Cambridge Assessment International Education

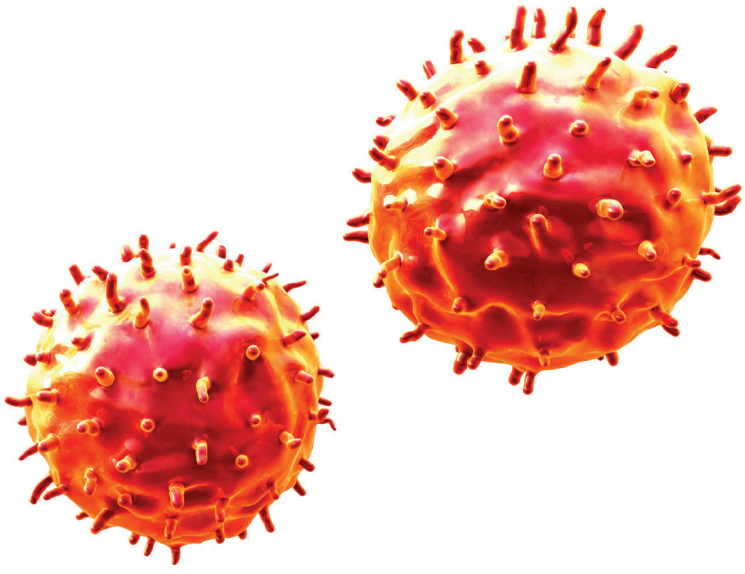
Example Candidate Responses

Paper 4

Cambridge IGCSE®

Biology 0610

For examination from 2016



Version 2.0

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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

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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.

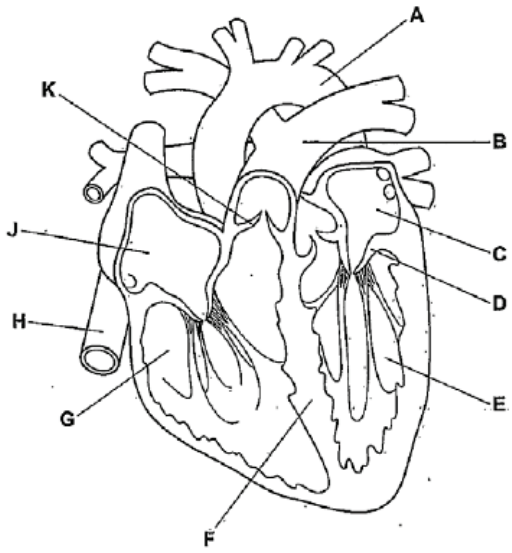


Fig. 1.1

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.

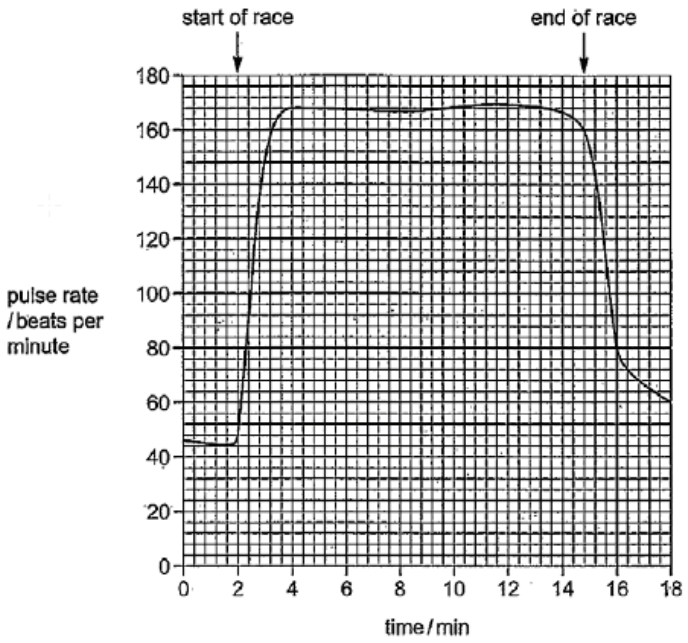


Fig. 1.2

(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.

