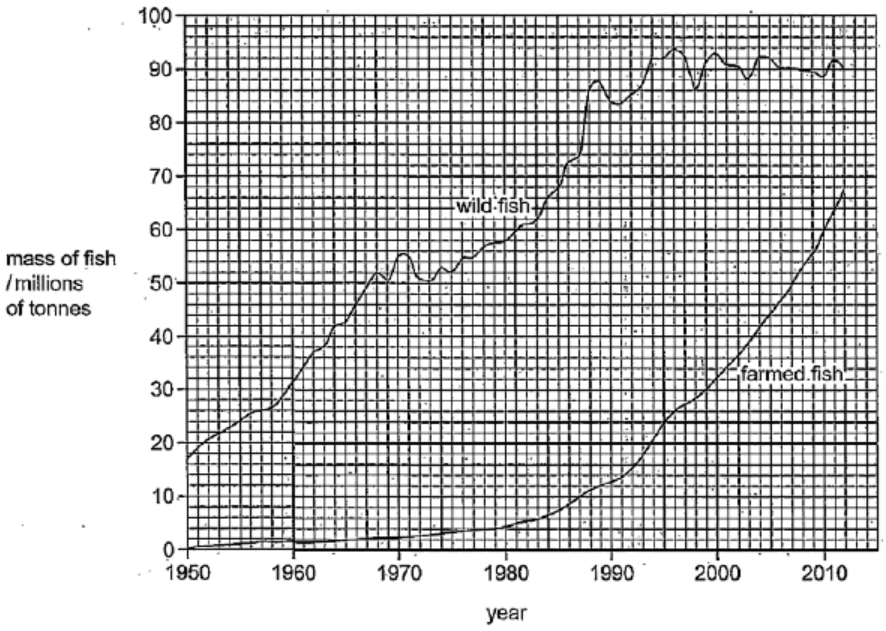


Fig. 5.1

(b) Describe the changes in the mass of **wild fish** caught between 1950 and 2012.

You will gain credit if you use data from Fig. 5.1.

The population of fish increased a lot, because farmed fish were used and so the wild fish weren't caught so more offsprings and less fishing.

[3]

The question specifies that the candidate *describe* the changes in the mass of wild fish seen in the figure. Instead, the candidate has tried to provide an *explanation* of the results by comparing farmed fish and wild fish.

Mark awarded for (b) = 0 out of 3

Example Candidate Response – Question 5, Low	Examiner comments
(c) It is predicted that wild fish stocks will decrease and become depleted because of overfishing. Suggest ways in which governments can try to maintain the stocks of wild fish. ~~Kill~~ Less fishing and Less killing for experiments [6] (d) Like fish stocks, forests can be a sustainable resource. Discuss what is meant by the term *sustainable resource*, using forests as an example. Lots of forest are ~~deforests~~ cut down causing deforistation in which more carbon dioxides is present and less oxygen is made and you can't grow tree's fast. and It also distro: distroy's lots of habbitat. [3] [Total: 19]	The candidate simply refers to '*less fishing*' without specifying how this can be achieved and so does not answer the question. **Mark awarded for 5(c) = 0 out of 6** It looks like the candidate sees that the question is about forests and assumes that the response needed is about deforestation. **Mark awarded for 5(d) = 0 out of 3** **Total mark awarded = 2 out of 19**

How the candidate could have improved the answer

(a) (i) The titles of the axes labels themselves are acceptable but the candidate has put the *x*-axis label on the *y*-axis and vice versa. The labels needed to be the other way round to gain the marks.

(a) (ii) The candidate has the right idea but is not specific enough. The candidate needed to say **what** the conditions are that make it a good environment and thus enable the fish population to grow exponentially. The examiners were looking for factors including little competition, few predators, few parasites, plenty of food, etc.

(b) The question specifies that the candidate should refer to the mass of wild fish. The candidate has referred to both wild fish and farmed fish in their response, comparing the two when providing an explanation of the results. The instruction to '*describe*' tells the candidate what sort of response is required. Examiners were looking for a description of the general trend including reference to the number of fish caught; mention of the fluctuations in the mass and when these fluctuations occur; reference to the maximum catch including the year and the number of tonnes; and when the steepest increases occurred.

(c) The candidate has simply referred to '*less fishing*' without specifying how this can be achieved. There are six marks available for this question, so the examiner was expecting six different points to be made. Less confident candidates should be encouraged to list their response in bullet points if they find this type of extended prose too challenging.

(d) The candidate response here suggests that they have seen that the question was about forests and assumed that the response needed to be about deforestation. It is possible that they didn't read the question properly and made assumptions, or that they answered a question that they wanted to answer rather than answering the question that was actually asked. Learning the syllabus definitions of terms such as '*sustainable resource*' can earn marks directly.

Common mistakes candidates made in Question 5

(a)(i) *The candidates were asked to use the axes provided to show exponential growth by drawing a curve and labelling the axes. Candidates needed to add a written label to the y- and x-axes to show what they represent. Candidates could extract the labels directly from the information given in the stem of the question.*

'*Population growth*' was an incorrect label for the *y*-axis that was commonly seen.

Credit for the curve was given to curves that **only** showed exponential growth. Any flexion of the line showing the beginning of a deceleration phase was not accepted. Many candidates began to level off the line and so did not gain this mark. It is important to read the question carefully to avoid errors such as this.

(a) (ii) *The candidates needed to give an explanation for the exponential growth of the fish population. The examiner was expecting candidates to use their knowledge and understanding to write a detailed prose response outlining several reasons. Four marks were available for this question so candidates were expected to provide at least four reasons.*

The less successful answers contained too much on one point, often the availability of food or absence of predators.

Some candidates wrote about the reproduction of fish and the fact that once there is a new generation of fish there are more males and females to reproduce, which although scientifically correct, was not what the question asked for and so did not gain credit.

(b) *The examiner was expecting candidates to write a detailed prose response that described the changes in mass shown in Fig. 5.1. Candidates were expected to quote data from the graph using the correct figures and units.*

Few candidates described the general trends seen in the graph. Some candidates simply stated the fish catches at certain years and did not describe the *changes*.

Candidates who did not gain much credit did not take care when extracting figures from the graph.

(c) *The examiner was expecting an extended prose response in which candidates applied their knowledge and understanding of how fish stocks can be maintained, to outline ways that*

governments of countries can maintain wild fish stocks. There were many possible answers to this question and any valid points could have been awarded marks.

This question was generally answered very well. A few candidates thought that stocks needed to be controlled because they were too large, so gave several methods of population control. Most candidates gained at least partial credit.

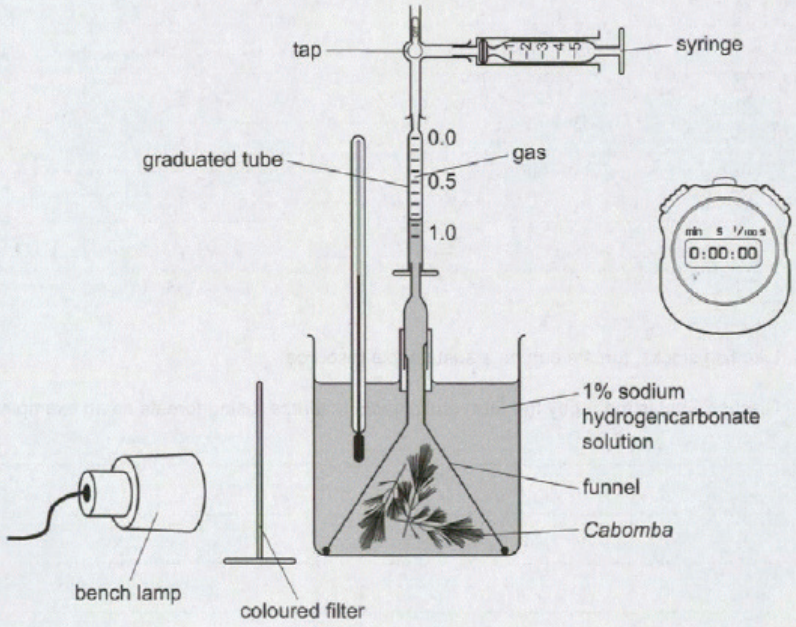
Some candidates did not provide enough suggestions. The number of marks available for a question is a good indication of the minimum number of points that need to be made.

(d) *The examiner was expecting a definition of the term 'sustainable resource', and statements of how forests can be defined as a sustainable resource. Candidates **must** have used forests as the example to gain full marks.*

Some candidates did not know what the term '*sustainable resource*' meant, which prevented them from answering this question fully. Some candidates confused it with non-renewable resources such as fossil fuels.

A few candidates did not read the question carefully and used fish stocks as an example of a sustainable resource rather than forests.

Question 6

Example Candidate Response – Question 6, High	Examiner comments
6 (a) State the balanced chemical equation for photosynthesis. $6CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} C_6H_{12}O_6 + 6O_2$ [2] A student investigated the effect of different wavelengths of light on the rate of photosynthesis of the water plant, *Cabomba*. The student used the apparatus shown in Fig. 6.1.  Fig. 6.1	The candidate gives the correct balanced equation. **Mark awarded for 6(a) = 2 out of 2**

Example Candidate Response – Question 6, High

(b) The student collected the gas produced by the plant for five minutes. The results are shown in Table 6.1.

Table 6.1

colour of filter	wavelength of light / nm	volume of gas collected / cm^3
violet	400	0.80
blue	475	0.80
green	550	0.20
yellow	600	0.40
red	675	0.90

Describe the effect of wavelength of light on the rate of photosynthesis as shown in the student's results in Table 6.1.

You will gain credit if you use data from the table.

As wavelength increases from 400 to 550, rate of photosynthesis decreases, but as wavelength is increased further, it increases. Greatest rate with wavelength 675 nm and volume of gas collected was 0.90 cm^3 in 5 minutes. At 400 nm, it was 0.8 cm^3 in 5 minutes and at 550 nm, it was 0.2 cm^3 in 5 minutes. [3]

(c) State how the student would calculate the rates of photosynthesis from the results in Table 6.1.

Divide volume of gas collected by 5. to obtain rate in cm^3 min^{-1} [1]

(d) State why the student:

(i) kept the lamp at the same distance during the investigation,

To keep light intensity constant as it is a controlled variable. [1]

(ii) used sodium hydrogencarbonate solution.

To provide carbon dioxide to the plant for photosynthesis. [1]

Examiner comments

The candidate makes a good attempt at describing the effect on photosynthesis.

They missed out on one mark because they made no reference to the colours/wavelengths that give high or low rates of photosynthesis.

Mark awarded for 6(b) = 2 out of 3

The first line of the candidate's answer is sufficient to score the mark.

Mark awarded for 6(c) = 1 out of 1

The statement is clear and accurate.

Mark awarded for 6(d)(i) = 1 out of 1

The statement is clear and accurate.

Mark awarded for 6(d)(ii) = 1 out of 1

Example Candidate Response – Question 6, High	Examiner comments
(e) State **three** uses in a plant of the carbohydrate produced in photosynthesis. 1. to release energy by respiration. 2. converted to starch for storage 3. converted to cellulose to make cell walls for new cells. [3] [Total: 11]	The candidate states three correct uses. **Mark awarded for 6(e) = 3 out of 3** **Total mark awarded = 10 out of 11**

How the candidate could have improved the answer

The candidate gained full marks for all parts except part **(b)**. All points were covered clearly so there are no specific ways they could have improved their response for these parts.

(b) To improve further, the candidate should have made sure that all figures quoted included the units. The candidate gave a reasonable description but they could have described which colour filters, or range of wavelengths, resulted in the highest and lowest rates of photosynthesis rather than just the peak volume of gas produced.

Example Candidate Response – Question 6, Middle	Examiner comments

6 (a) State the balanced chemical equation for photosynthesis.

$C_6H_{12}O_6 + O_2 \xrightarrow[\text{chlorophyll}]{\text{light}} 6CO_2 + 6H_2O$

[2]

A student investigated the effect of different wavelengths of light on the rate of photosynthesis of the water plant, *Cabomba*.

The student used the apparatus shown in Fig. 6.1.

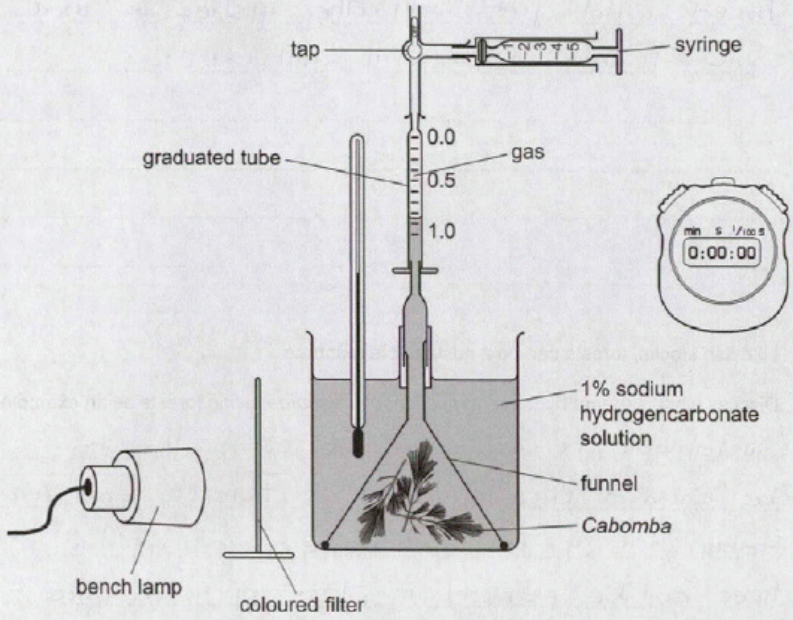


Fig. 6.1

This is the equation for *aerobic respiration* not photosynthesis. Given that it is correct and balanced; it suggests a misreading of the question.

Mark awarded for 6(a) = 0 out of 2

Example Candidate Response – Question 6, Middle

(b) The student collected the gas produced by the plant for five minutes. The results are shown in Table 6.1.

Table 6.1

colour of filter	wavelength of light / nm	volume of gas collected / cm^3
violet	400	0.80
blue	475	0.80
green	550	0.20
yellow	600	0.40
red	675	0.90

Describe the effect of wavelength of light on the rate of photosynthesis as shown in the student's results in Table 6.1.

You will gain credit if you use data from the table.

Generally, as wavelength of light increases, volume of gas collected increases. At first the volume of gas collected was 0·80 cm^3 at a wavelength of 400 nm. But at 675 nm, the volume increased to 0·90 cm^3

[3]

(c) State how the student would calculate the rates of photosynthesis from the results in Table 6.1.

~~By finding the average or~~

By dividing the wavelength over the time [1]

(d) State why the student:

(i) kept the lamp at the same distance during the investigation,

Controlled variable for a fair test

[1]

(ii) used sodium hydrogencarbonate solution.

As a supply of carbon dioxide.

[1]

Examiner comments

The candidate does not describe the general trend accurately and does not make any attempt to analyse the data. In questions such as this, credit is not available for directly quoting from the table, some analysis of the results are needed.

Mark awarded for 6(b) = 0 out of 3

The calculation is not correct.

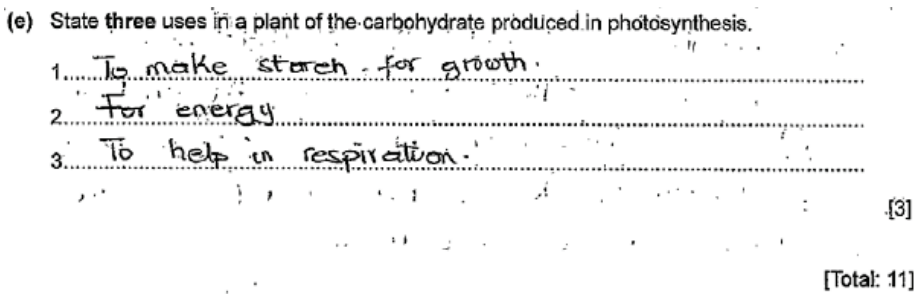
Mark awarded for 6(c) = 0 out of 1

The candidate refers to it being a controlled variable without specifically referring to what is being controlled. The candidate needs to specify light intensity as the factor to gain credit.

Mark awarded for 6(d)(i) = 0 out of 1

The statement is clear and accurate.

Mark awarded for 6(d)(ii) = 1 out of 1

Example Candidate Response – Question 6, Middle	Examiner comments
 (e) State **three** uses in a plant of the carbohydrate produced in photosynthesis. 1. To make starch for growth. 2. For energy 3. To help in respiration. [3] [Total: 11]	The responses '*respiration*' and '*for energy*' are considered to the same thing here, since the carbohydrate is used in respiration to generate energy. **Mark awarded for 6(e) = 2 out of 3** **Total mark awarded = 3 out of 11**

How the candidate could have improved the answer

(a) The candidate has written a fully balanced and correct equation *for aerobic respiration* rather than photosynthesis. They should have read the question more carefully and checked the appropriateness of their answer, i.e. photosynthesis *uses* carbon dioxide, it does not produce it.

(b) The candidate has not described the general trend accurately, describing an increase in the rate of photosynthesis rather than a decrease followed by an increase. They have not related the volume of gas to the rate of photosynthesis and have made no attempt to analyse the data; simply quoting figures from the table is not enough to gain credit. The candidate could have improved their response by describing which colour filters or range of wavelengths result in the highest and lowest rates of photosynthesis.

(c) The candidate incorrectly included wavelength in the calculation, rather than dividing the volume by time.

(d) (i) The candidate refered to it being a controlled variable without specifically referring to what is being controlled. The candidate needed to specify '*light intensity*' as the factor to gain credit.

(e) The responses '*respiration*' and '*for energy*' were considered to be the same thing since the carbohydrate is used in respiration to generate energy. When candidates are asked to provide a list they should try to state independent points. This question required candidates to access information from different parts of the syllabus to gain full credit.

Example Candidate Response – Question 6, Low	Examiner comments

6 (a) State the balanced chemical equation for photosynthesis.

? $H_2O + CO_2 + H_{12}O_6$ —light, chlorophyll→ H_2O_{12}

[2]

A student investigated the effect of different wavelengths of light on the rate of photosynthesis of the water plant, *Cabomba*.

The student used the apparatus shown in Fig. 6.1.

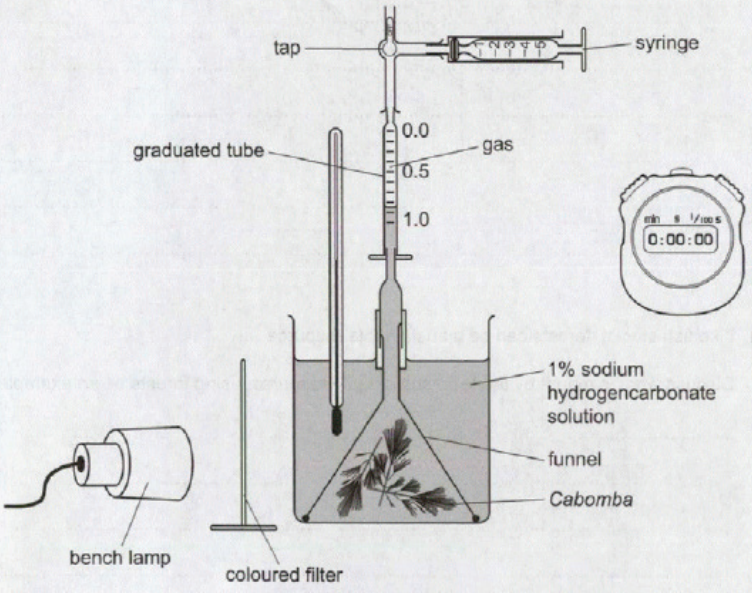


Fig. 6.1

It is clear that the candidate does not know the equation for photosynthesis.

Mark awarded for 6(a) = 0 out of 2

Example Candidate Response – Question 6, Low	Examiner comments

(b) The student collected the gas produced by the plant for five minutes. The results are shown in Table 6.1.

Table 6.1

colour of filter	wavelength of light / nm	volume of gas collected / cm^3
violet	400	0.80
blue	475	0.80
green	550	0.20
yellow	600	0.40
red	675	0.90

Describe the effect of wavelength of light on the rate of photosynthesis as shown in the student's results in Table 6.1.

You will gain credit if you use data from the table.

The effect of wavelength of light on the rate of photosynthesis as shown in the table is that

[3]

The candidate has made no attempt to analyse the data or answer the question.

Mark awarded for 6(b) = 0 out of 3

(c) State how the student would calculate the rates of photosynthesis from the results in Table 6.1.

By seeing and figuring out how the results relate to rates of photosynthesis. [1]

The candidate attempts to describe an approach. The request for a calculation suggests a formula is required.

Mark awarded for 6(c) = 0 out of 1

(d) State why the student:

(i) kept the lamp at the same distance during the investigation,

So that ~~[illegible]~~ results would be accurate and that variable would remain controlled. [1]

The candidate refers to it being a controlled variable without specifically referring to what is being controlled. The candidate needed to specify '*light intensity*' as the factor to gain credit.

Mark awarded for 6(d)(i) = 0 out of 1

Example Candidate Response – Question 6, Low	Examiner comments
(ii) used sodium hydrogencarbonate solution. Because this solution gives the most accurate results and it's better to use for this experiment. [1] (e) State three uses in a plant of the carbohydrate produced in photosynthesis. 1. Used to make sugars 2. Used to make the plant produce food 3. Used to help the plant grow. [3]	It is clear that the candidate does not know the use for sodium hydrogencarbonate solution. **Mark awarded for 6(d)(ii) = 0 out of 1** The candidate has the right idea but is not specific enough in their response. Vague references to growth, sugars or food are not accepted. At this level, candidates are expected to refer to specific substances such as sucrose, cellulose, starch and amino acids. **Mark awarded for 6(e) = 0 out of 3** **Total mark awarded = 0 out of 11**

How the candidate could have improved the answer

(a) It is clear that the candidate did not know the equation for photosynthesis. Candidates should be encouraged to learn the balanced equations given in the syllabus for biological processes.

(b) The candidate made no attempt to analyse the data. Candidates that struggle with extended prose should be encouraged to use bullet points in their responses. All candidates should be encouraged to describe a general trend first, and then go into more detail, quoting data and including the units. In questions such as this, credit is not available for directly quoting from the table, some analysis of the results is needed. Commenting on the wavelengths that resulted in the highest/lowest rate of photosynthesis would have gained credit here.

(c) A description of how to calculate rate was expected. The use of the term '*calculation*' in this question should indicate to candidates that use of a formula may be required (in words or units, as appropriate). Candidates should be aware of how to calculate the rate of a reaction.

(d) (i) The candidate refers to it being a controlled variable without specifically referring to what is being controlled. The candidate needed to specify '*light intensity*' as the factor to gain credit.

(d) (ii) It is clear that the candidate did not know the use for sodium hydrogencarbonate solution. Candidates should be encouraged to look back at the information in the stem of the question in order to help their responses.

(e) The candidate had the right idea but was not specific enough in their response. Vague references to growth, sugars or food were not accepted. At this level, candidates are expected to refer to specific substances such as sucrose, cellulose, starch and amino acids.

Common mistakes candidates made Question 6

(a) *The examiner was expecting candidates to use the correct chemical formulae to write a balanced chemical equation for photosynthesis. This equation is given in the syllabus. An equation in words was **not** accepted.*

Errors included giving the word equation, writing an equation that was not balanced and giving the equation for aerobic respiration.

(b) *The examiner was expecting an extended prose response that describes what happens to the rate of photosynthesis as the wavelength of light changes, using data from Table 6.1, including units. Candidates were expected to relate the volume of gas to the rate of photosynthesis.*

Many candidates could not detect a pattern in the data and instead just wrote down the results from the table without any form of description. Very few candidates analysed the data to give the four points examiners were looking for: a description of the decrease and then increase of the rate of photosynthesis as wavelength increased; the high rates in blue, violet and red regions of the spectrum; the low rates in green and yellow light; and either the maximum rate of photosynthesis or the minimum rate, with appropriate figures.

(c) *The examiner was expecting a description of how to carry out the calculation. 'Calculation' suggests that some type of formula may be required.*

Many incorrect formulae were seen to calculate the rate of photosynthesis, including using wavelength, and the use of multiplication.

Some candidates weren't specific enough and referred to the '*amount*' of gas rather than the '*volume'* of gas divided by time.

(d)(i) *The examiner was expecting a concise answer that gives a reason for the condition given.*

Many candidates used the phrase '*to make sure there is a fair test*', which was not credited.

Some candidates were not specific enough and referred to controlling the amount of light rather than the light intensity.

(d)(ii) *The examiner was expecting a concise answer that gives a reason for the condition given.*

Many candidates thought that sodium hydrogencarbonate was sodium hydrogencarbonate *indicator solution*. As a result, they wrote about detecting changes in pH and carbon dioxide concentration and measuring how much carbon dioxide is used in photosynthesis by *Cabomba*.

Some candidates thought the solution was to measure the oxygen produced.

(e) *The examiner was expecting candidates to give three uses of carbohydrate by a plant.*

Some candidates gave '*respiration*' and '*for energy*' as two separate uses, but these were considered to be the same marking point so could only be credited one mark.

Some candidates were vague in their responses, and general ideas such as '*growth*' did not gain credit.

Cambridge Assessment International Education
The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA, United Kingdom
t: +44 1223 553554
e: info@cambridgeinternational.org www.cambridgeinternational.org

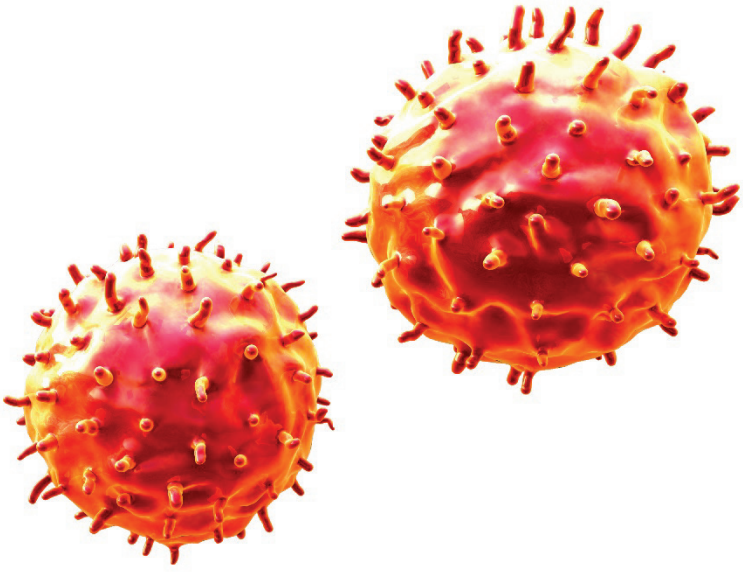
Cambridge Assessment International Education

Example Candidate Responses

Paper 5

Cambridge IGCSE™

Biology 0610



Version 2.0

Cambridge Pathway

In order to help us develop the highest quality resources, we are undertaking a continuous programme of review; not only to measure the success of our resources but also to highlight areas for improvement and to identify new development needs.

We invite you to complete our survey by visiting the website below. Your comments on the quality and relevance of our resources are very important to us.

www.surveymonkey.co.uk/r/GL6ZNJB

Would you like to become a Cambridge International consultant and help us develop support materials?

Please follow the link below to register your interest.

www.cambridgeinternational.org/cambridge-for/teachers/teacherconsultants/

Contents

Introduction

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

In this booklet candidate responses have been chosen to exemplify a range of answers. Each response is accompanied by a brief commentary explaining the strengths and weaknesses of the answers.

For each question, response is annotated with clear explanation of where and why marks were awarded or omitted. This, in turn, followed by examiner comments on how the answer could have been improved. In this way it is possible for you to understand what candidates have done to gain their marks and what they will have to do to improve their marks. At the end there is a list of common mistakes candidates made in their answers for each question.

This document provides illustrative examples of candidate work. These help teachers to assess the standard required to achieve marks, beyond the guidance of the mark scheme. Some question types where the answer is clear from the mark scheme, such as short answers and multiple choice, have therefore been omitted.

The questions, mark schemes and pre-release material used here are available to download from the School Support Hub. These files are:

Question Paper 52, November 2016	
Question paper	0620_w16_qp_52.pdf
Mark scheme	0620_w16_ms_52.pdf

Other past papers, Examiner Reports and other teacher support materials are available on the School Support Hub www.cambridgeinternational.org/support

How to use this booklet

This booklet goes through the paper one question at a time, showing you the high-, middle- and low-level response for each question. The candidate answers are set in a table. In the left-hand column are the candidate answers, and in the right-hand column are the Examiner comments.

Example Candidate Response – high, continued	Examiner comments

You are going to measure the length of the coleoptiles and the total length of the seedlings visible above the soil. You will measure **all** the seedlings grown in the light and **all** the seedlings grown in the dark.

(b) (i) Prepare a table to record your results.

FEATURE	SEEDLINGS GROWN IN LIGHT (L)			SEEDLINGS GROWN IN DARK (D)		
	1	2	3	1	2	3
LENGTH OF COLEOPTILES (cm)	2.0	1.5	3.0	3.0	2.5	3.5
TOTAL LENGTH				42.0	43.0	

2

[6]

2 The table sh
expected featur
main columns i
seedling with su
seedling measu
rows, one for ea
measurements, and an acceptable
unit. All the table cells are filled in
and the results show the expected
pattern.

Mark awarded for (b) (i) = 6 out of 6

Answers by real candidates in exam conditions. These show you the types of answers for each level.

Discuss and analyse the answers with your learners in the classroom to improve their skills.

Examiner comments are alongside the answers, linked to specific part of the answer. These explain where and why marks were awarded. This helps you to interpret the standard of Cambridge exams and helps your learners to refine exam technique.

How the candidate could have improved the answer

(a) The first feature needed only to be 'colour'. For the
another **visible** feature such as the length of the plan

(b) The format of the table was acceptable, although
'Light condition' or 'place of growth'. Alternatively ano
and dark, and the current first column headed 'sample
always go in the column or row heading.

This explains how the candidate could have improved the answer. This helps you to interpret the standard of Cambridge exams and helps your learners to refine exam technique.

Common mistakes candidates made in this question

(a) Poor identification of the features being compared

(b) (i) Failing to read the instructions so that tables co
outside columns or rows, putting units in the body of t

This describes the common mistakes candidates made in answering each question. This will help your learners to avoid these mistakes at the exam and give them the best chance of achieving a high mark.

Assessment at a glance

All candidates take three papers.

Candidates who have studied the Core subject content, or who are expected to achieve a grade D or below, should be entered for Paper 1, Paper 3 and either Paper 5 or Paper 6. These candidates will be eligible for grades C to G.

Candidates who have studied the Extended subject content (Core and Supplement), and who are expected to achieve a grade C or above, should be entered for Paper 2, Paper 4 and either Paper 5 or Paper 6. These candidates will be eligible for grades A* to G.

Core candidates take:

Paper 1 45 minutes
Multiple Choice 30%
40 marks
40 four-choice multiple-choice questions
Questions will be based on the Core subject content
Assessing grades C–G
Externally assessed

Extended candidates take:

Paper 2 45 minutes
Multiple Choice 30%
40 marks
40 four-choice multiple-choice questions
Questions will be based on the Extended subject content (Core and Supplement)
Assessing grades A*–G
Externally assessed

and Core candidates take:

Paper 3 1 hour 15 minutes
Theory 50%
80 marks
Short-answer and structured questions
Questions will be based on the Core subject content
Assessing grades C–G
Externally assessed

and Extended candidates take:

Paper 4 1 hour 15 minutes
Theory 50%
80 marks
Short-answer and structured questions
Questions will be based on the Extended subject content (Core and Supplement)
Assessing grades A*–G
Externally assessed

All candidates take either:

Paper 5 1 hour 15 minutes
Practical Test 20%
40 marks
Questions will be based on the experimental skills in Section 4
Assessing grades A*–G
Externally assessed

or:

Paper 6 1 hour
Alternative to Practical 20%
40 marks
Questions will be based on the experimental skills in Section 4
Assessing grades A*–G
Externally assessed

Teachers are reminded that the latest syllabus is available on our public website at www.cambridgeinternational.org and the School Support Hub at www.cambridgeinternational.org/support

Paper 5 – Practical Test

Question 1

Example Candidate Response – high	Examiner comments

1 Maize (corn) is an important food crop that produces grain. Fig. 1.1 shows a maize grain that has germinated to form a seedling.

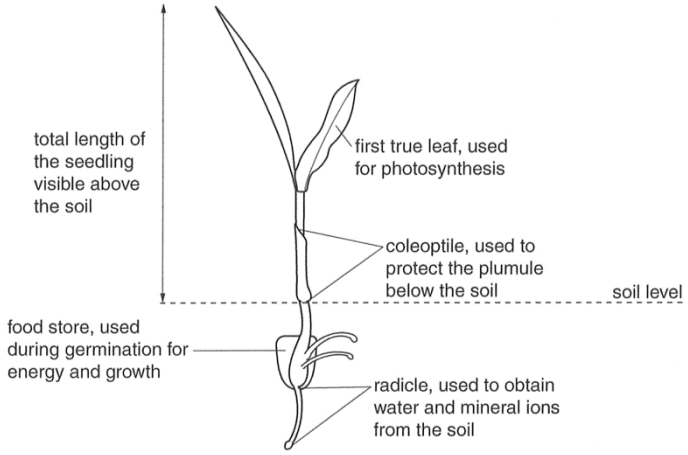


Fig. 1.1

You are going to investigate the effect of light on the germination and early growth of maize. You will measure and observe maize grown in the light and maize grown in the dark.

Three maize grains were planted in each of the two pots labelled **L** and **D**.
One pot (**L**) was placed in the light and the other pot (**D**) placed in the dark.
The seedlings were kept at a constant temperature.

Step 1 Observe the appearance of the seedlings carefully.

(a) Complete Table 1.1 by recording two **visible** differences in the seedlings grown in the light and the seedlings grown in the dark.

Table 1.1

feature	seedlings grown in the light	seedlings grown in the dark
Stem	upright, firm	bending, weak, floppy
Leaves	green in colour	pale yellow in colour 1

[2]

1 The candidate gives two acceptable answers. The feature 'leaves' is accepted because the description included a reference to colour.

Mark awarded for (a) = 2 out of 2

Example Candidate Response – high, continued

You are going to measure the length of the coleoptiles and the total length of the seedlings visible above the soil. You will measure **all** the seedlings grown in the light and **all** the seedlings grown in the dark.

(b) (i) Prepare a table to record your results.

FEATURE	SEEDLINGS GROWN IN LIGHT (L)			SEEDLINGS GROWN IN DARK (D)		
	1	2	3	1	2	3
LENGTH OF COLEOPTILES (cm)	2.0	1.5	3.0	3.0	2.5	3.5
TOTAL LENGTH OF SEEDLING (cm)	39.0	41.0	41.0	42.0	~~42~~.0	43.0

2

[6]

Step 2 Use a ruler to measure the length of the coleoptile and the total length of the seedling visible above the soil for each seedling.

Record the results for the seedlings grown in pot **L** and in pot **D** in your table.

(ii) Look at Table 1.1 and the results of your measurements.
State **two** conclusions that can be made about the effect of light on the germination and early growth of maize.

1 Lack of light causes the lack of photosynthesis and the lack of production of chlorophyll 3

4

2 Lack of light causes the plant to be weaker

[2]

Examiner comments

2 The table shows all the expected features. There are two main columns identifying the type of seedling with sub-columns for each seedling measured. There are two rows, one for each of the expected measurements, and an acceptable unit. All the table cells are filled in and the results show the expected pattern.

Mark awarded for (b) (i) = 6 out of 6

3 This answer is acceptable. Although not required, the candidate has used correct knowledge about the green colour to answer the question.

4 This answer is not accepted because the word 'weaker' is too vague and is re-stating the comparison made in (a).

Mark awarded for (b) (ii) = 1 out of 2

Example Candidate Response – high, continued	Examiner comments

Use gloves and eye protection while carrying out steps 3 to 14 of the practical work for question 1.

Step 3 Use a marker pen to draw a line down the centre of a white tile. Label one side **L** and the other side **D**.

Step 4 Use a spatula to carefully dig out from each pot, **two** of the seedlings grown in the light and **two** of the seedlings grown in the dark.

Step 5 Use a scalpel or razor blade to cut the remains of the food store from each of the seedlings.

Step 6 Use the water in the beaker labelled **water for washing** to wash each of these food stores and remove the outer covering. Put the outer covering in the beaker labelled **waste**.

Step 7 Place the food stores from the seedlings grown in the light on the side of the tile labelled **L** and the food stores from seedlings grown in the dark on the side of the tile labelled **D**.

Step 8 Wash the spatula in the beaker labelled **water for washing** and dry it with a paper towel. Use the spatula to crush together the two food stores from the seedlings grown in the light on the part of the tile labelled **L**.

Separate the crushed food store into two equal parts spaced at least 2 cm apart, as shown in Fig. 1.2.

Step 9 Repeat step 8 using the two food stores from the seedlings grown in the dark on the part of the tile labelled **D**.

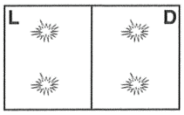


Fig. 1.2

Step 10 Label two test-tubes, one with the letter **L** and the other with the letter **D**.

Step 11 Scrape one of the food stores from the seedlings grown in the light into the test-tube labelled **L**. Add 2 cm^3 of water from the beaker labelled **water**, taking care to wash the crushed food store to the bottom of the test-tube.

Step 12 Repeat step 11 using one of the food stores from the seedlings grown in the dark and the test-tube labelled **D**.

Step 13 Carry out a Benedict's test on the contents of test-tube **L** and test-tube **D**.

Raise your hand when you are ready for hot water to be placed in the beaker labelled **water-bath**.

Leave the test-tubes for 5 minutes.