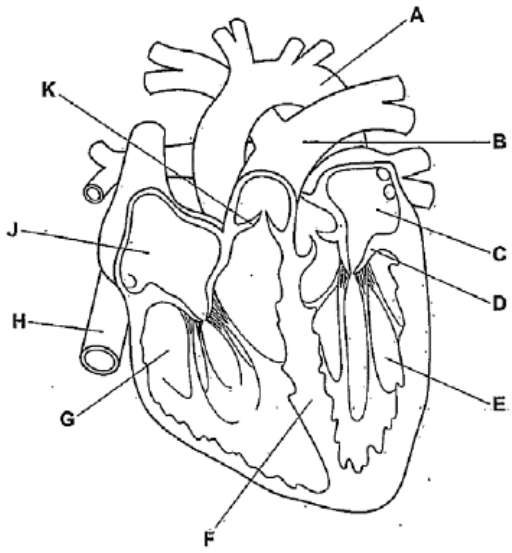


Fig. 1.1

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 volve
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

[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.

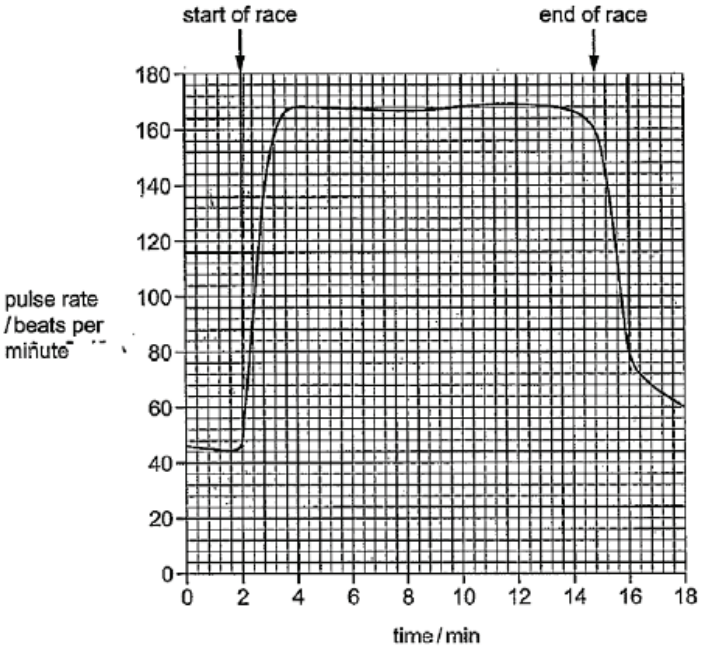


Fig. 1.2

(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.

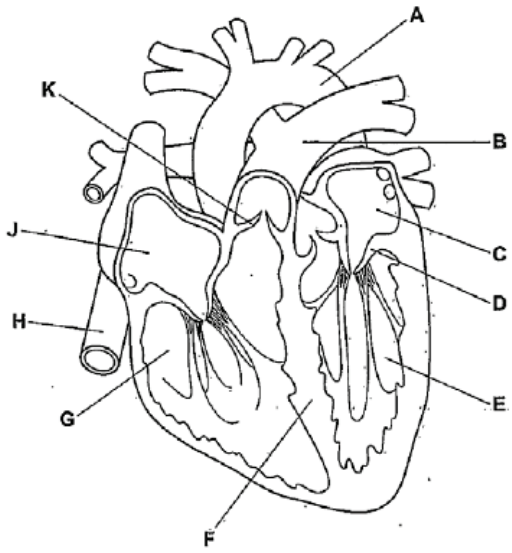


Fig. 1.1

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.