During this time carry out step 14 and answer question **(c)(i)**.

Step 14 Add 1 drop of iodine solution to the remaining two food stores on the white tile. Record your results in Table 1.2.

Example Candidate Response – high, continued	Examiner comments
(c) (i) Describe how to carry out a biuret test on a crushed food store. 5 Crush up the food source and place it in a test tube. Add some water and shake the test tube. Add biuret solution and if it turns purple protein is present. [1] (ii) The results of a biuret test are recorded in Table 1.2. Complete step 13 by recording the results of your Benedict's tests in Table 1.2. **Table 1.2** test / seedlings grown in light / seedlings grown in dark biuret / purple / purple Benedict's / blue / blue iodine / dark brown / blue black 6 [2] (iii) State the conclusion for the results shown in Table 1.2. Plants grown in the dark contain starch, Plants grown in the light don't 7 [1]	5 This is a correct answer. Mark awarded for (c) (i) = 1 out of 1 6 The results for Benedict's test are accepted but the results for the iodine test are not accepted because the supervisor report gives different results from those of the candidate. Mark awarded for (c) (ii) = 1 out of 2 7 This conclusion does not include all the results. Mark awarded for (c) (iii) = 0 out of 1

Example Candidate Response – high, continued

(d) A group of students investigated the changes in dry mass during germination and growth of maize grown in the light and maize grown in the dark.

The dry mass is the total mass left after all the water has been evaporated.

Table 1.3 shows the results of the investigation for the maize seedlings grown in the light.

Table 1.3

	time / days										
	0	2	4	6	8	10	12	14	16	18	20
dry mass of 10 maize seedlings / g	22	20	17	12	10	8	11	13	14	15	17

(i) Describe a method the students could have used to carry out this investigation.

Use the information on **page 2** to help you.

Plant 10 seeds in the soil in a container with the same type of soil. Place a seed that has not been planted in the oven to remove the water, and measure it's dry mass. At 2 day intervals dig up one of the seeds you planted, place it in the oven to dry out, and measure it's dry mass by weighing it on a scales. Record your readings. For the seeds that germinate cut off the leaves, stem and roots, and only measure the dry mass of the food store.

[6]

(ii) Suggest why the students measured the dry mass instead of the mass including water in their investigation.

To have a more accurate result in how much actual mass is produced

[1]

[Total: 21]

Examiner comments

8 The candidate gains credit for knowing the seeds have to be planted, but does not realise that there should be seeds in both light and dark, or that 10 seeds is not enough, as according to the information given 10 seedlings are removed every two days.

9 The candidate gains credit for a correct method of drying.

10 mp9 could have been credited as an error carried forward for planting too few seeds but as the candidate then goes on to weigh only the food store, this mark is rejected (R).

11 The candidate gains credit for understanding that the starting dry mass was needed.

Mark awarded for (d) (i) = 3 out of 6

12 This is true, but to gain credit there must be more explanation of why the result is more accurate.

Mark awarded for (d) (ii) = 0 out of 1

Total mark awarded = 14 out of 21

How the candidate could have improved the answer

(a) For the first feature, ‘colour’ was enough to gain the mark. For the second feature, the candidate needed to choose another **visible** feature such as the length of the plant.

(b) The format of the table was acceptable although the labelling of the first column would have been better as ‘light condition’ or ‘place of growth’. Alternatively, another column could have been added, with row headings ‘light’ and ‘dark’ and the current first column headed ‘sample’ or ‘seedling’. Candidates need to remember that units always go in the column heading or row heading.

(c) (i) The results of the test were not required. Only the method of the test was required.

(c) (ii) The candidate’s answer could not be allowed because the supervisor report was ‘green’ . This illustrates the importance of the supervisor report in this examination.

(c) (iii) The candidate’s answer to (c) (ii) indicated they were expecting lilac as a positive result and that they did not realise lilac is a type of purple. Candidates need to know that the actual colour given by the biuret test is purple, which can also be described as lilac or violet.

(d) (i) The candidate needed to understand more clearly what the experiment was about and to make sure they knew what was being measured. The candidate needed to work out what the information in Table 1.3 told them about the number of seeds being measured and how often, so they could include this in their method. They also needed to include variables that needed to be kept constant and a method of drying the seedlings before measuring.

(d) (ii) Although this was a correct answer, it could have been written more succinctly.

Example Candidate Response – middle	Examiner comments

1 Maize (corn) is an important food crop that produces grain. Fig. 1.1 shows a maize grain that has germinated to form a seedling.

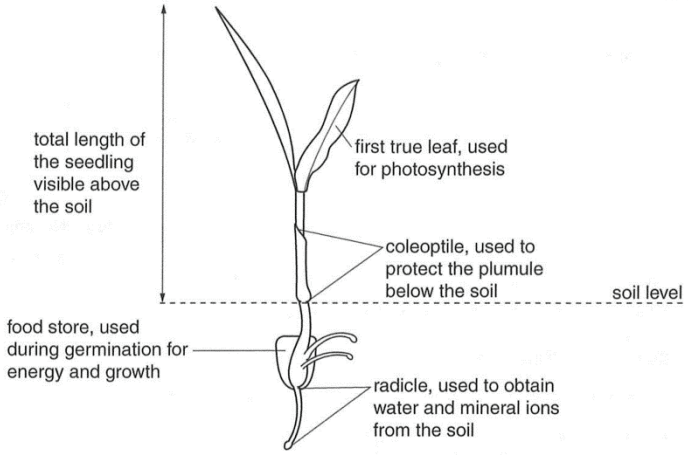


Fig. 1.1

You are going to investigate the effect of light on the germination and early growth of maize. You will measure and observe maize grown in the light and maize grown in the dark.

Three maize grains were planted in each of the two pots labelled **L** and **D**.
One pot (**L**) was placed in the light and the other pot (**D**) placed in the dark.
The seedlings were kept at a constant temperature.

Step 1 Observe the appearance of the seedlings carefully.

(a) Complete Table 1.1 by recording two **visible** differences in the seedlings grown in the light and the seedlings grown in the dark.

Table 1.1

feature	seedlings grown in the light	seedlings grown in the dark
Leaves	Fresh (green)	Pale (yellowish)
Coleoptile	green coloured	White coloured

[2]

1 The candidate gains credit for both answers, although the features are not clearly stated.

Mark awarded for (a) (i) = 2 out of 2

Example Candidate Response – middle, continued

You are going to measure the length of the coleoptiles and the total length of the seedlings visible above the soil. You will measure **all** the seedlings grown in the light and **all** the seedlings grown in the dark.

(b) (i) Prepare a table to record your results.

	Seedlings grown (L) in the light	Seedlings grown (D) in the dark
length of coleoptiles (cm)	3 cm	9.5 cm
Total length of the seedlings (cm)	22.7 cm	30.8 cm

2

[6]

Step 2 Use a ruler to measure the length of the coleoptile and the total length of the seedling visible above the soil for each seedling.

Record the results for the seedlings grown in pot **L** and in pot **D** in your table.

(ii) Look at Table 1.1 and the results of your measurements.
State **two** conclusions that can be made about the effect of light on the germination and early growth of maize.

3

1 If the light is where the place the maize grown, the coleoptiles is smaller than it is grown in the dark

2 The growth of maize that is grown in light is more rapid/faster compare to the maize grown in the dark 4

[2]

2 The table has two clear columns for the independent variables and two rows for the dependent variables, gaining some credit. The units are in the row headings, but also in the body of the table, so invalidating the mark. There are insufficient spaces for all the expected results. The candidate appears to only record one result for each measurement. Because the supervisor report does not indicate a problem in providing sufficient plants, credit is not given for recording results.

Mark awarded for (b) (i) = 2 out of 6

3 This answer is not accepted because it only describes the results.

4 This answer is not accepted because no information is provided about the age of the plants grown in the dark in comparison to the plants grown in the light. Also the evidence indicates that plants grown in the dark are taller than plants grown in the light.

Mark awarded for (b) (ii) = 0 out of 2

Example Candidate Response – middle, continued	Examiner comments

Use gloves and eye protection while carrying out steps 3 to 14 of the practical work for question 1.

Step 3 Use a marker pen to draw a line down the centre of a white tile.
Label one side **L** and the other side **D**.

Step 4 Use a spatula to carefully dig out from each pot, **two** of the seedlings grown in the light and **two** of the seedlings grown in the dark.

Step 5 Use a scalpel or razor blade to cut the remains of the food store from each of the seedlings.

Step 6 Use the water in the beaker labelled **water for washing** to wash each of these food stores and remove the outer covering. Put the outer covering in the beaker labelled **waste**.

Step 7 Place the food stores from the seedlings grown in the light on the side of the tile labelled **L** and the food stores from seedlings grown in the dark on the side of the tile labelled **D**.

Step 8 Wash the spatula in the beaker labelled **water for washing** and dry it with a paper towel. Use the spatula to crush together the two food stores from the seedlings grown in the light on the part of the tile labelled **L**.

Separate the crushed food store into two equal parts spaced at least 2 cm apart, as shown in Fig. 1.2.

Step 9 Repeat step 8 using the two food stores from the seedlings grown in the dark on the part of the tile labelled **D**.

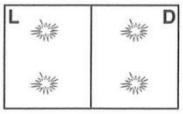


Fig. 1.2

Step 10 Label two test-tubes, one with the letter **L** and the other with the letter **D**.

Step 11 Scrape one of the food stores from the seedlings grown in the light into the test-tube labelled **L**. Add 2 cm^3 of water from the beaker labelled **water**, taking care to wash the crushed food store to the bottom of the test-tube.

Step 12 Repeat step 11 using one of the food stores from the seedlings grown in the dark and the test-tube labelled **D**.

Step 13 Carry out a Benedict's test on the contents of test-tube **L** and test-tube **D**.

Raise your hand when you are ready for hot water to be placed in the beaker labelled **water-bath**.

Leave the test-tubes for 5 minutes.

During this time carry out step 14 and answer question **(c)(i)**.

Step 14 Add 1 drop of iodine solution to the remaining two food stores on the white tile. Record your results in Table 1.2.

Example Candidate Response – middle, continued	Examiner comments

(c) (i) Describe how to carry out a biuret test on a crushed food store.

drop the solution into the crushed food store

5 .....[1]

(ii) The results of a biuret test are recorded in Table 1.2.
Complete step 13 by recording the results of your Benedict's tests in Table 1.2.

Table 1.2

test	seedlings grown in light	seedlings grown in dark
biuret	purple	purple
Benedict's	yellow	yellow
iodine	Black	Black

6

[2]

(iii) State the conclusion for the results shown in Table 1.2.

The starch is present in the maize

7 .....[1]

5 Benefit of the doubt is given that 'the solution' is the biuret solution.

Mark awarded for (c) (i) = 1 out of 1

6 Both marks are awarded as the candidate's results agree with those of the supervisor.

Mark awarded for (c) (ii) = 2 out of 2

7 This answer is not accepted because not all the results in Table 1.2 have been considered.

Mark awarded for (c) (iii) = 0 out of 1

Example Candidate Response – middle, continued

(d) A group of students investigated the changes in dry mass during germination and growth of maize grown in the light and maize grown in the dark.

The dry mass is the total mass left after all the water has been evaporated.

Table 1.3 shows the results of the investigation for the maize seedlings grown in the light.

Table 1.3

	time / days										
	0	2	4	6	8	10	12	14	16	18	20
dry mass of 10 maize seedlings / g	22	20	17	12	10	8	11	13	14	15	17

(i) Describe a method the students could have used to carry out this investigation.

Use the information on **page 2** to help you.

Students should grown the maize grown in light and maize grown in dark with the constant temperature, every 2 days, the students should measure the weight in grams and make the record. [6]

(ii) Suggest why the students measured the dry mass instead of the mass including water in their investigation.

If the water is counted, the result will not be specific & the weight of water may vary. [1]

[Total: 21]

Examiner comments

8 The candidate gains credit for growing seeds in the light and the dark. The number of seeds and how they are grown is not considered.

9 The candidate gains credit for one controlled variable.

10 There is not enough information for credit. The candidate does not mention the number of seedlings nor any method of drying the seedlings.

Mark awarded for (d) (i) = 2 out of 6

11 This answer is acceptable.

Mark awarded for (d) (ii) = 1 out of 1

Total mark awarded = 10 out of 21

How the candidate could have improved the answer

(a) The features could have been more clearly shown and the descriptions could have been more precise. The colour in brackets for the 'leaves' gained credit. The comparison 'fresh and pale' was not valid.

(b) (i) The candidate needed to read the instructions before answering the question in order to prepare a suitable table and to put units only in the table headings.

(b) (ii) The candidate needed to give an effect that light or lack of light might have on the germination, growth or colour of the seedlings.

(c) (i) The answer would have been clearer if the candidate had specified biuret solution in their answer and included the apparatus in which the test was done.

(c) (ii) The candidate needed to use 'blue-black' to describe the colour of iodine with starch.

(c) (iii) The answer should have included the conclusions for the biuret test and Benedict's test.

(d) (i) The answer should have contained more detail, e.g. the number of seeds needed, the number of seedlings weighed and how the seedlings were dried.

(d) (ii) The candidate needed to make it clearer that the water content of seedlings varied all the time.

Common mistakes candidates made in this question

(a) Poor identification of the features being compared, e.g. 'leaf' instead of 'colour of leaf'.

(b) (i) Failing to read the instructions so that tables contained the wrong number of results, writing headings outside columns or rows, putting units in the body of the table.

(b) (ii) Re-stating the comparisons from (a).

(c) (i) Heating the biuret solution to obtain a colour change.

(c) (ii) Imprecise colours, e.g. brown-black, red-purple.

(c) (iii) Omitting some of the results from the conclusion, commonly biuret.

(d) (i) Poor comprehension of the information given resulting in methods that did not make sense, e.g. uprooting seedlings, drying and weighing them, replanting them to grow for another two days.

Question 2

Example Candidate Response – high

2 (a) A group of students investigated the effect of two different exercises on the heart rate of ten male and ten female students.

Before the first exercise, the pulse rate at rest was measured and the group then jumped on the same spot for two minutes without moving their arms. Every two seconds an investigator shouted 'jump'.

After two minutes the pulse rate was measured and the students were allowed ten minutes to rest.

Before the second exercise, the pulse rate at rest was measured again and the group was asked to do a different exercise.

The students jumped on the same spot for two minutes lifting their arms above their head as they jumped up and dropping their arms as they came down. Every two seconds an investigator shouted 'jump'.

Table 2.1 shows the results of this investigation.

Table 2.1

activity	average pulse rate/beats per minute		
	male students	female students	all students
resting	68	74	71
after jumping	96	92	94
after jumping and moving arms	128	140	134

1

(i) Complete Table 2.1 by writing in the average pulse rate for all students after both forms of exercise.

[2]

(ii) Describe **two** variables in this investigation that have been controlled.

1 the duration of both forms of exercise were kept constant at 2 minutes.

2

2 the investigator shouted the word jump every 2 seconds for each form of exercise

[2]

(iii) Explain why the students had to rest before carrying out the second exercise.

3

to ensure the pulse rate would reduce back down to the rate before the exercise. [1]

(iv) State **one** variable that cannot be controlled during the exercise and describe the effect of this variable on the results of the investigation.

variable the different pulse rates of each student

4

effect on results the average pulse rate may significantly drop or rise because of one students pulse rate which may be totally different to the other students. [2]

Examiner comments

1 Both calculations are correct.

Mark awarded for (a) (i) = 2 out of 2

2 Both answers are correct and stated clearly.

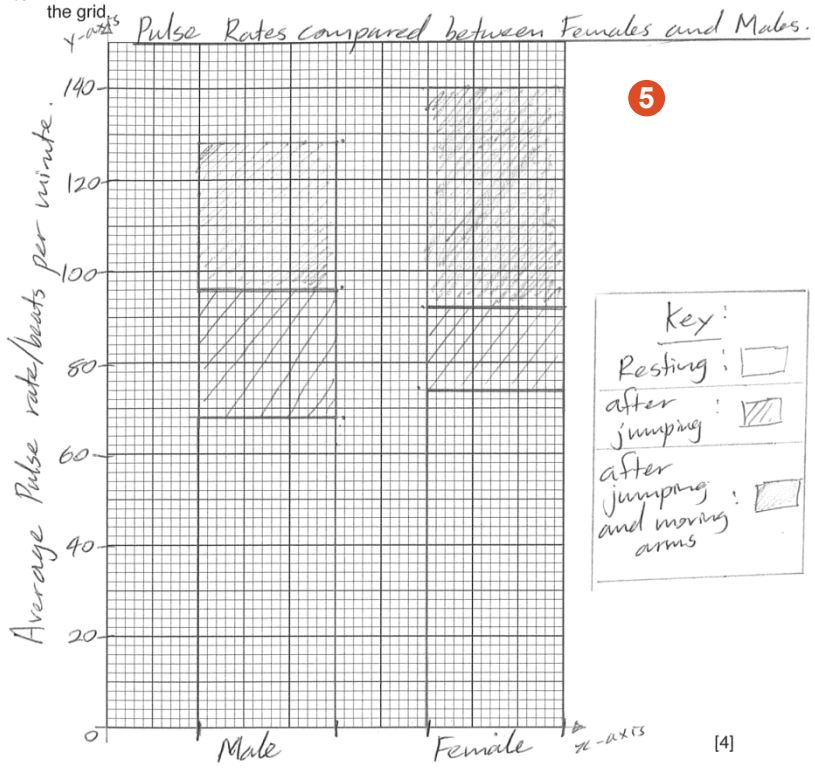
Mark awarded for (a) (ii) = 2 out of 2

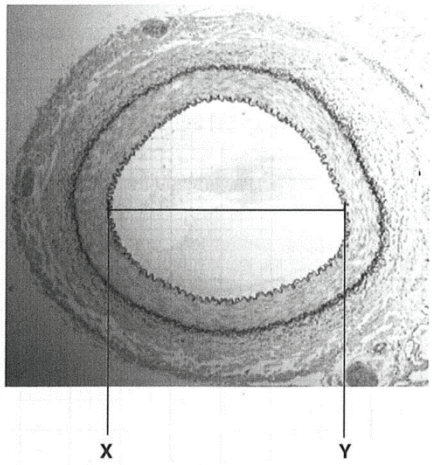
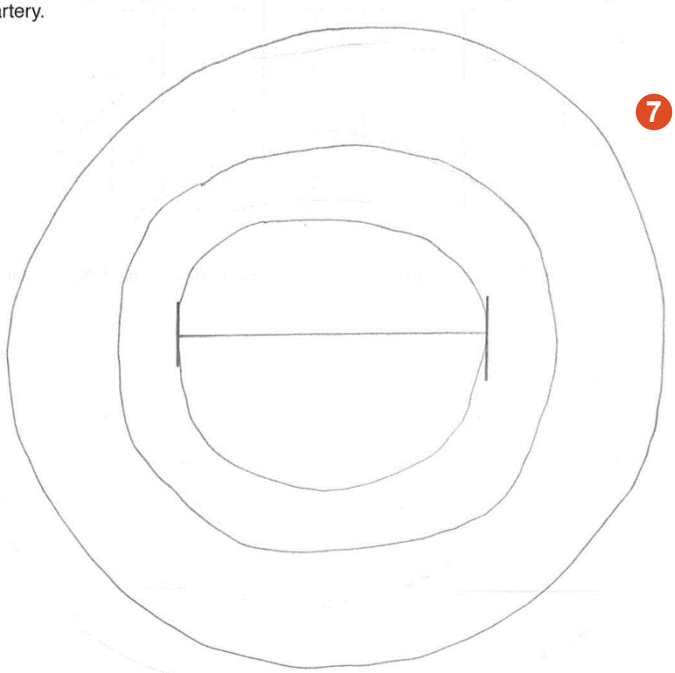
3 This answer is correct and written succinctly.

Mark awarded for (a) (iii) = 1 out of 1

4 This answer is not accepted because the candidate describes the dependent variable in the investigation.

Mark awarded for (a) (iv) = 0 out of 2

Example Candidate Response – high, continued	Examiner comments
(b) (i) Plot a bar chart of the data in Table 2.1, for both the male and the female students, on the grid.  5 [4] (ii) State **one** similarity and **one** difference the effect of exercise has on males and females. similarity ~~They~~ their pulse rates both increase with exercise. 6 difference the females ~~heart~~ pulse rate increases higher than the males pulse rate with exercise. ~~Compare~~ [2]	5 There is a suitably labelled scale on the y-axis and the bars are plotted accurately. The candidate also identifies and separates the two main categories on the x-axis and identifies the individual bars by a key. Mark awarded for (b) (i) = 4 out of 4 6 The similarity is acceptable, but the difference given is not precise enough because the female heart rate does not always increase more than the male heart rate. Mark awarded for (b) (ii) = 1 out of 2

Example Candidate Response – high, continued	Examiner comments
(c) Fig. 2.1 shows a photomicrograph of a cross section of an artery from a mammal.  **Fig. 2.1** **(i)** Make a large diagram of this cross section to show the layers forming the wall of the artery.  7 [3]	7 The candidate gains credit for a drawing with clear and continuous lines and because the diagram is large enough to occupy most of the space provided. Their observation is not sufficient to gain credit because the drawing does not show the irregular appearance of the inner layer. Mark awarded for (c) (i) = 2 out of 3

Example Candidate Response – high, continued	Examiner comments
(ii) Measure the diameter of the lumen of the artery between points **X** and **Y** on Fig. 2.1. **Include the unit.** Diameter of the lumen on Fig. 2.1 ..... 47mm ..... 8 Draw a line in the same position on your drawing and measure the diameter of the lumen on your drawing. Diameter of the lumen on your drawing ..... 62mm ..... 9 magnification = diameter of the lumen on your drawing / diameter of the lumen on Fig. 2.1 Calculate the magnification of your drawing using the equation given and your answers. Show your working. Mgn = Drawing / Actual = 62mm / 47mm = 1.319148936 10 magnification ..... x1.32 ..... [3] **[Total: 19]**	8 This is a correct measurement and unit. 9 The line drawn is in the correct position and the measurement is correct. 10 The calculation is correct and the candidate has rounded to a sensible value although this is not required by the question. Mark awarded for (c) (ii) = 3 out of 3 **Total mark awarded = 15 out of 19**

How the candidate could have improved the answer

(a) (ii) to **(iii)** A capital letter at the start of the sentences would have been grammatically correct.

(a) (iv) The candidate needed to think about the actual exercise and what might vary while it was being carried out, not what would change as a result of the exercise.

(b) (i) Although the type of bar chart was acceptable, separate bars for each activity would have conveyed the information more clearly. It was not necessary to identify the *x*-axis and *y*-axis with labels. The arrow heads added to the axes were ignored but these should not be added to a scale with numerical values or a bar chart axis.

(b) (ii) The candidate needed to state which of the exercises resulted in a higher pulse rate in females.

(c) The candidate needed to observe more carefully and draw a wavy line for the inner layer of the drawing.

Example Candidate Response – middle

2 (a) A group of students investigated the effect of two different exercises on the heart rate of ten male and ten female students.

Before the first exercise, the pulse rate at rest was measured and the group then jumped on the same spot for two minutes without moving their arms. Every two seconds an investigator shouted 'jump'.

After two minutes the pulse rate was measured and the students were allowed ten minutes to rest.

Before the second exercise, the pulse rate at rest was measured again and the group was asked to do a different exercise.

The students jumped on the same spot for two minutes lifting their arms above their head as they jumped up and dropping their arms as they came down. Every two seconds an investigator shouted 'jump'.

Table 2.1 shows the results of this investigation.

Table 2.1

activity	average pulse rate/beats per minute		
	male students	female students	all students
resting	68	74	71
after jumping	96	92	94
after jumping and moving arms	128	140	134

1

(i) Complete Table 2.1 by writing in the average pulse rate for all students after both forms of exercise.

[2]

(ii) Describe **two** variables in this investigation that have been controlled.

1 Time 2

2 Where the students jumped, they must land on the same spot. 3

[2]

(iii) Explain why the students had to rest before carrying out the second exercise.

So their pulse rate can go back to normal so it 4

[1]

(iv) State **one** variable that cannot be controlled during the exercise and describe the effect of this variable on the results of the investigation. 5

variable How high the students jump

effect on results This will alter the results, as the students will jump at different heights.

[2]

Examiner comments

1 Both calculations are correct.

Mark awarded for (a) (i) = 2 out of 2

2 This answer is not accepted because the candidate does not state the aspect of the investigation which has a controlled time.

3 This is not an acceptable variable because it is unlikely to affect the dependent variable.

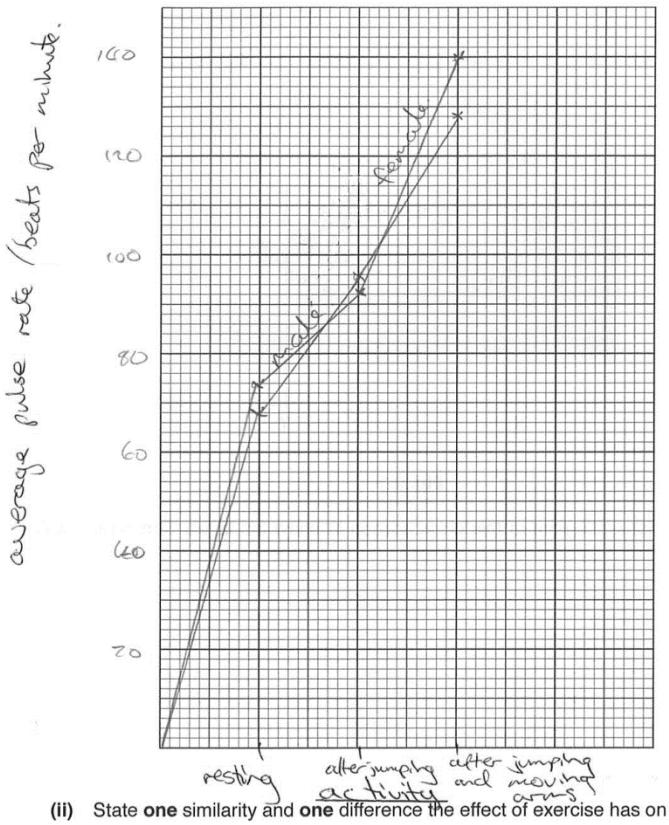
Mark awarded for (a) (ii) = 0 out of 2

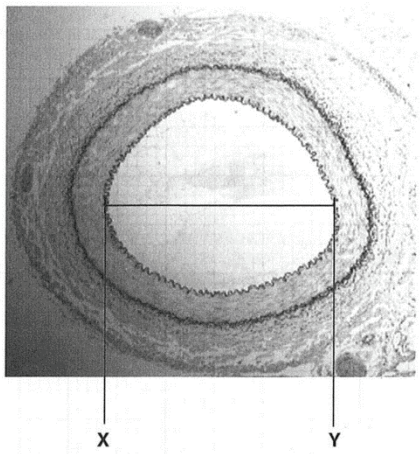
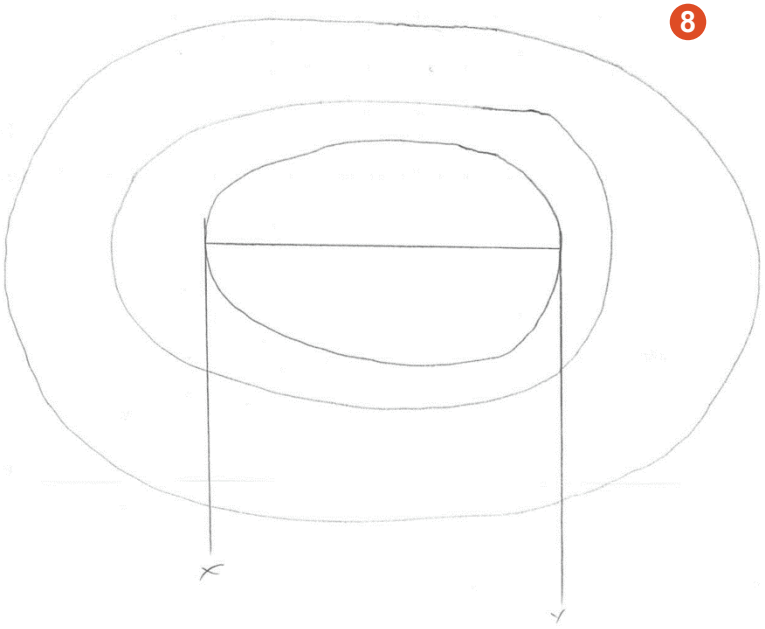
4 This answer is acceptable.

Mark awarded for (a) (iii) = 1 out of 1

5 The variable is acceptable but the effect on results is too vague for credit. The candidate does not say how the results would be affected.

Mark awarded for (a) (iv) = 1 out of 2

Example Candidate Response – middle, continued	Examiner comments
(b) (i) Plot a bar chart of the data in Table 2.1, for both the male and the female students, on the grid.  6 [4] **(ii)** State **one** similarity and **one** difference the effect of exercise has on males and females. similarity heart beat per minute increases 7 difference male heart rate increases less than females [2]	6 The candidate gains some credit but because they draw a line graph instead of a bar chart, maximum credit is not available. The axes and the scale on the *y*-axis are suitable. The *y*-axis label is correct and the different exercises are identified on the *x*-axis. The plots are incorrect – some of them are misidentified by incorrect labels on the lines. Mark awarded for (b) (i) = 2 out of 4 7 The similarity is acceptable even though the candidate refers to heart beat rather than what is actually being measured (pulse/heart rate). The difference given is not precise enough. Mark awarded for (b) (ii) = 1 out of 2

Example Candidate Response – middle, continued	Examiner comments
(c) Fig. 2.1 shows a photomicrograph of a cross section of an artery from a mammal.  **Fig. 2.1** **(i)** Make a large diagram of this cross section to show the layers forming the wall of the artery.  8 [3]	8 The drawing is large enough and drawn with clear lines but the inner line does not show sufficient detail for any credit. Mark awarded for (c) (i) = 2 out of 3

Example Candidate Response – middle, continued	Examiner comments
(ii) Measure the diameter of the lumen of the artery between points **X** and **Y** on Fig. 2.1. **Include the unit.** Diameter of the lumen on Fig. 2.1 ..... 4.7cm ..... 9 Draw a line in the same position on your drawing and measure the diameter of the lumen on your drawing. Diameter of the lumen on your drawing ..... 7.2cm ..... 10 magnification = diameter of the lumen on your drawing / diameter of the lumen on Fig. 2.1 Calculate the magnification of your drawing using the equation given and your answers. Show your working. 7.2cm / 4.7cm = 1.5cm 11 magnification ~~x~~ 1.5cm ..... [3] **[Total: 19]**	9 The candidate gives a correct measurement with a suitable unit for Fig. 2.1. 10 The measurement of the drawing is accepted because it is within 1 mm of the measurement made by the supervisor. 11 The candidate uses the correct figures and calculates correctly but includes a unit in their answer, invalidating the mark. Mark awarded for (c) (ii) = 2 out of 3 **Total mark awarded = 11 out of 19**

How the candidate could have improved the answer

(a) (ii) The candidate needed to include the time interval they were referring to. Because there were three possible situations where time was being measured, maximum credit could have been obtained by a clear statement about two of them. In choosing a controlled variable the candidate needed to think more carefully about which variables would affect the reliability of the results.

(a) (iii) The sentence construction could have been more grammatically correct.

(a) (iv) The candidate needed to answer the question instead of rephrasing their answer to 'variable' part.

(b) (i) The candidate needed to read the question more carefully and follow the instruction about the type of graph to plot.

(b) (ii) The candidate needed to state the exercise during which the male pulse rate increased at a slower rate than the female pulse rate.

(c) (i) The candidate should have used a sharper pencil – some of the lines are quite thick. They also needed to observe the appearance of the inner lining of Fig. 2.1 more carefully and draw a wavy line.

(c) (ii) The unit should have been omitted from the magnification.

Example Candidate Response – low

2 (a) A group of students investigated the effect of two different exercises on the heart rate of ten male and ten female students.

Before the first exercise, the pulse rate at rest was measured and the group then jumped on the same spot for two minutes without moving their arms. Every two seconds an investigator shouted 'jump'.

After two minutes the pulse rate was measured and the students were allowed ten minutes to rest.

Before the second exercise, the pulse rate at rest was measured again and the group was asked to do a different exercise.

The students jumped on the same spot for two minutes lifting their arms above their head as they jumped up and dropping their arms as they came down. Every two seconds an investigator shouted 'jump'.

Table 2.1 shows the results of this investigation.

Table 2.1

activity	average pulse rate/beats per minute		
	male students	female students	all students
resting	68	74	71
after jumping	96	92	94
after jumping and moving arms	128	140	134

(i) Complete Table 2.1 by writing in the average pulse rate for all students after both forms of exercise.

[2]

(ii) Describe **two** variables in this investigation that have been controlled.

1 Resting it is a low cam

2 After jumping and moving arms

[2]

(iii) Explain why the students had to rest before carrying out the second exercise.

To reduce heat beats

[1]

(iv) State **one** variable that cannot be controlled during the exercise and describe the effect of this variable on the results of the investigation.

variable ~~The heat beating fast~~ After jumping and moving arms

effect on results the average pulse rate /beats per minutes is high in all students it is 134 beats per minutes

[2]

Examiner comments

1 Both calculations are correct.

Mark awarded for (a) (i) = 2 out of 2

2 There is nothing relevant in this answer. Responses appear to be copies of row headings.

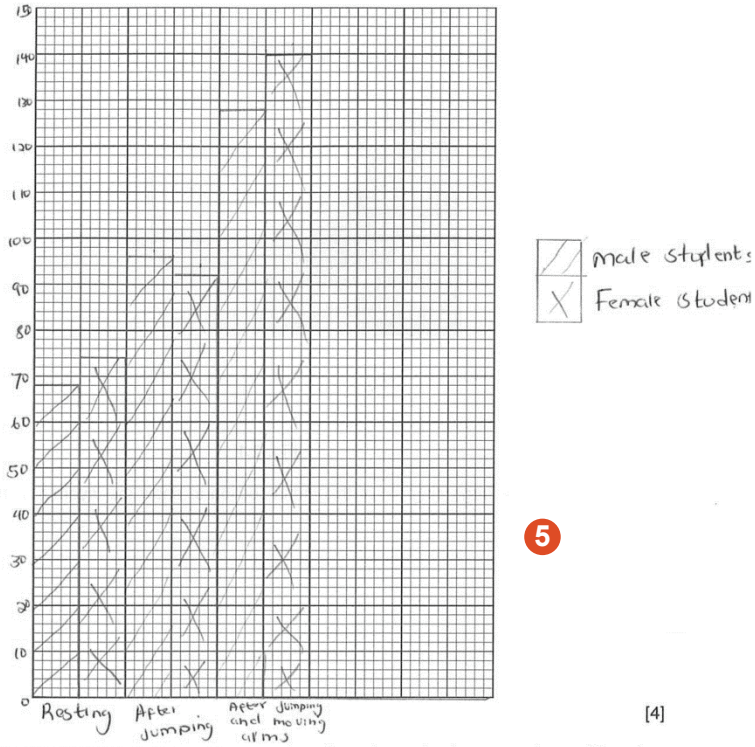
Mark awarded for (a) (ii) = 0 out of 2

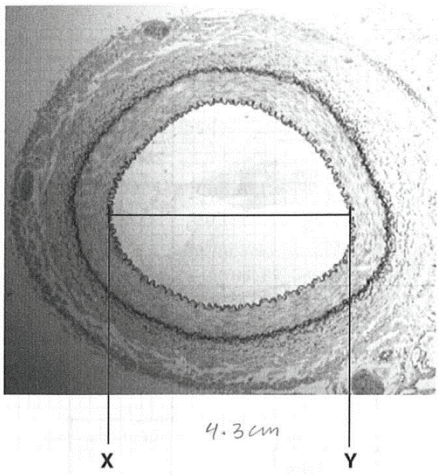
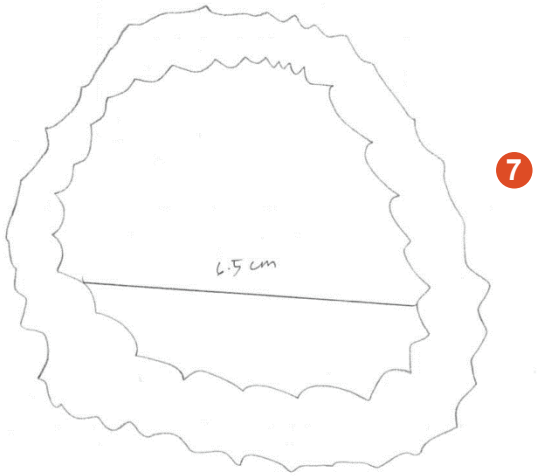
3 There is not quite enough in this answer to gain credit.

Mark awarded for (a) (iii) = 0 out of 1

4 The candidate's answer is one aspect of the independent variable, but they have not said how it might not be controlled. The rest of the answer is a description of the effect of the independent variable on the dependent variable.