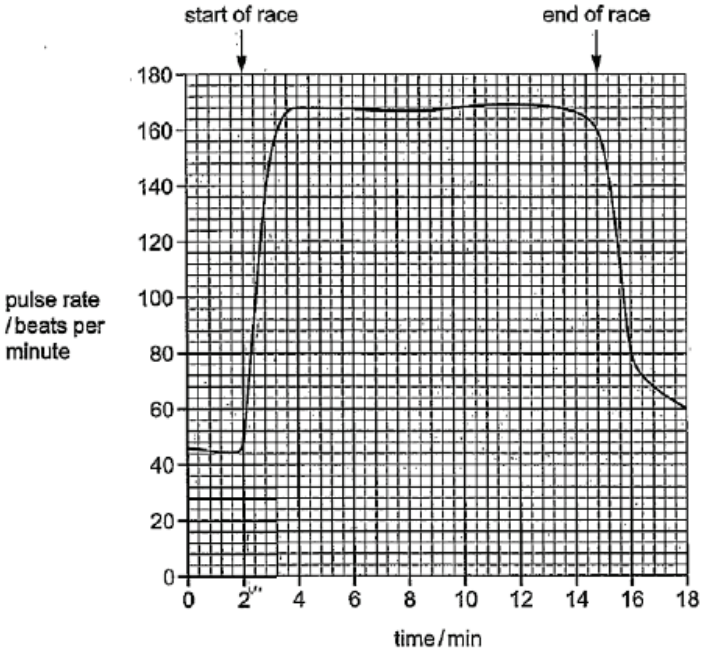


Fig. 1.2

(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).

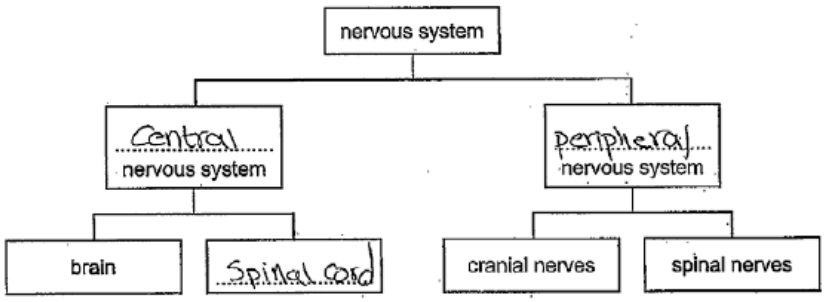
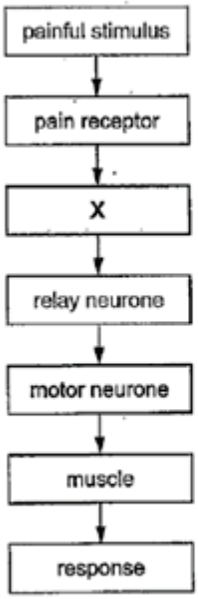
(b) (ii) *The candidates were expected to give an answer that **explains**. The examiner will be expecting an extended prose response, in which candidates use their scientific knowledge to state **why** the pulse rate increases between 2 and 3 minutes. It is not enough to state that it increases, they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

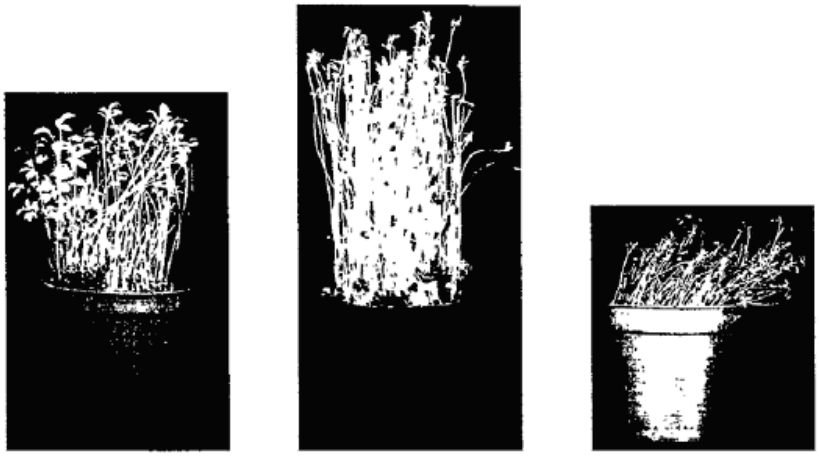
(iii) State **two** ways in which a voluntary action differs from an involuntary action.

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.

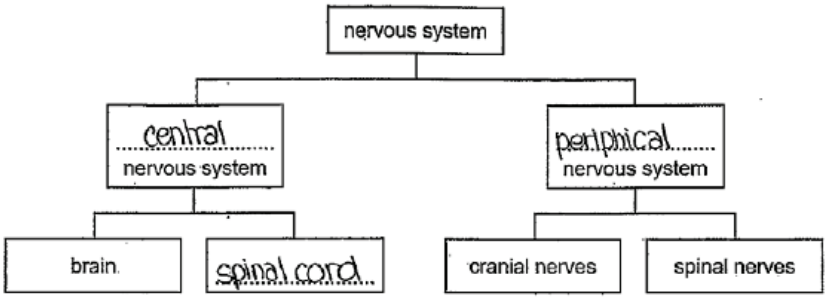


Fig. 2.1

[3]

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

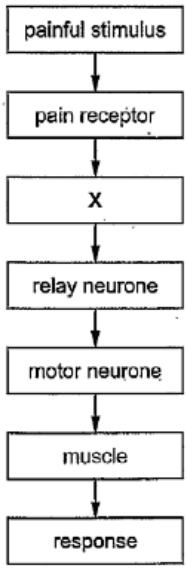


Fig. 2.2

(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

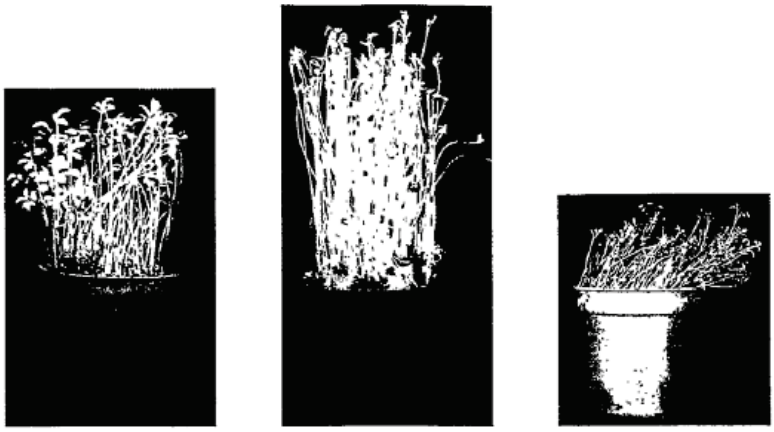
The candidate gains full credit despite the misspelling of peripheral.

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.

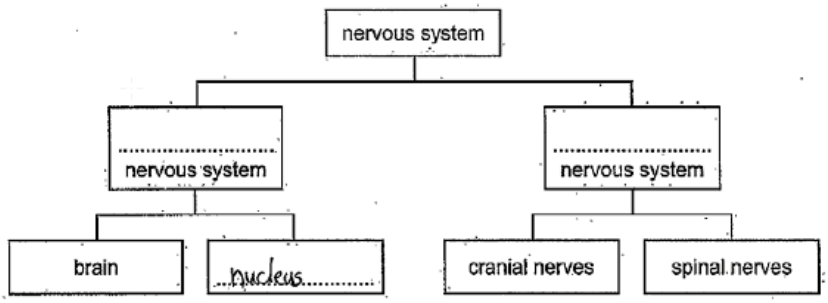


Fig. 2.1

[3]

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

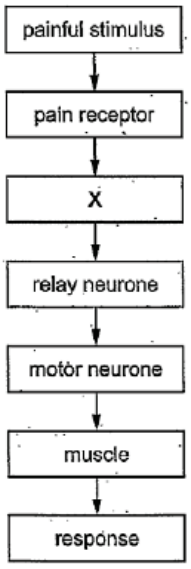


Fig. 2.2

(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.