Mark awarded for (a) (iv) = 0 out of 2

Example Candidate Response – low, continued	Examiner comments
(b) (i) Plot a bar chart of the data in Table 2.1, for both the male and the female students, on the grid.  5 [4] **(ii)** State **one** similarity and **one** difference the effect of exercise has on males and females. similarity After jumping that exercise almost has the same average pulse rate/beats per minute. There are both in the 90's. female students have 92 male students have 92 difference Resting females rest more compared to males. Females have 74 beats per minutes while males have 68 beats per minutes 6 [2]	5 Credit is given for a suitable scale and correct plots. Mark awarded for (b) (i) = 2 out of 4 6 The similarity is acceptable but the difference is related to resting, not to an effect of exercise. Mark awarded for (b) (ii) = 1 out of 2

Example Candidate Response – low, continued	Examiner comments
(c) Fig. 2.1 shows a photomicrograph of a cross section of an artery from a mammal.  **Fig. 2.1** **(i)** Make a large diagram of this cross section to show the layers forming the wall of the artery.  7 [3]	7 The drawing is a suitable size but it is incomplete. Mark awarded for (c) (i) = 1 out of 3

Example Candidate Response – low, continued	Examiner comments
(ii) Measure the diameter of the lumen of the artery between points **X** and **Y** on Fig. 2.1. **Include the unit**. Diameter of the lumen on Fig. 2.1 ..... 4.3 cm ..... 8 Draw a line in the same position on your drawing and measure the diameter of the lumen on your drawing. Diameter of the lumen on your drawing ..... 6.5 cm ..... magnification = diameter of the lumen on your drawing / diameter of the lumen on Fig. 2.1 Calculate the magnification of your drawing using the equation given and your answers. Show your working. magnification: 6.5 cm / 4.3 cm = 1.51162791 x ≈ 1.51 x 9 magnification 1.51 x ..... [3] **[Total: 19]**	8 The measurement is incorrect for Fig. 2.1. The measurement on the drawing is acceptable but the line drawn is not in the correct place. 9 The mark for calculating the magnification is allowed because the candidate has used correct measurements. Mark awarded for (c) (ii) = 2 out of 3 **Total mark awarded = 8 out of 18**

How the candidate could have improved the answer

(a) The candidate needed to be clearer about the different types of variable in the investigation to avoid confusion in the answer.

(a) (ii) The candidate needed to read the information more carefully to choose the correct variables.

(a) (iii) The candidate needed to be more precise to qualify how far the heart beat should be reduced. The answer should be linked more clearly to the investigation which was measuring pulse rate.

(a) (iv) The candidate needed to choose a suitable variable in order to answer this question.

(b) (i) The candidate needed to label the y axis using the heading in Table 2.1. They should have drawn the pairs of bars for each activity separated from each other.

(b) (ii) The difference should have been about an effect of jumping and moving arms on the pulse rates of males and females.

(c) (i) The candidate needed to draw in the outer layer present in Fig. 2.1. They should have drawn the wavy appearance of the inner lining more accurately.

(c) (ii) The candidate needed to measure more carefully. Their measurement was 4 mm different from the actual measurement.

Common mistakes candidates made in this question

(a) (i) Poorly written figures.

(a) (ii) and **(iv)** Poor comprehension of the investigation leading to incorrect identification of variables. Imprecise descriptions of variables.

(b) (i) Failing to separate the bars of the graph from each other.

(b) (ii) Using the data from resting pulse rates.

(c) (i) Poor observation of the detail of the inner surface of Fig. 2.1.

(c) (ii) Incorrect positioning of the line on the drawing. Including units with magnification.

Cambridge Assessment International Education
The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA, United Kingdom
t: +44 1223 553554
e: info@cambridgeinternational.org www.cambridgeinternational.org

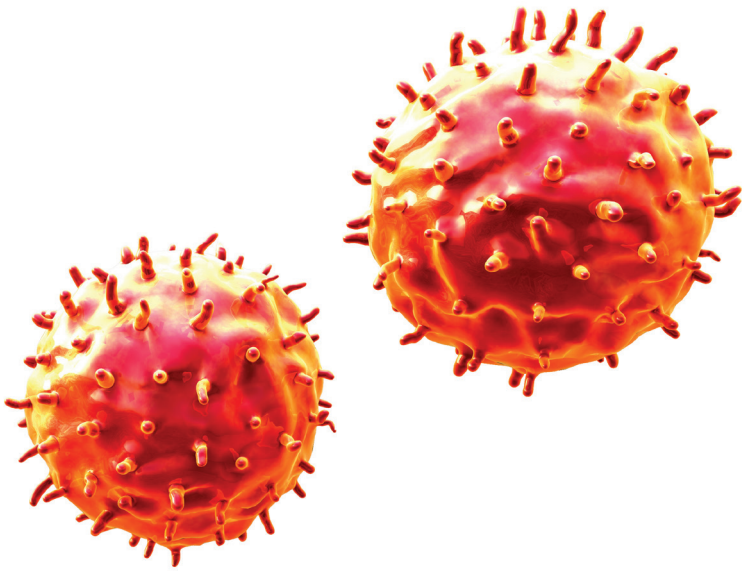
Cambridge Assessment International Education

Example Candidate Responses

Paper 6

Cambridge IGCSE™

Biology 0610



Version 2.0

Cambridge Pathway

In order to help us develop the highest quality resources, we are undertaking a continuous programme of review; not only to measure the success of our resources but also to highlight areas for improvement and to identify new development needs.

We invite you to complete our survey by visiting the website below. Your comments on the quality and relevance of our resources are very important to us.

www.surveymonkey.co.uk/r/GL6ZNJB

Would you like to become a Cambridge International consultant and help us develop support materials?

Please follow the link below to register your interest.

www.cambridgeinternational.org/cambridge-for/teachers/teacherconsultants/

Contents

Introduction

The main aim of this booklet is to exemplify standards for those teaching Cambridge IGCSE Biology (0610), and to show how different levels of candidates' performance (high, middle and low) 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 high, middle and low responses. Each response is accompanied by a brief commentary explaining the strengths and weaknesses of the answers.

For each question, the response is annotated with clear explanation of where and why marks were awarded or omitted. This is followed by examiner comments on how the answer could have been improved. In this way, it is possible for you to understand what candidates have done to gain their marks and what they could do to improve their answers. At the end of the booklet, there is a list of common mistakes candidates made in their answers for each question.

This document provides illustrative examples of candidate work with Examiner commentary. These help teachers to assess the standard required to achieve marks beyond the guidance of the mark scheme. Therefore, in some circumstances, such as where exact answers are required, there will not be much additional comment.

The questions, mark schemes and pre-release material used here are available to download as a zip file from the School Support Hub as the Example Candidate Responses Files. The papers used in this booklet are:

Question Paper 6, June 2016	
Question paper	June 2016 Question Paper 61 (0610_s16_qp_61.pdf)
Mark scheme	June 2016 Paper 61 Mark Scheme (0610_s16_ms_61.pdf)

Other past papers, Examiner Reports and other teacher support materials are available on the School Support Hub www.cambridgeinternational.org/support

How to use this booklet

This booklet goes through the paper one question at a time, showing you the high-, middle- and low-level response for each question. The candidate answers are set in a table. In the left-hand column are the candidate answers, and in the right-hand column are the Examiner comments.

Example Candidate Response – Question 1, High	Examiner comments
(ii) Compare the activity of catalase in the potato pieces **A, B and C.** THE ACTIVITY IS MORE EFFICIENT IN PIECE B (19.5 bubbles) WHILE IT DECREASES IN C (11 bubbles) AND THE LEAST EFFICIENT WAS IN A (4 bubbles) [1]	The mark is awarded as the candidate gives the relative activities of all three samples.

Answers are by real candidates in exam conditions. These show you the types of answers for each level.

Discuss and analyse the answers with your learners in the classroom to improve their skills.

Examiner comments are alongside the answers. These explain where and why marks were awarded. This helps you to interpret the standard of Cambridge exams so you can help your learners to refine their exam technique.

How the candidate could have improved the answer

(a)(ii) The candidate was awarded full marks but could have improved the column headings by expanding them to '**Number of** bubbles / 3 min' and 'Mean **number of** bubbles / **3 min**' to make them more precise.

This section explains how the candidate could have improved each answer. This helps you to interpret the standard of Cambridge exams and helps your learners to refine their exam technique.

Common mistakes candidates made in this question

(a)(i) *The examiner was expecting candidates to use a ruler to determine the dimensions of the potato pieces. The dimensions should be entered into the table in millimetres (as that unit is given in the column heading).*

The most common error that candidates made was to state their measurements in centimetres and not in millimetres (as stated in the table heading.)

Often candidates lose marks because they misread or misinterpret the questions.

Lists the common mistakes candidates made in answering each question. This will help your learners to avoid these mistakes and give them the best chance of achieving the available marks.

Assessment at a glance

All candidates take three papers. Candidates who have studied the Core subject content, or who are expected to achieve a grade D or below, should be entered for Paper 1, Paper 3 and either Paper 5 or Paper 6. These candidates will be eligible for grades C to G. Candidates who have studied the Extended subject content (Core and Supplement), and who are expected to achieve a grade C or above, should be entered for Paper 2, Paper 4 and either Paper 5 or Paper 6. These candidates will be eligible for grades A* to G.

Core candidates take:

Paper 1 45 minutes
Multiple Choice 30%
40 marks
40 four-choice multiple-choice questions
Questions will be based on the Core subject content
Assessing grades C–G
Externally assessed

Extended candidates take:

Paper 2 45 minutes
Multiple Choice 30%
40 marks
40 four-choice multiple-choice questions
Questions will be based on the Extended subject content (Core and Supplement)
Assessing grades A*–G
Externally assessed

and Core candidates take:

Paper 3 1 hour 15 minutes
Theory 50%
80 marks
Short-answer and structured questions
Questions will be based on the Core subject content
Assessing grades C–G
Externally assessed

and Extended candidates take:

Paper 4 1 hour 15 minutes
Theory 50%
80 marks
Short-answer and structured questions
Questions will be based on the Extended subject content (Core and Supplement)
Assessing grades A*–G
Externally assessed

All candidates take either:

Paper 5 1 hour 15 minutes
Practical Test 20%
40 marks
Questions will be based on the experimental skills in Section 4
Assessing grades A*–G
Externally assessed

or:

Paper 6 1 hour
Alternative to Practical 20%
40 marks
Questions will be based on the experimental skills in Section 4
Assessing grades A*–G
Externally assessed

Teachers are reminded that the latest syllabus is available on our public website at www.cambridgeinternational.org and the School Support Hub at www.cambridgeinternational.org/support

Paper 6 – Alternative to Practical

Question 1

Example Candidate Response – Question 1, High	Examiner comments

1 Metabolic reactions in cells produce toxic chemicals which can be converted to harmless or less toxic chemicals.

Hydrogen peroxide is broken down using the enzyme catalase which is found in most cells.

Fig. 1.1 shows this reaction.

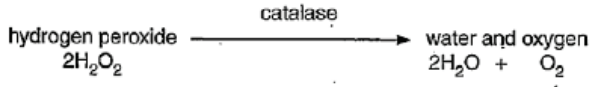


Fig. 1.1

A student investigated the effect of alcohol (ethanol) on the activity of catalase found in potato, using three pieces of potato cut to the same size.

Fig. 1.2 shows these pieces of potato.

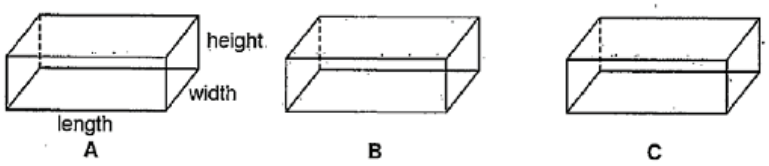


Fig. 1.2

(a) (i) Measure the length, width and height of one of these pieces of potato.

Record your results in Table 1.1.

Table 1.1

length of potato piece /mm	width of potato piece /mm	height of potato piece /mm
1 ~~300~~ 30	~~100~~ 10	~~100~~ 10

[1]

Step 1 The student labelled six test-tubes, **1**, **2**, **3**, **4**, **5**, and **6** and used a syringe to add 10 cm^3 of hydrogen peroxide solution to each of the test-tubes.

Step 2 They cut potato piece **A** to obtain two slices of similar size.

Step 3 The student placed the free end of a delivery tube into a large test-tube containing water.

Step 4 They placed one of the slices of potato piece **A** into the hydrogen peroxide solution in test-tube **1**.

Step 5 The student immediately placed the rubber bung attached to the delivery tube into test-tube **1** and pushed it in as tightly as possible, as shown in Fig. 1.3.

1 Note how the candidate has crossed out the answers they did not want to be marked. Doing this makes it very clear to the Examiner which text is the intended answer.

The candidate gives three accurate measurements, so gains the mark.

Mark awarded for 1(a)(i) = 1 out of 1

Example Candidate Response – Question 1, High

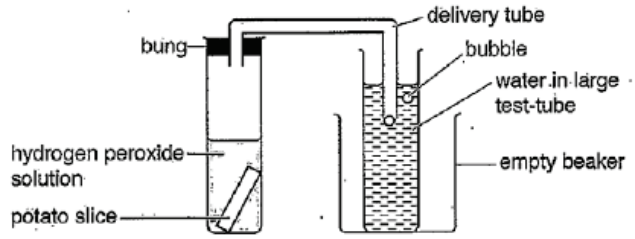


Fig. 1.3

Step 6 They counted the number of bubbles released from the delivery tube in 3 minutes.

Step 7 The student repeated steps **4–6** for the second slice of potato piece **A** using test-tube **2.**

Step 8 They repeated steps **2–7** for potato piece **B** using test-tubes **3** and **4.**

Step 9 They repeated steps **2–7** for potato piece **C** using test-tubes **5** and **6.**

The student used a tally to count the number of bubbles.

Fig. 1.4 shows their tally count.

A1 𝍸	**A2** 𝍸
B1 𝍸 𝍸 𝍸 𝍸	**B2** 𝍸 𝍸
C1 𝍸 𝍸	**C2** 𝍸 𝍸

Fig. 1.4

MEAN CALCULATIONS

$A = \frac{5+3}{2} = 4$

$B = \frac{18+11}{2} = 14,5$

$C = \frac{12+10}{2} = 11$

(ii) Prepare a table to record the student's results.
Your table should show:

- the numbers of bubbles produced by each slice of potato in 3 minutes
- the mean number of bubbles produced by each of potato piece **A**, **B** and **C**.

Complete your table using the results from Fig. 1.4.

POTATO PIECES	BUBBLES PRODUCED in 3min	MEAN OF bubbles
A_1	5	4
A_2	3	
B_1	18	14,5
B_2	11	
C_1	12	11
C_2	10	

[5]

Examiner comments

The table is drawn neatly with an appropriate number of cells; all column headings are adequate and the unit is given; data is entered correctly.

Mark awarded for 1(a)(ii) = 5 out of 5

Example Candidate Response – Question 1, High	Examiner comments
(b) (i) Suggest why the free end of the delivery tube was placed in the water before adding the potato slice to the hydrogen peroxide solution and connecting the test-tube to the bung of the delivery tube. TO MAKE SURE THAT THE TEST TUBE WAS COVERED AS FAST AS POSSIBLE. .....[1]	The candidate essentially re-states the information given in the stem, and does not answer the question. **Mark awarded for 1(b)(i) = 0 out of 1**
(ii) Explain why the bung of the delivery tube must fit tightly into the test-tube. BECAUSE THERE WILL NO LOSS of O_2 IN THE AIR OUTSIDE AND ALL THE O_2 PRODUCED WILL GO PASS THROUGH THE DELIVERY TUBE.....[2]	The candidate is awarded one mark for 'prevents leakage of oxygen / all oxygen collected' (with benefit of doubt as the answer is not expressed clearly.) The candidate does not refer to the validity / consistency of the results, so they do not gain the second mark. **Mark awarded for 1(b)(ii) = 1 out of 2**
(c) The pieces of potato that the student used in their investigation were soaked in different concentrations of alcohol for 24 hours. • Potato piece **A** was soaked in 20% alcohol. • Potato piece **B** was soaked in 2% alcohol. • Potato piece **C** was soaked in 10% alcohol. **(i)** Suggest the relationship between the number of bubbles and the activity of catalase. AS THE ACTIVITY OF THE CATALASE is RELATED TO THE AMOUNT OF ALCOHOL IN WHICH THE PIECES WERE SOAKED, THE AS THE ALCOHOL INCREASES IT STOPS THE ACTIVITY OF THE CATALASE AND SO LESS BUBBLES ARE PRODUCED.....[1]	The response is not ideal as the candidate refers to the *amount* of alcohol instead of the alcohol *concentration* but the mark is awarded for the final statement about reduced activity of the catalase resulting in fewer bubbles. **Mark awarded for 1(c)(i) = 1 out of 1**
(ii) Compare the activity of catalase in the potato pieces **A, B and C.** THE ACTIVITY IS MORE EFFICIENT IN PIECE B (19.5 bubbles) WHILE IT DECREASES IN C (11 bubbles) AND THE LEAST EFFICIENT WAS IN A (4 bubbles).....[1]	The mark is awarded as the candidate gives the relative activities of all three samples. **Mark awarded for 1(c)(ii) = 1 out of 1**
(iii) Predict the number of bubbles that would be produced in 3 minutes if a piece of potato was soaked in 50% alcohol before being placed in hydrogen peroxide solution. IT WILL BE LESS THAN 4, maybe 2 or 1 or none.....[1]	The candidate reasons correctly that the increased alcohol concentration would result in a bubble number less than 4.

Example Candidate Response – Question 1, High

(d) (i) State **one** variable that has been controlled in the student's investigation.

Describe how this variable was controlled.

variable *the sizes of the potatoes the amount of $2H_2O_2$*

how it was controlled *IT was controlled by cutting pieces of the same size. using a syringe. it was added 10 cm^3 in each test tube*

[2]

(ii) The method of measuring the oxygen gas produced is a source of error.

State **one** reason why this method is a source of error.

counting the bubbles delivered isn't reliable.

Suggest how to improve the method to minimise this error.

Repeat the experiment more times and to have a more accurate mean.

[2]

(iii) Identify the source of error in step 2. State why this is a source of error.

source of error *the sizes are similar, not identical*

reason *As the sizes are not the same the number of bubbles will be different for sure.*

[2]

(iv) Describe a control experiment that the student could carry out for this investigation.

instead of putting the pieces of potato in hydrogen peroxide solution, put them in distilled water and do all the steps of the real experiment.

[2]

(v) Predict the result expected from the control experiment described in (iv).

there will be no bubbles produced.

[1]

Examiner comments

Mark awarded for 1(c)(iii) = 1 out of 1

A valid variable was selected. It would be preferable to state *volume* or *concentration* of hydrogen peroxide rather than *amount*. A correct method of control is given.

Mark awarded for 1(d)(i) = 2 out of 2

The reason given needs to be more specific by explaining *why* counting bubbles is unreliable. For example, bubbles will vary in size. The improvement is acceptable.

Mark awarded for 1(d)(ii) = 1 out of 2

A correct source of error but an inadequate reason. The candidate needs to refer to surface area or the number of catalase molecules available.

Mark awarded for 1(d)(iii) = 1 out of 2

The candidate gains a mark for saying that the same experimental procedure would be used. Using water instead of hydrogen peroxide would not be a control for this experiment.

Mark awarded for 1(d)(iv) = 1 out of 2

Although the control in (iv) was incorrect, this prediction was awarded a mark on the basis of error-carried-forward.

Example Candidate Response – Question 1, High

(e) State one safety precaution required when ethanol is used in an investigation.

Use protect safety glasses and gloves

.....[1]

(f) In an investigation into the effects of alcohol on the nervous system, people were asked to carry out a test on their reaction time.

The person being tested looked at a coloured block on a computer screen.
As soon as the colour changed they pressed a button.
The time taken to press the button was recorded by the computer.
This was their reaction time.

Twenty people were tested before and after consuming a drink containing the same concentration of alcohol.

Table 1.2 shows the results of this investigation.

Table 1.2

test person	reaction time before consuming alcohol /milliseconds	reaction time after consuming alcohol /milliseconds
1	272	322
2	310	350
3	225	270
4	243	290
5	240	308
6	264	315
7	201	238
8	262	300
9	225	252
10	235	278
11	225	253
12	247	271
13	226	266
14	194	220
15	206	239
16	309	340
17	223	261
18	243	286
19	270	316
20	180	225
mean	240	280

(i) Calculate the mean for the reaction time after consuming alcohol.

Write your answer in Table 1.2. [1]

Examiner comments

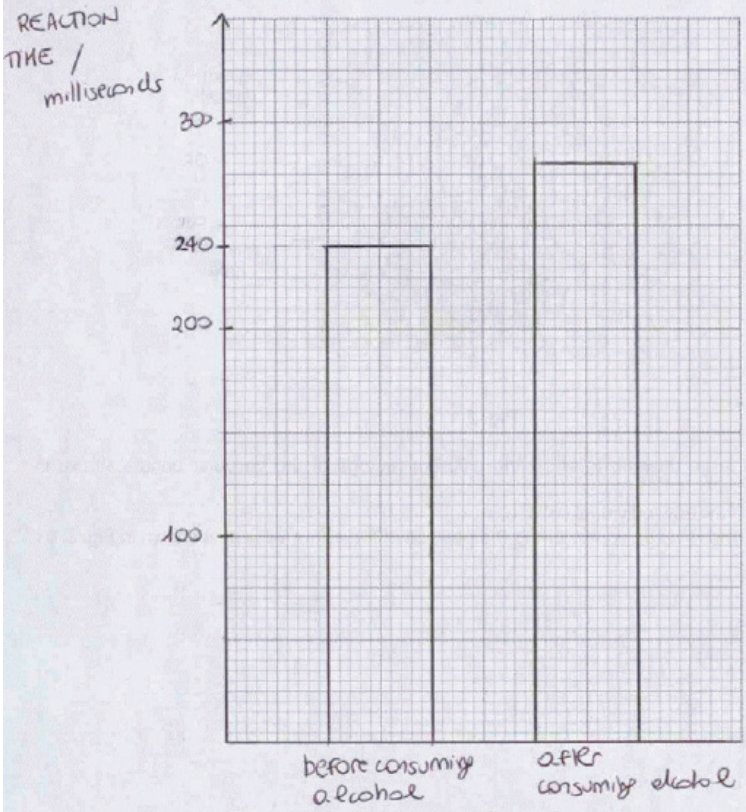
Mark awarded for 1(d)(v) = 1 out of 1

A correct safety precaution stated.

Mark awarded for 1(e) = 1 out of 1

The mean is calculated accurately.

Mark awarded for 1(f)(i) = 1 out of 1

Example Candidate Response – Question 1, High	Examiner comments
(ii) Plot a bar chart to show the **mean** reaction time of the people tested before and after consuming alcohol.  [3] (iii) The range of reaction times recorded before consuming alcohol is 180–310 milliseconds. Use Table 1.2 to identify the range of reaction times recorded after consuming alcohol. 225 ~~252~~ - 350 ..... milliseconds [1] **[Total: 27]**	The axes are labelled correctly and the scale on the *y*-axis is even. Both plots are accurate. Columns are of equal width, not touching and occupy more than half the grid on the *y*-axis. **Mark awarded for 1(f)(ii) = 3 out of 3** Incorrect range given. **Mark awarded for 1(f)(iii) = 0 out of 1** **Total mark awarded = 21 out of 27**

How the candidate could have improved the answer

(a)(ii) The candidate was awarded full marks but could have improved the column headings by expanding them to 'number of bubbles / 3 min' and 'Mean number of bubbles / 3 min' to make them more precise.

(b)(i) The candidate could have improved by reading the question more carefully and thinking about their response, as they did not answer the question posed. It was necessary to give a response along the lines of preventing leakage of oxygen, or that bubbles could be counted as soon as the reaction starts.

(b)(ii) The instruction in the question was to '*explain*' and the question carries two marks, which usually indicates that two distinct points are needed. The candidate provided one point only. The candidate would have gained full marks if there was reference to the validity / consistency of the results. The candidate could also have stated their answer more clearly.

(c)(i) Although the candidate was given the benefit of the doubt and awarded the mark, candidates should be encouraged to use the correct scientific vocabulary and refer to '*volume*' or '*concentration*' and not '*amount*'.

(d)(i) All the material required for full marks is present, but it could have been expressed more clearly. The candidate could improve by deciding what to write before putting pen to paper. On a minor point, it is preferred that chemical names are written, rather than the symbols given. In this instance, $2H_2O_2$ indicates 'two molecules of hydrogen peroxide'.

(d)(ii) The candidate could improve by explaining why counting bubbles is an unreliable method. This could be that bubbles vary in size, or that small bubbles might not be counted.

(d)(iii) The candidate gains one mark from what is written in total. Ideally, the source of error needs to say that the imprecise method of cutting leads to different sized pieces of potato. The candidate then needs to give a reason for it being a source of error, i.e. it would mean different surface areas of potato / different numbers of catalase molecules exposed to hydrogen peroxide solution, thus the volume of oxygen released would vary.

(d)(iv) The response could have been improved by having a control that eliminated the effect of alcohol. For example, soaking the potato in water and not in alcohol.

(d)(v) The candidate was awarded a mark for stating the result that would have been obtained if their control suggestion had been carried out; the follow-through reasoning was appropriate.

(f)(ii) A minor improvement would be to label the *y*-axis '**mean** reaction time / ms'.

(f)(iii) The candidate got the lower end of the range incorrect: the correct range was **220** – 350.

Example Candidate Response – Question 1, Middle

Examiner comments

1 Metabolic reactions in cells produce toxic chemicals which can be converted to harmless or less toxic chemicals.

Hydrogen peroxide is broken down using the enzyme catalase which is found in most cells.

Fig. 1.1 shows this reaction.

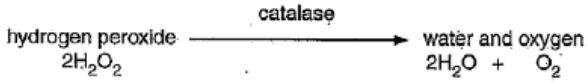


Fig. 1.1

A student investigated the effect of alcohol (ethanol) on the activity of catalase found in potato, using three pieces of potato cut to the same size.

Fig. 1.2 shows these pieces of potato.

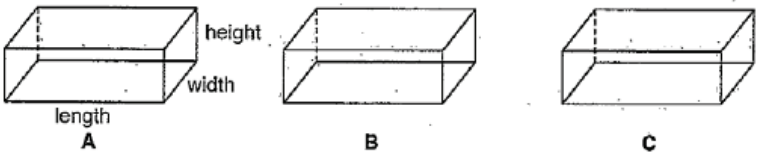


Fig. 1.2

(a) (i) Measure the length, width and height of one of these pieces of potato.

Record your results in Table 1.1.

Table 1.1

length of potato piece /mm	width of potato piece /mm	height of potato piece /mm
30 1	10	10

[1]

1 An incorrect answer has been crossed out and replaced with the correct answer. It is important that incorrect answers are clearly crossed out. If two conflicting answers are given, no marks are awarded.

Mark awarded for 1(a)(i) = 1 out of 1

Step 1 The student labelled six test-tubes, **1**, **2**, **3**, **4**, **5**, and **6** and used a syringe to add 10 cm^3 of hydrogen peroxide solution to each of the test-tubes.

Step 2 They cut potato piece **A** to obtain two slices of similar size.

Step 3 The student placed the free end of a delivery tube into a large test-tube containing water.

Step 4 They placed one of the slices of potato piece **A** into the hydrogen peroxide solution in test-tube **1**.

Step 5 The student immediately placed the rubber bung attached to the delivery tube into test-tube **1** and pushed it in as tightly as possible, as shown in Fig. 1.3.

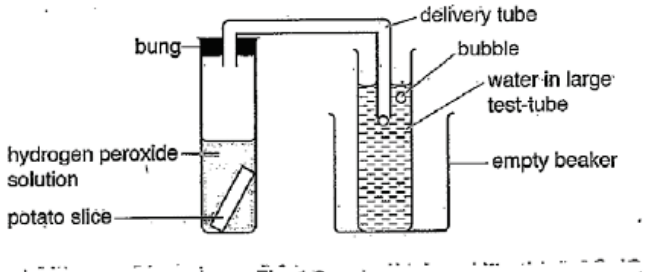


Fig. 1.3

Example Candidate Response – Question 1, Middle

Step 6 They counted the number of bubbles released from the delivery tube in 3 minutes.

Step 7 The student repeated steps **4–6** for the second slice of potato piece **A** using test-tube **2**.

Step 8 They repeated steps **2–7** for potato piece **B** using test-tubes **3** and **4**.

Step 9 They repeated steps **2–7** for potato piece **C** using test-tubes **5** and **6**.

The student used a tally to count the number of bubbles.

Fig. 1.4 shows their tally count.

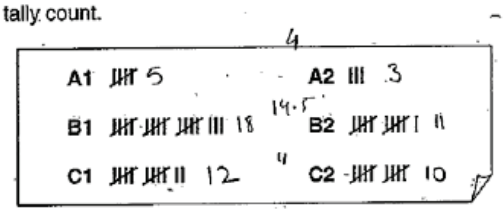


Fig. 1.4

(ii) Prepare a table to record the student's results.
Your table should show:

- the numbers of bubbles produced by each slice of potato in 3 minutes
- the mean number of bubbles produced by each of potato piece **A**, **B** and **C**.

Complete your table using the results from Fig. 1.4.

number of bubbles	potato pieces					
number of bubbles	A		B		C	
	1	2	1	2	1	2
number of bubbles produced	5	3	18	11	12	10
mean	4		14.5		11	

[5]

(b) (i) Suggest why the free end of the delivery tube was placed in the water before adding the potato slice to the hydrogen peroxide solution and connecting the test-tube to the bung of the delivery tube.

To prevent the escape of oxygen gas, as the potato slice contains the catalase enzyme.

.....[1]

The candidate produces a table with the correct number of columns and rows. The data entered is correctly. However, the units are missing from both the number of bubbles and the mean (number of bubbles), so a mark is lost.

Mark awarded for 1(a)(ii) = 4 out of 5

The candidate gives a correct response.

Mark awarded for 1(b)(i) = 1 out of 1

Example Candidate Response – Question 1, Middle	Examiner comments
(ii) Explain why the bung of the delivery tube must fit tightly into the test-tube. To prevent the gas pressure inside from blocking the tube. [2]	The answer does not make sense, no marks are awarded. **Mark awarded for 1(b)(ii) = 0 out of 2**
(c) The pieces of potato that the student used in their investigation were soaked in different concentrations of alcohol for 24 hours. • Potato piece **A** was soaked in 20% alcohol. • Potato piece **B** was soaked in 2% alcohol. • Potato piece **C** was soaked in 10% alcohol. (i) Suggest the relationship between the number of bubbles and the activity of catalase. As the activity of catalase enzyme increases, the more hydrogen peroxide broken water and oxygen bubbles are produced [1]	The candidate states the correct relationship. **Mark awarded for 1(c)(i) = 1 out of 1**
(ii) Compare the activity of catalase in the potato pieces **A**, **B** and **C**. The activity in potato piece B was more, as the mean number of bubbles was 14.5, while the mean number of bubbles in A was 4 and in C, it was 11. [1]	The candidate starts correctly by stating that B had more (catalase) activity, but does not complete the answer by relating this to the activity of A and C. Quoting the number of bubbles produced is not explicit enough. **Mark awarded for 1(c)(ii) = 0 out of 1**
(iii) Predict the number of bubbles that would be produced in 3 minutes if a piece of potato was soaked in 50% alcohol before being placed in hydrogen peroxide solution. 10 bubbles. 4 → 0.2, 1 → 0.5 10 [1]	The prediction is incorrect. **Mark awarded for 1(c)(iii) = 0 out of 1**
(d) (i) State one variable that has been controlled in the student's investigation. Describe how this variable was controlled. variable temperature. how it was controlled by using a water bath, which can regulate the temperature. [2]	Temperature was not a variable that was controlled in this investigation, so both parts of the answer are incorrect. **Mark awarded for 1(d)(i) = 0 out of 2**

Example Candidate Response – Question 1, Middle	Examiner comments
(ii) The method of measuring the oxygen gas produced is a source of error. State one reason why this method is a source of error. As the student can miscount the number of bubbles produced. Suggest how to improve the method to minimise this error. By measuring the volume of oxygen produced by attaching a gas ~~syringe~~ syringe to the apparatus. [2]	The candidate correctly identifies a source of error and has suggests an improvement that would increase the accuracy of the result. **Mark awarded for 1(d)(ii) = 2 out of 2**
(iii) Identify the source of error in step 2. State why this is a source of error. source of error ~~Parallax~~ parallax error may have occured, while measuring the sides. reason as the ruler wasn't on the potato, while measuring it's length, width and height. [2]	This answer does not relate to step 2 (where no ruler was used in cutting the original slice into two pieces). **Mark awarded for 1(d)(iii) = 0 out of 2**
(iv) Describe a control experiment that the student could carry out for this investigation. By doing the same experiment, but using ~~with~~ a boiled piece of potato to denature the catalase enzyme. [2]	The candidate is awarded a mark for stating that the same experiment is repeated. Using boiled potato does not test the effect of alcohol, so the second mark is not awarded. **Mark awarded for 1(d)(iv) = 1 out of 2**
(v) Predict the result expected from the control experiment described in (iv). no oxygen bubbles will be produced. [1]	This is awarded one mark on the basis of error-carried-forward. The candidate's reasoning that boiled potato would not produce any oxygen is correct. **Mark awarded for 1(d)(v) = 1 out of 1**
(e) State one safety precaution required when ethanol is used in an investigation. using a water-bath, when heating to prevent the ~~Alcohol~~ ethanol from splashing. [1]	The safety precaution is accepted as valid. **Mark awarded for 1(e) = 1 out of 1**

Example Candidate Response – Question 1, Middle	Examiner comments

(f) In an investigation into the effects of alcohol on the nervous system, people were asked to carry out a test on their reaction time.

The person being tested looked at a coloured block on a computer screen.
As soon as the colour changed they pressed a button.
The time taken to press the button was recorded by the computer.
This was their reaction time.

Twenty people were tested before and after consuming a drink containing the same concentration of alcohol.

Table 1.2 shows the results of this investigation.

Table 1.2

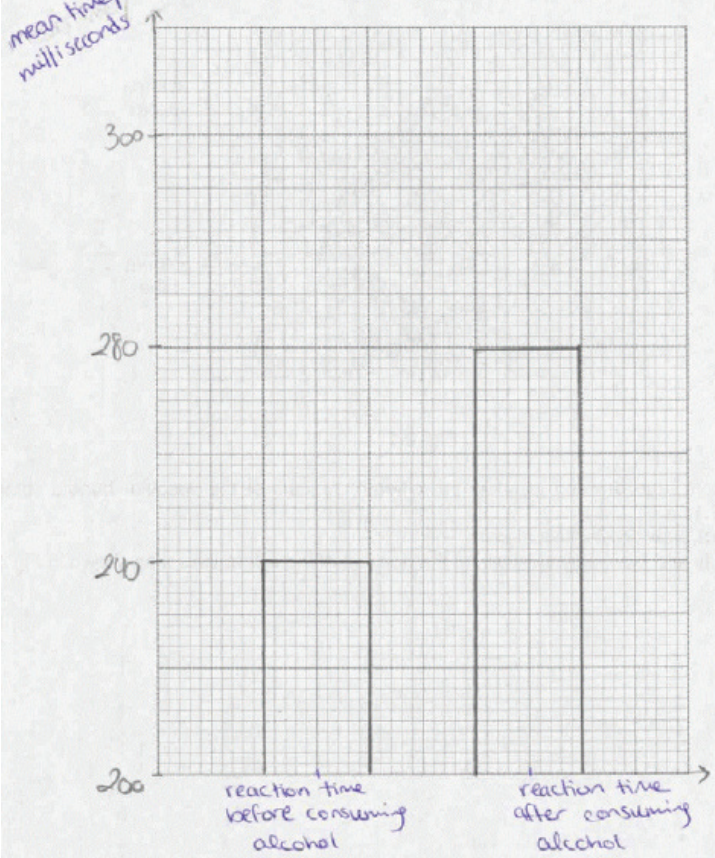
test person	reaction time before consuming alcohol /milliseconds	reaction time after consuming alcohol /milliseconds
1	272	322
2	310	350
3	225	270
4	243	290
5	240	308
6	264	315
7	201	238
8	262	300
9	225	252
10	235	278
11	225	253
12	247	271
13	226	266
14	194	220
15	206	239
16	309	340
17	223	261
18	243	286
19	270	316
20	180	225
mean	240	280

(i) Calculate the mean for the reaction time after consuming alcohol.

Write your answer in Table 1.2. [1]

The mean is calculated correctly.

Mark awarded for 1(f)(i) = 1 out of 1

Example Candidate Response – Question 1, Middle	Examiner comments
(ii) Plot a bar chart to show the **mean** reaction time of the people tested before and after consuming alcohol.  [3] (iii) The range of reaction times recorded before consuming alcohol is 180–310 milliseconds. Use Table 1.2 to identify the range of reaction times recorded after consuming alcohol. 220 – 350 milliseconds [1] **[Total: 27]**	Marks are awarded as columns are plotted accurately, they are equal width and not touching. The *y*-axis is not fully labelled and the scale on the *y*-axis is uneven so one mark is not awarded. **Mark awarded for 1(f)(ii) = 2 out of 3** The range is accurate. **Mark awarded for 1(f)(iii) = 1 out of 1** **Total mark awarded = 16 out of 27**

How the candidate could have improved the answer

1(a)(ii) The candidate would have gained another mark by giving the headings as 'number of bubbles / 3 min" and 'mean number of bubbles / 3 min.'

1(b)(ii) The candidate could have improved by stating that if the bung does not fit tightly, oxygen will escape from the apparatus. This will mean that the number of bubbles will be reduced and so results will not be valid.

1(c)(ii) The candidate needed to take their answer further by stating that potato piece B had the greatest catalase activity and A had the least (and therefore, C was in between).

1(c)(iii) The candidate needed to base their prediction on the fact that A (soaked in 20% alcohol) produced the smallest number of bubbles: mean of 4 bubbles / 3 min. Thus, soaking the potato piece in 50% alcohol would not produce more bubbles than A. Any answer between 0 – 4 (bubbles / 3 min) was acceptable.

1(d)(i) The candidate could have improved by reading the description of the investigation with more care and then selecting a variable that was controlled. The method of controlling the variable would depend on which one was selected. For example, the surface areas of the potato pieces were controlled by cutting each piece to the same dimensions.

1(d)(iii) The candidate could have improved by reading step 2 carefully. No ruler was used. This resulted in the two pieces having different dimensions. This would mean that the number of enzyme molecules available would be different and so different volumes of gas would be produced.