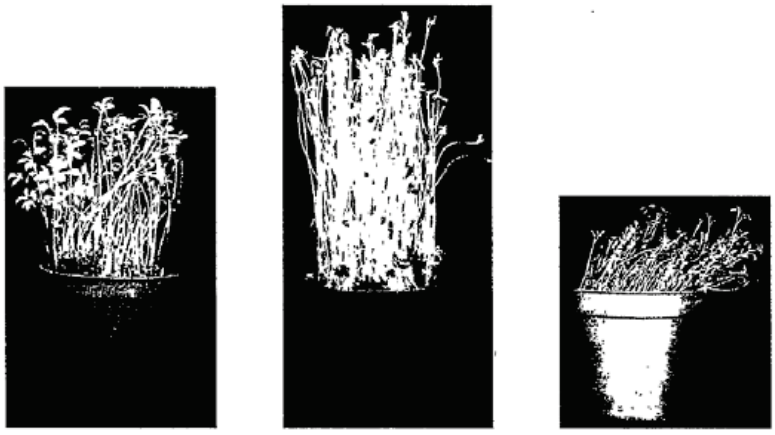
Mark awarded for 2(a) = 0 out of 3

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 ~~Sun~~ Plant was exposed to the sun from only one side so it grew ~~towan~~ towards the Sun. And it grew longer roots and it is easier for spreading pollen grains for reproduction of ~~animals~~ 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. ~~A~~ Pot are was partially exposed to the Sun and bearly watered so the ~~ox~~ 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.

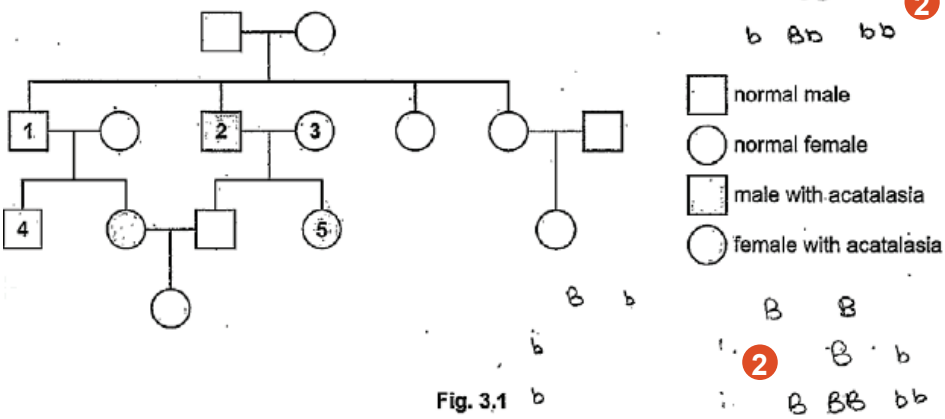


Fig. 3.1

(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.