1(d)(iv) The candidate could have improved by considering the information given about the treatment of the pieces that resulted in the differing oxygen volumes. This treatment involved soaking in alcohol, so the control must test whether this treatment was actually responsible for the differing volumes of gas produced.

1(d)(v) The candidate could have improved this answer if the correct response to (d)(iv) had been given.

1 (f)(ii) An improvement would have been to label the *y*-axis correctly as “mean reaction time / ms.” Also the scale on the *y*-axis between 280 and 300 should be made even.

Example Candidate Response – Question 1, Low

Examiner comments

1 Metabolic reactions in cells produce toxic chemicals which can be converted to harmless or less toxic chemicals.

Hydrogen peroxide is broken down using the enzyme catalase which is found in most cells.

Fig. 1.1 shows this reaction.

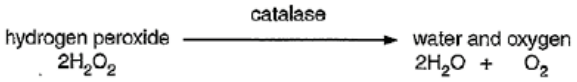


Fig. 1.1

A student investigated the effect of alcohol (ethanol) on the activity of catalase found in potato, using three pieces of potato cut to the same size.

Fig. 1.2 shows these pieces of potato.

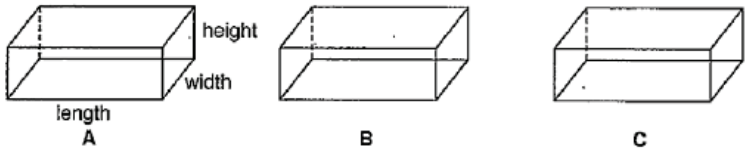


Fig. 1.2

(a) (i) Measure the length, width and height of one of these pieces of potato.

Record your results in Table 1.1.

Table 1.1

length of potato piece /mm	width of potato piece /mm	height of potato piece /mm
3mm	1mm	1mm

[1]

The mark is not awarded as the measurements are incorrect. It looks as if candidate has given them in cm, not mm.

Mark awarded for 1(a)(i) = 0 out of 1

Step 1 The student labelled six test-tubes, **1**, **2**, **3**, **4**, **5**, and 6 and used a syringe to add 10 cm^3 of hydrogen peroxide solution to each of the test-tubes.

Step 2 They cut potato piece **A** to obtain two slices of similar size.

Step 3 The student placed the free end of a delivery tube into a large test-tube containing water.

Step 4 They placed one of the slices of potato piece **A** into the hydrogen peroxide solution in test-tube **1**.

Step 5 The student immediately placed the rubber bung attached to the delivery tube into test-tube **1** and pushed it in as tightly as possible, as shown in Fig. 1.3.

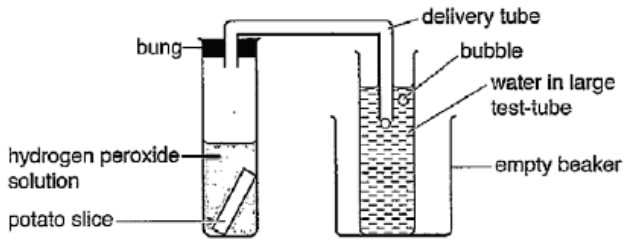


Fig. 1.3

Example Candidate Response – Question 1, Low

Step 6 They counted the number of bubbles released from the delivery tube in 3 minutes.

Step 7 The student repeated steps **4–6** for the second slice of potato piece **A** using test-tube **2**.

Step 8 They repeated steps **2–7** for potato piece **B** using test-tubes **3** and **4**.

Step 9 They repeated steps **2–7** for potato piece **C** using test-tubes **5** and **6**.

The student used a tally to count the number of bubbles.

Fig. 1.4 shows their tally count.

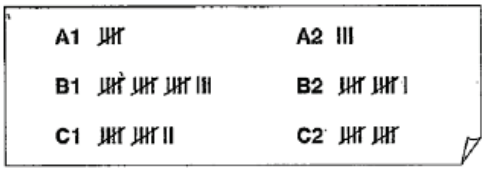
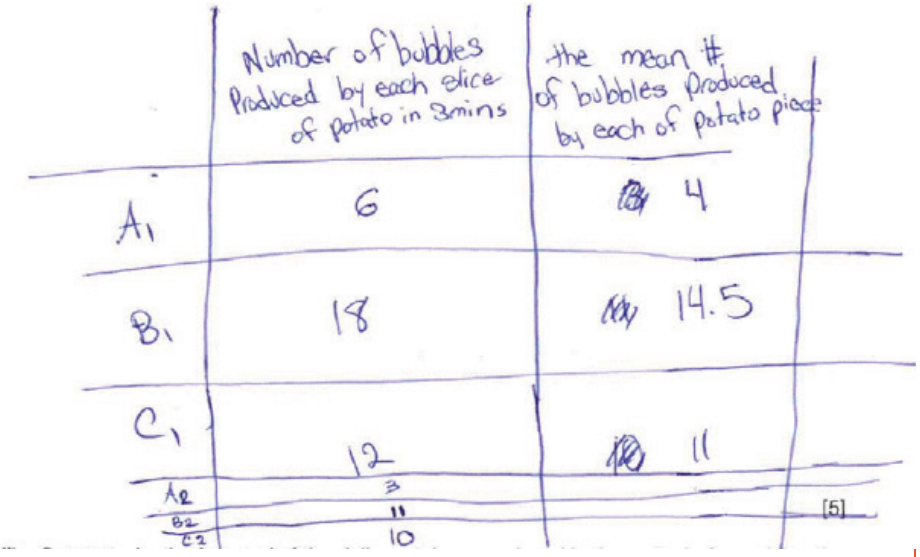


Fig. 1.4

(ii) Prepare a table to record the student's results.
Your table should show:

- the numbers of bubbles produced by each slice of potato in 3 minutes
- the mean number of bubbles produced by each of potato piece **A**, **B** and **C**.

Complete your table using the results from Fig. 1.4.



Examiner comments

The candidate is awarded marks for drawing a table, including an appropriate number of cells, and correctly calculating all three means.

The candidate is not awarded the other two marks because there is no heading for the 'potato piece' column and the number of bubbles for A1 is incorrect.

Mark awarded for 1(a)(ii) = 3 out of 5

Example Candidate Response – Question 1, Low	Examiner comments
(b) (i) Suggest why the free end of the delivery tube was placed in the water before adding the potato slice to the hydrogen peroxide solution and connecting the test-tube to the bung of the delivery tube. So no reaction happens without the delivery tube and connecting the test-tube to the bung being there [1]	The candidate recognises that it is important to have the apparatus set up before the start of the reaction but is not awarded a mark because no reference is made to oxygen / gas produced (either that it is prevented from escaping or that all the gas will be collected). **Mark awarded for 1(b)(i) = 0 out of 1**
(ii) Explain why the bung of the delivery tube must fit tightly into the test-tube. (1) So nothing can escape (2) So results are accurate [2]	The candidate gains a mark for stating that the results would be accurate. '*… nothing can escape*' is too vague and so does not gain a mark. It is essential to say that oxygen / gas cannot escape. **Mark awarded for 1(b)(ii) = 1 out of 2**
(c) The pieces of potato that the student used in their investigation were soaked in different concentrations of alcohol for 24 hours. • Potato piece **A** was soaked in 20% alcohol. • Potato piece **B** was soaked in 2% alcohol. • Potato piece **C** was soaked in 10% alcohol. (i) Suggest the relationship between the number of bubbles and the activity of catalase. they aren't the same [1]	The candidate is not awarded a mark as the answer is too vague and no relationship is given. **Mark awarded for 1(c)(i) = 0 out of 1**
(ii) Compare the activity of catalase in the potato pieces **A**, **B** and **C**. they are all different [1]	The answer is not sufficiently detailed to be awarded a mark. **Mark awarded for 1(c)(ii) = 0 out of 1**
(iii) Predict the number of bubbles that would be produced in 3 minutes if a piece of potato was soaked in 50% alcohol before being placed in hydrogen peroxide solution. 35 [1]	The candidate gives a figure that is too high, suggesting that they do not understand the experiment or the results. **Mark awarded for 1(c)(iii) = 0 out of 1**

Example Candidate Response – Question 1, Low

(d) (i) State **one** variable that has been controlled in the student's investigation.

Describe how this variable was controlled.

variable Potato slice

how it was controlled in each test tube the same size of potato slice

[2]

(ii) The method of measuring the oxygen gas produced is a source of error.

State **one** reason why this method is a source of error.

Because it can be more or less oxygen in each test-tube

Suggest how to improve the method to minimise this error.

Use the same tube

[2]

(iii) Identify the source of error in step **2**. State why this is a source of error.

source of error Cutting potato slice A to two slices

reason the slices A might not be equally the same

[2]

(iv) Describe a control experiment that the student could carry out for this investigation.

Boiled enzymes

[2]

Examiner comments

'*Potato slice*' is not awarded a mark as it is unclear which aspect of the potato is being controlled. The mark for the variable is actually awarded in the second part of the answer where it becomes clear that it is the *size* that is being controlled. The second mark is awarded for use of the *same* size of potato in each test.

Mark awarded for 1(d)(i) = 2 out of 2

The candidate does not identify a source of error in the method, and so cannot suggest an improvement. No marks are awarded.

Mark awarded for 1(d)(ii) = 0 out of 2

One mark is awarded for stating that the two pieces of potato may not be identical in size (taking what is written in total.) The second mark cannot be awarded as the candidate does not explain why differently sized pieces would result in an error.

Mark awarded for 1(d)(iii) = 1 out of 2

No marks are awarded as the candidate does not describe a suitable control for this experiment.

Mark awarded for 1(d)(iv) = 0 out of 2

Example Candidate Response – Question 1, Low

(v) Predict the result expected from the control experiment described in (iv).

faster results

.....[1]

(e) State one safety precaution required when ethanol is used in an investigation.

Safety goggles

.....[1]

(f) In an investigation into the effects of alcohol on the nervous system, people were asked to carry out a test on their reaction time.

The person being tested looked at a coloured block on a computer screen.
As soon as the colour changed they pressed a button.
The time taken to press the button was recorded by the computer.
This was their reaction time.

Twenty people were tested before and after consuming a drink containing the same concentration of alcohol.

Table 1.2 shows the results of this investigation.

Table 1.2

test person	reaction time before consuming alcohol /milliseconds	reaction time after consuming alcohol /milliseconds
1	272	322
2	310	350
3	225	270
4	243	290
5	240	308
6	264	315
7	201	238
8	262	300
9	225	252
10	235	278
11	225	253
12	247	271
13	226	266
14	194	220
15	206	239
16	309	340
17	223	261
18	243	286
19	270	316
20	180	225
mean	240	280

$60

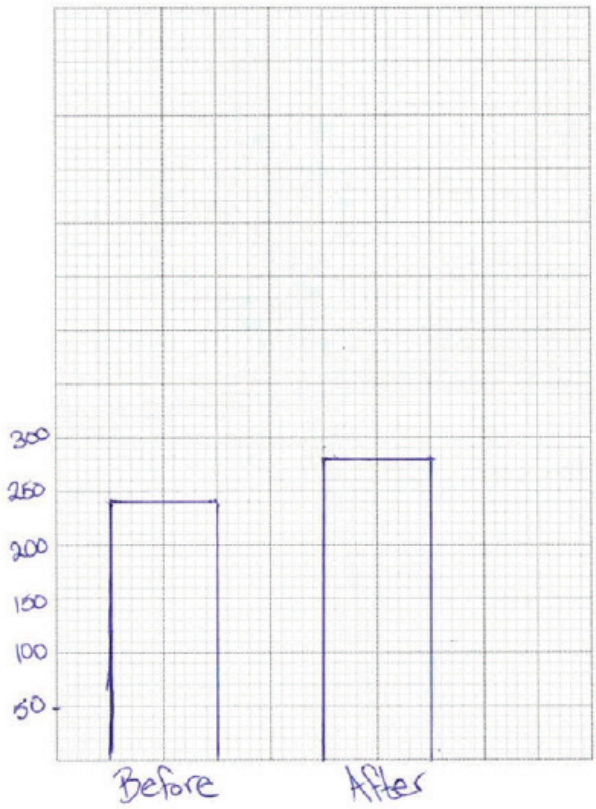
Examiner comments

Error-carried-forward is acceptable here. However, no marks are awarded because if a boiled enzyme had been used, no gas would have been produced.

Mark awarded for 1(d)(v) = 0 out of 1

One mark is awarded for an acceptable safety precaution.

Mark awarded for 1(e) = 1 out of 1

Example Candidate Response – Question 1, Low	Examiner comments
(i) Calculate the mean for the reaction time after consuming alcohol. Write your answer in Table 1.2. [1]	The mean is calculated accurately. **Mark awarded for 1(f)(i) = 1 out of 1**
(ii) Plot a bar chart to show the **mean** reaction time of the people tested before and after consuming alcohol.  [3]	One mark is awarded for accurately plotting both bars. The other two marks are not awarded as there is no label on the *y*-axis and the bars occupy less than half the grid on the *y*-axis. **Mark awarded for 1(f)(ii) = 1 out of 3**
(iii) The range of reaction times recorded before consuming alcohol is 180–310 milliseconds. Use Table 1.2 to identify the range of reaction times recorded after consuming alcohol. 404.5 milliseconds [1] **[Total: 27]**	It is unclear how the candidate arrives at the answer given, which is incorrect. **Mark awarded for 1(f)(iii) = 0 out of 1** **Total mark awarded = 10 out of 27**

How the candidate could have improved the answer

1(a)(i) The candidate could have improved their answer by using the correct units. It is also worth noting that if units are given in the column / row header, then units should not be repeated in the data cell.

If the candidate had measured the potatoes in cm and also changed the units in the table headings to cm, the mark would have been awarded, since the units in the table and the data would have matched.

1(a)(ii) The candidate could have improved the answer by:

- drawing lines with a ruler
- inserting outer borders to the table
- pre-planning the table (A2, B2 and C2 are obviously a late addition and squashed into the available space)
- arranging the pairs of test-tubes in two parallel columns
- counting the tally marks more carefully
- giving a heading for the potato piece column
- putting units in the "mean" column heading.

(b)(i) The candidate could have improved the response by answering the question more fully.

(b)(ii) The candidate could have improved the answer by being specific in the response. In this case, they were not awarded a mark because they did not state specifically what was prevented from escaping (gas/oxygen). Although they were awarded the mark for saying the experiment would be accurate, an improved response would have been to say it would be **more** accurate.

(c)(i) This answer could have been improved by stating the relationship: the lower the concentration of alcohol, the more bubbles were produced.

(c)(ii) The candidate could have improved by being more detailed. They needed to state that sample B had the highest catalase activity, followed by C, with A having the least activity.

(c)(iii) The candidate needed to base the prediction on the fact that A (soaked in 20% alcohol) produced the smallest number of bubbles: mean of 4 bubbles / 3 min. Thus, soaking the potato piece in 50% alcohol would not produce more bubbles than A. Any answer between 0 – 4 (bubbles / 3 min) was acceptable.

(d)(i) Although the candidate was awarded full marks for this question, they could have improved the answer by stating the variable (size of potato piece) in the correct answer space.

(d)(ii) The candidate could have improved by stating clearly a source of error in the measurement of the oxygen, and then suggest a way of rectifying this. The most obvious error is that bubbles vary in size, so counting them would not be a reliable method of estimating the total gas volume produced. Any reasonable improvement would have gained the second mark.

(d)(iii) The candidate could have improved on this answer by explaining that different sized pieces would have different surface areas. This would mean that the number of enzyme molecules available would be different and so different volumes of gas would be produced.

(d)(iv) The candidate could have improved by considering the information given about the treatment of the pieces that resulted in the differing oxygen volumes. This treatment involved soaking in alcohol, so the control must test whether this treatment was actually responsible for the differing volumes of gas produced. The candidate would have been awarded a second mark for saying that exactly the same procedure would be followed with the control as in the investigation described.

(d)(v) The correct response for an error-carried-through mark to be awarded (i.e. the response to match the incorrect control suggested) would be that no gas would be produced (as boiling would denature the catalase).

(e) An improvement would be to say that safety goggles should be worn.

(f)(ii) The candidate could have improved the answer by labelling the *y*-axis ('*mean reaction time / ms*') and using the height of the available graph paper more efficiently. The *x*-axis label could also have been improved to '*before drinking alcohol*' and '*after drinking alcohol*'.

(f)(iii) The improvement would be to quote a range (as given in the example provided in the question). The correct answer was 220 – 350 (milliseconds).

Common mistakes candidates made in Question 1

(a)(i) *The examiner was expecting candidates to use a ruler to determine the dimensions of the potato pieces. The dimensions should be entered into the table in millimetres (as that unit is given in the column heading).*

The most common error that candidates made was to state their measurements in centimetres and not in millimetres (as stated in the table heading.)

(a)(ii) *The examiner was expecting candidates to construct a table with the correct number of cells and with column headings, and to correctly record their data into the table.*

A commonly mistake made by candidates was to omit the units (/ 3 min) from the column headings. Some candidates could not count the tally signs correctly; it appeared that the sloping line denoting '5' was not understood. Some candidates drew tables without using a ruler.

(b)(i) *The use of 'suggest' in the question indicated that the candidate is not expected to have met this scenario previously. They are expected to provide a sensible reason for the action described, using previous experimental experience.*

A number of candidates incorrectly thought that the procedure described would prevent air (from the atmosphere) entering the delivery tube.

(b)(ii) *The examiner was expecting the candidate to give a reason why the bung has to have a tight fit in the test tube.*

Some candidates incorrectly thought that a tightly fitting bung was there to prevent substances entering the test-tube. It was common for candidates to refer to '*fair tests*' rather than using a precise term such as '*accuracy*' or '*validity*'.

(c)(i) *The examiner was expecting the candidate to apply general knowledge to a novel situation and state the relationship between bubble numbers produced and catalase activity.*

The most common error was to refer to the amount of alcohol rather than the percentage or concentration of alcohol.

(c)(ii) *The examiner was expecting the catalase activity of all three potato pieces to be placed in order.*

The most common errors were:

- restating the number of bubbles with no interpretation
- saying that sample B was more active than sample A, with no reference to the activity of sample C.

(c)(iii) *The use of the word 'predict' in the question indicated that candidates were required to make a logical connection between the pieces of information, in order to arrive at a certain number of bubbles for the answer.*

Many candidates stated a number of bubbles that was not based on the experimental results given. It appeared that they were guessing.

(d)(i) *The examiner was expecting a concise answer to 'state one variable.' The candidate was then expected to state in words how the variable selected was kept constant.*

The most common errors were:

- stating a variable that was not controlled in the experiment (such as temperature)
- stating 'potato' as the variable, and then in answer to the second part of the question saying, 'the size was controlled'.

These candidates were giving insufficient detail.

(d)(ii) *The examiner was expecting a concise reason for the oxygen measurement method to be a source of error. The candidate was expected to apply general knowledge of the subject to this novel situation and provide a possible modification to the method. There was no unique answer.*

A fairly common error was to say that the gas collected may not be oxygen and thus the gas must be tested with a glowing match (or similar).

(d)(iii) *The examiner was expecting the candidate to refer to step 2 in the description of the investigation. The single source of error had to be stated. Following on from this, the candidate was expected to explain why it constituted a source of error.*

Many candidates did not appreciate what 'step 2' involved (which was dividing a piece of potato without using a ruler). Many assumed a ruler had been used and so gave inappropriate sources of error. Even those who gave a correct source of error could not explain the reason.

(d)(iv) *The examiner was expecting the candidate to devise a control experiment and say what it would entail. As there were two marks for the answer, the examiner was expecting two distinct points to be made.*

Many candidates appeared to be using controls that they were accustomed to use in class experiments, but that were not applicable here, such as: boiled potato, no potato, boiled catalase, or glass beads.

(d)(v) *The candidate was expected to use logic to say what the results of the control experiment would be.*

The most common error here was to quote a number of bubbles that bore no relationship to the control suggested.

(e) *The examiner was expecting a concise description of a safety precaution that would be necessary when using ethanol in a laboratory.*

A significant number of candidates gave safety precautions that were unrelated to the use of ethanol.

(f)(i) *The examiner was expecting a numerical response.*

Very occasionally, the candidates calculated the mean incorrectly. A few candidates appeared not to have calculators as they were manually adding up in the margins and then performing the division.

(f)(ii) *The candidate was expected to construct a bar chart on the grid provided.*

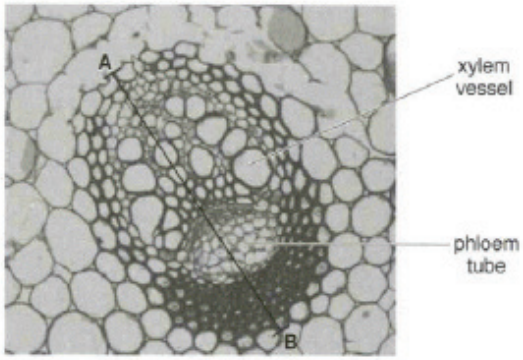
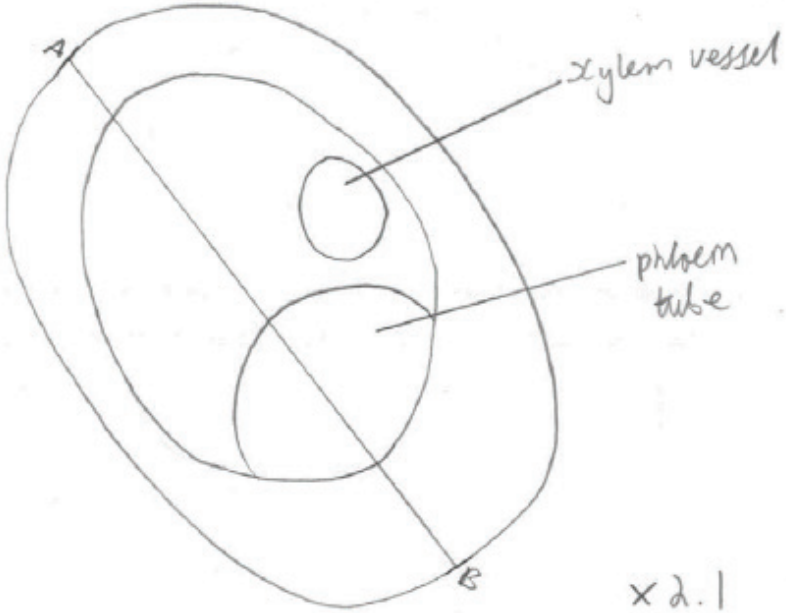
The most common errors were:

- not labelling the *y*-axis
- omitting the units from the *y*-axis label
- drawing touching bars

(f)(iii) *The examiner was expecting a lower and an upper limit to be given for the range.*

It was fairly common for the range to be selected incorrectly.

Question 2

Example Candidate Response – Question 2, High	Examiner comments
2 Fig. 2.1 is a photograph of a cross-section of a vascular bundle in a leaf. Line **AB** shows the length of the vascular bundle.  **Fig. 2.1** **(a) (i)** Make a large drawing to show the different regions of the vascular bundle shown in Fig. 2.1. Do **not** draw any individual cells. Identify and label on your drawing the position of the xylem vessel as shown in Fig. 2.1.  [5]	The candidate is awarded marks: for all lines being clear, single and unbroken; the drawing is larger than the photograph; the vascular bundle is oval in shape, and the areas of phloem and xylem are shown; the correct position of the required label. One mark is not awarded because two other areas (visible in the photograph) are not drawn. **Mark awarded for 2(a)(i) = 4 out of 5**

Example Candidate Response – Question 2, High

(ii) Measure the length of line **AB** as shown on Fig. 2.1. **Include the unit.**

Length of **AB** 58mm

Mark on your drawing a line in the same position as **AB**.

Measure the line you have drawn.

Length of line on drawing 121mm

$$\text{magnification} = \frac{\text{length of line on drawing}}{\text{length of AB}}$$

Calculate the magnification of your drawing using the information above and your answers.

Show your working. magnification = length line on drawing / length of AB

$$m = \frac{121}{58}$$

$m = 2.086$ magnification ×2.1

[3]

(iii) State **one** way **visible** in Fig. 2.1 in which the xylem vessel is different from the phloem tube.

The phloem tube is made up of lots of cells whereas the xylem vessel is hollow.

[1]

(b) The walls of xylem vessels are supported by a chemical called lignin, which can be stained by a red dye. This makes the xylem vessel walls easily seen when using a microscope.

Use this information to plan how you could find the position of the vascular bundles in a stem.

You could get cut a cross-section of a stem and place it on a white tile so the red colour can easily be seen. You could take 5 pieces of samples (cross sections) of the stem and cut them all the same depth of 10mm. You could then add 5 drops of the dye to each cross section of the stem, which would highlight the xylem vessel. Then you could compare the distance of the vessels from the xylem vessel on a microscope and compare it with the actual piece, to locate the outline of the vascular bundle in each sample. Using different samples allows for errors in the measuring, as the vascular bundle may be in a different place in each case. [4]

[Total: 13]

Examiner comments

Both measurements are accurate and the appropriate units are given. The magnification is calculated correctly, rounded to a sensible number and expressed with a × sign.

Mark awarded for 2(a)(ii) = 3 out of 3

The photograph has a phloem tube and a xylem vessel labelled, so that a direct comparison can be made. The candidate has taken the entire area of phloem as one tube, and so the answer is not correct.

Mark awarded for 2(a)(iii) = 0 out of 1

The candidate gains full marks for cutting sections of a suitable plant material, adding the dye (to stain the lignin) and then identifying the vascular bundle by the presence of the dyed structures. The candidate states that the cross sections had a depth of 10 mm, which is impractical, but this did not detract from the marks.

Mark awarded for 2(b) = 4 out of 4

Total marks awarded =

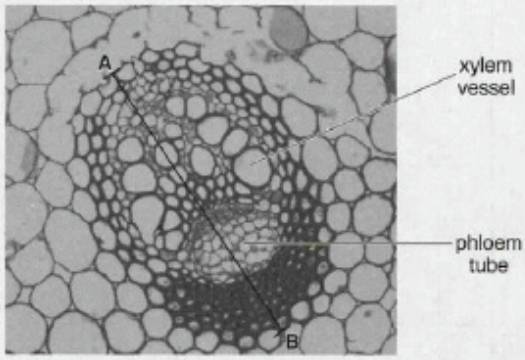
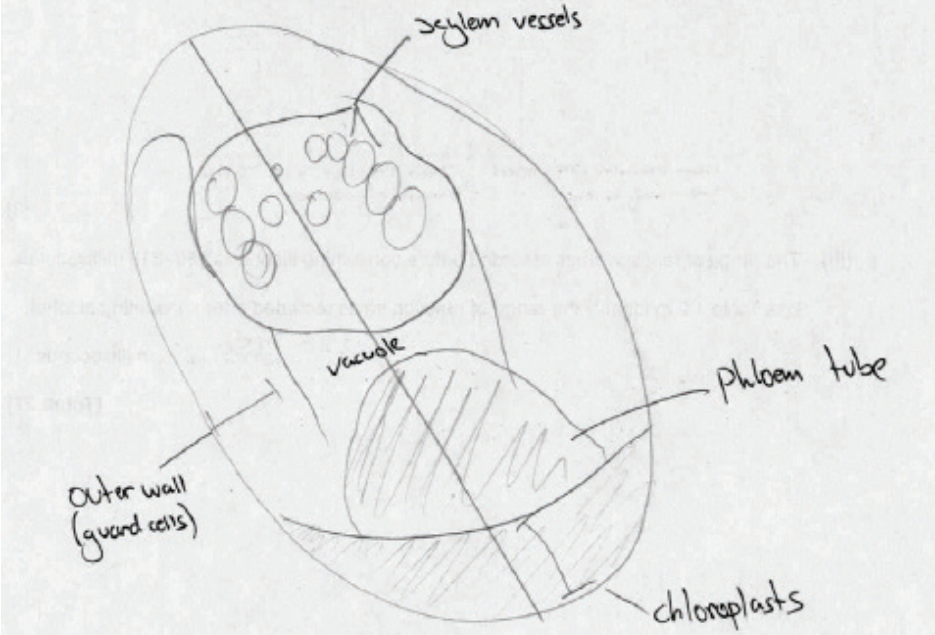
11 out of 13

How the candidate could have improved the answer

(a)(i) The candidate could have improved their answer by examining the photograph more carefully and indicating other areas on the diagram. It is not expected that candidates have knowledge of vascular bundle structure (other than xylem and phloem), but it is expected that they can examine a specimen and distinguish different areas.

(a)(iii) The candidate could have improved by examining the specimen more carefully.

(b) No major improvement required. It was not necessary (from the instructions) to carry out the staining on five pieces of stem, but it was not incorrect to do so. The scientific principle behind the repetition is sound. An improvement would have been to state an appropriate thickness for the sections, but saying they were thin would have been sufficient.

Example Candidate Response – Question 2, Middle	Examiner comments
2 Fig. 2.1 is a photograph of a cross-section of a vascular bundle in a leaf. Line **AB** shows the length of the vascular bundle.  **Fig. 2.1** **(a) (i)** Make a large drawing to show the different regions of the vascular bundle shown in Fig. 2.1. Do **not** draw any individual cells. Identify and label on your drawing the position of the xylem vessel as shown in Fig. 2.1.  [5]	Two marks are awarded since: the diagram is sufficiently large; and the overall shape is oval, the phloem area is shown and there are three contiguous xylem vessels. Marks were not awarded because: the lines are not continuous, there are some overlaps and the phloem is shaded; only one other area (the schlerenchyma) is shown; and although there is a label stating 'xylem vessels' the lines do not end on the structures. Note that strange labels 'vacuole', 'guard cells' and 'chloroplasts', appear. **Mark awarded for (a)(i) = 2 out of 5**

Example Candidate Response – Question 2, Middle	Examiner comments
(ii) Measure the length of line **AB** as shown on Fig. 2.1. **Include the unit.** Length of **AB** 59mm. Mark on your drawing a line in the same position as **AB**. Measure the line you have drawn. Length of line on drawing 140mm $\text{magnification} = \frac{\text{length of line on drawing}}{\text{length of AB}}$ Calculate the magnification of your drawing using the information above and your answers. Show your working. $\frac{140}{59} = 2.37$ magnification x2.37 [3]	The first measurement is accurate, the second one is not. The magnification calculation is carried out correctly. **Mark awarded for (a)(ii) 2 out of 3**
(iii) State **one** way **visible** in Fig. 2.1 in which the xylem vessel is different from the phloem tube. The xylem vessels are much wider. [1]	The correct comparison is stated. **Mark awarded for (a)(iii) = 1 out of 1**
(b) The walls of xylem vessels are supported by a chemical called lignin, which can be stained by a red dye. This makes the xylem vessel walls easily seen when using a microscope. Use this information to plan how you could find the position of the vascular bundles in a stem. Use the dye to enter the xylem vessels. Diset the stem. In order to find the vascular bundle look for a large area that is dyed red. This is your bundle. [4] **[Total: 13]**	The dye is added to stain the xylem vessels and the latter, is used to locate the vascular bundle. **Mark awarded for (b) = 2 out of 4** **Total marks awarded = 7 out of 13**

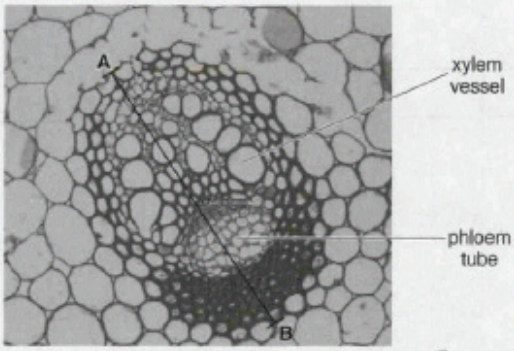
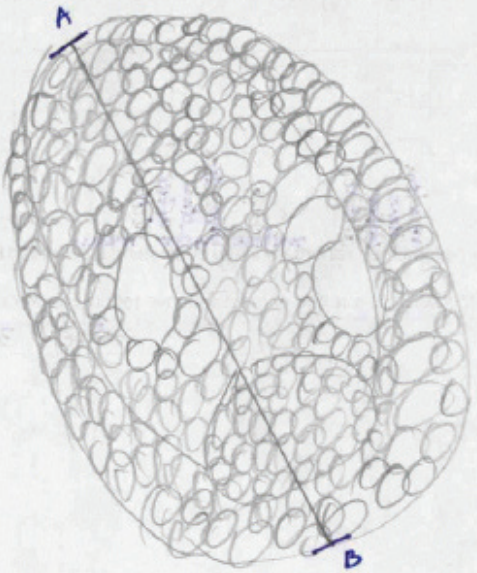
How the candidate could have improved the answer

(a)(i) The candidate could have improved by:

- drawing clear continuous lines and not shading parts of the diagram
- examining the photograph in more detail and drawing all the areas visible
- ensuring that label lines end on the intended structures.

(a)(ii) An improvement would have been to measure the length of the line drawn on the diagram more accurately.

(b) The candidate could have improved by giving more detail of the planning, such as cutting a thin section and giving the dye sufficient time to stain the xylem vessels. Dissecting the stem is not appropriate.

Example Candidate Response, Question 2, Low	Examiner comments
2 Fig. 2.1 is a photograph of a cross-section of a vascular bundle in a leaf. Line **AB** shows the length of the vascular bundle.  Fig. 2.1 (a) (i) Make a large drawing to show the different regions of the vascular bundle shown in Fig. 2.1. Do **not** draw any individual cells. Identify and label on your drawing the position of the xylem vessel as shown in Fig. 2.1.  [5]	Two marks are awarded since: the drawing is much larger than the original photograph; and the drawing shows the area of phloem plus three contiguous xylem vessels (which is allowed as representing the area of xylem). Marks were not awarded since: the lines are not single, clear and unbroken; the candidate has ignored the instruction given and has drawn numerous cells with many errors in line quality; no other areas are defined on the drawing; and the candidate has not shown the position of the xylem vessel. **Mark awarded for 2(a)(i) = 2 out of 5**

Example Candidate Response, Question 2, Low	Examiner comments

(ii) Measure the length of line **AB** as shown on Fig. 2.1. **Include the unit.**

Length of **AB** 59 mm

1cm = 10mm
5.9 =

Mark on your drawing a line in the same position as **AB**.

Measure the line you have drawn.

Length of line on drawing 109 mm

$$\text{magnification} = \frac{\text{length of line on drawing}}{\text{length of AB}}$$

Calculate the magnification of your drawing using the information above and your answers.

Show your working.

$\frac{109}{59}$

magnification x 109/59 mm 1

[3]

The candidate is awarded marks for the accurate measurement and units of the line AB on the photo, and for the correct measurement of the line on their drawing.

The magnification calculation is incomplete, so a mark is not awarded here.

1 Note that the candidate has included 'mm' in the magnification, which would invalidate the answer even if it were calculated correctly.

Mark awarded for 2(a)(ii) = 2 out of 3

(iii) State **one** way **visible** in Fig. 2.1 in which the xylem vessel is different from the phloem tube.

Xylem vessel are bigger and wider than phloem tube

[1]

The candidate is awarded one mark for correctly identifying a difference.

Mark awarded for 2(a)(iii) = 1 out of 1

(b) The walls of xylem vessels are supported by a chemical called lignin, which can be stained by a red dye. This makes the xylem vessel walls easily seen when using a microscope.

Use this information to plan how you could find the position of the vascular bundles in a stem.

→ Put few drops of lignin in the steam.

→ ~~If the colour~~ wait till it diffuse.

→ ~~the part where you can~~ Put it under the microscope

→ The part which will be red in colour → Vascular bundles.

[4]

[Total: 13]

The candidate appears to have misunderstood the information given, as the dye is referred to as lignin. The only mark awarded is for the waiting period to give the dye time to be absorbed. The location of the vascular bundle is insufficiently explained.

Mark awarded for 2(b) = 1 out of 4

Total mark awarded = 6 out of 13

How the candidate could have improved the answer

(a)(i) The candidate could have improved by:

- drawing areas (not individual cells)
- representing all the different areas visible in the photograph
- improving line quality and ensuring lines do not overlap
- following all instructions, particularly the instruction to label the xylem vessel.

(a)(ii) The answer could be improved by the candidate completing the calculation and remembering that a magnification is not followed by units of length.

(a)(iii) The sole improvement would be to use the correct tense (but this is a minor matter and does not impact on the mark as the biology is perfectly clear).

(b) The candidate could have improved the answer by having a better understanding of the question. Reading the information given more carefully would have helped. The candidate needs to say that a thin section of the stem is cut (otherwise any cell detail would not be visible under the microscope).

Common mistakes candidates made in Question 2

(a)(i) *The examiner was expecting a drawing, in pencil, showing the different regions of the vascular bundle from the photograph provided. The candidate was expected to label a xylem vessel on the drawing produced.*

The majority of candidates drew cells and not areas of different cell types. Where cells were drawn the line quality almost inevitably fell below the standard required as lines were numerous. Many of those who drew areas of different cells used shading. The majority differentiated xylem and phloem only. Many neglected to label an xylem vessel.

(a)(ii) *The examiner was expecting the candidate to make two linear measurements, using a ruler, and to state these, giving appropriate units. These measurements should then be used to calculate the magnification of the candidate's drawing.*

The most common error was not drawing the line AB on the diagram.

(a)(iii) *The examiner was expecting a brief description of a visible difference between a xylem vessel and a phloem tube shown in the photograph.*

Some candidates mistook the whole area of phloem tissue for one phloem tube.

(b) *The examiner was expecting a precise sequence of actions that would be carried out in order to locate a vascular bundle. There were four marks available so the candidate was expected to give at least four steps in the process they planned.*

Many candidates had not planned the sequence of procedures before starting to write and so produced rather muddled accounts. Common stages omitted were cutting a section and leaving time for the dye to be absorbed by the lignin.

Cambridge Assessment International Education
The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA, United Kingdom
t: +44 1223 553554
e: info@cambridgeinternational.org www.cambridgeinternational.org