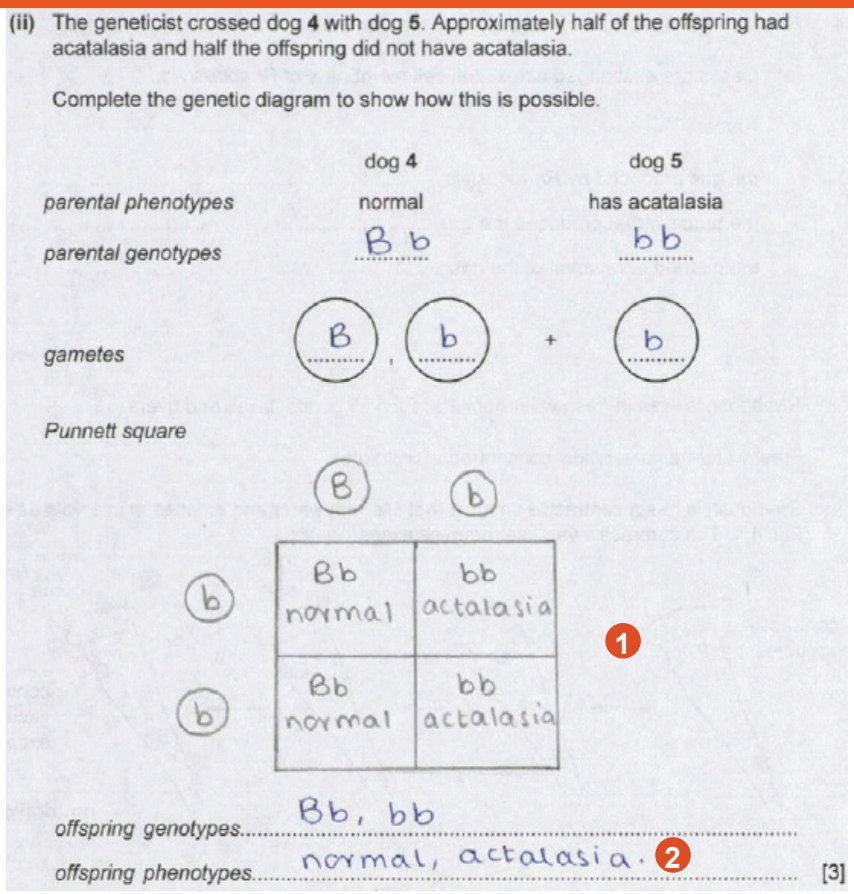
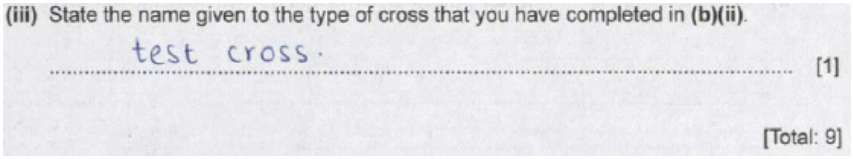
Mark awarded for 3(a) = 2 out of 2

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.

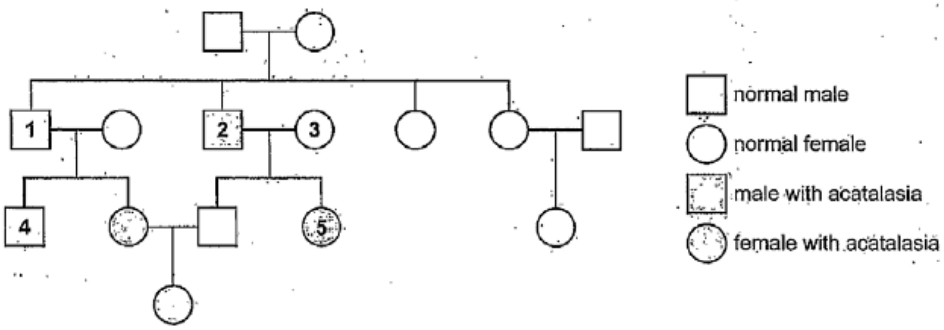


Fig. 3.1

(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

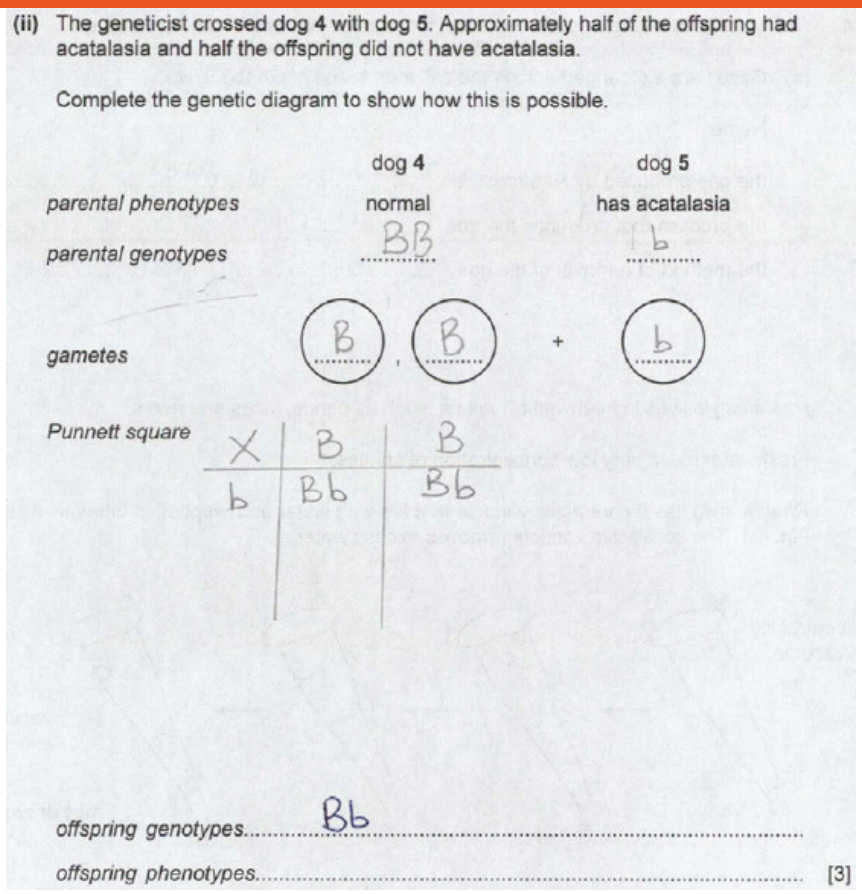
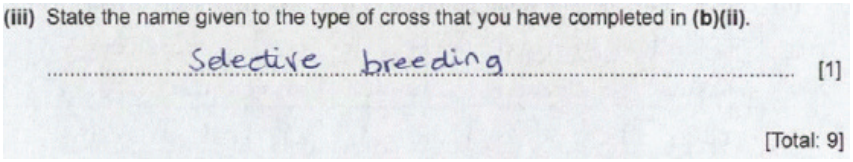
1 The mark is awarded for the definition of a gene.

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.

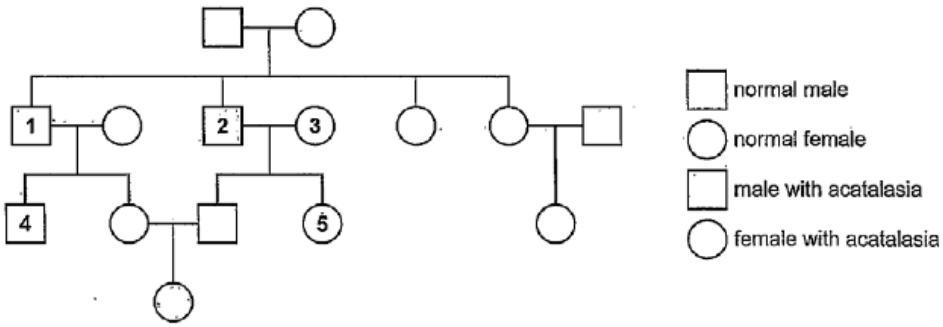


Fig. 3.1

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

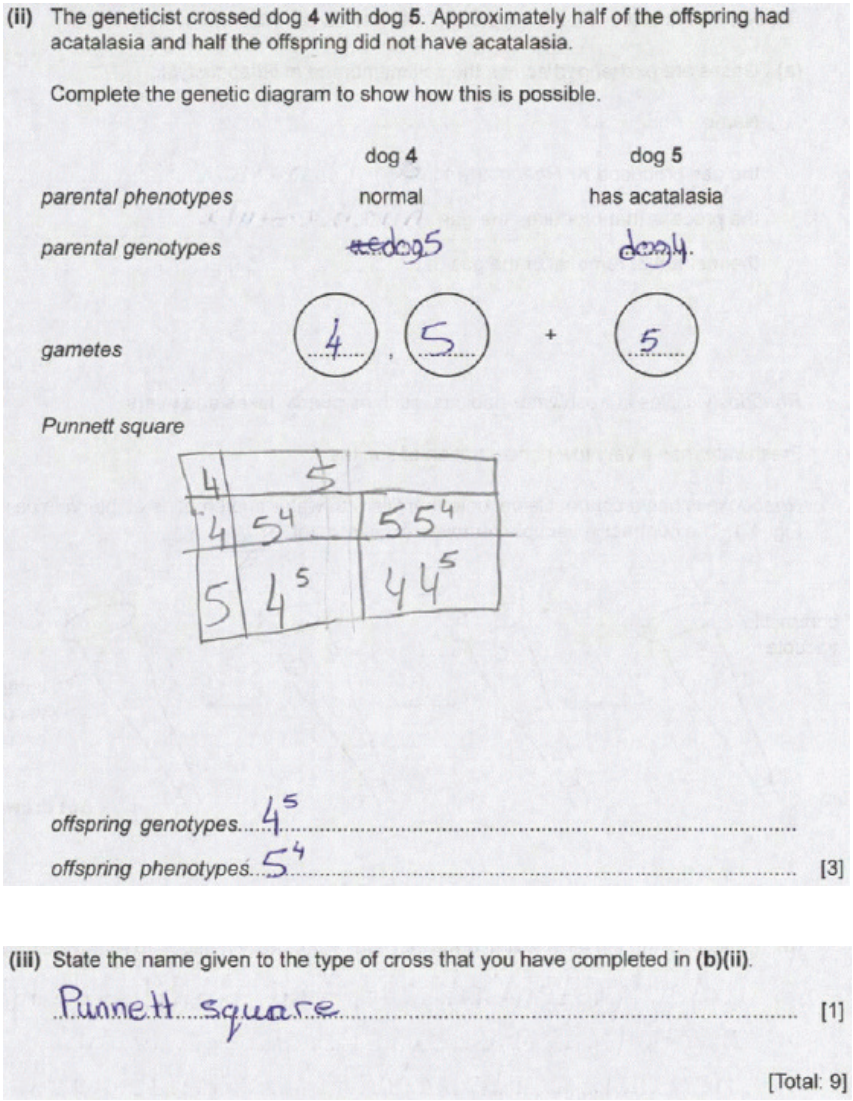
1 normal male

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.*

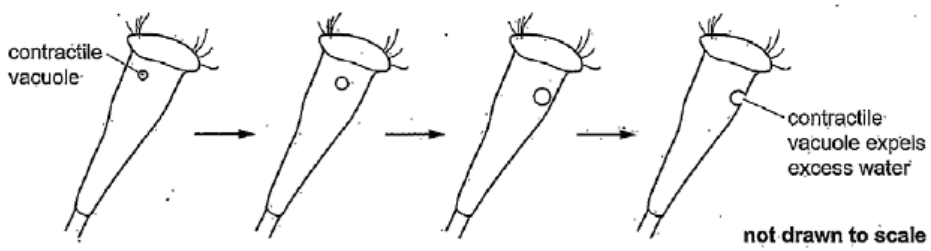
The most common error was to choose the genotype **BB** rather than **Bb** for dog 4. Candidates could still gain some marks for correct application.

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.

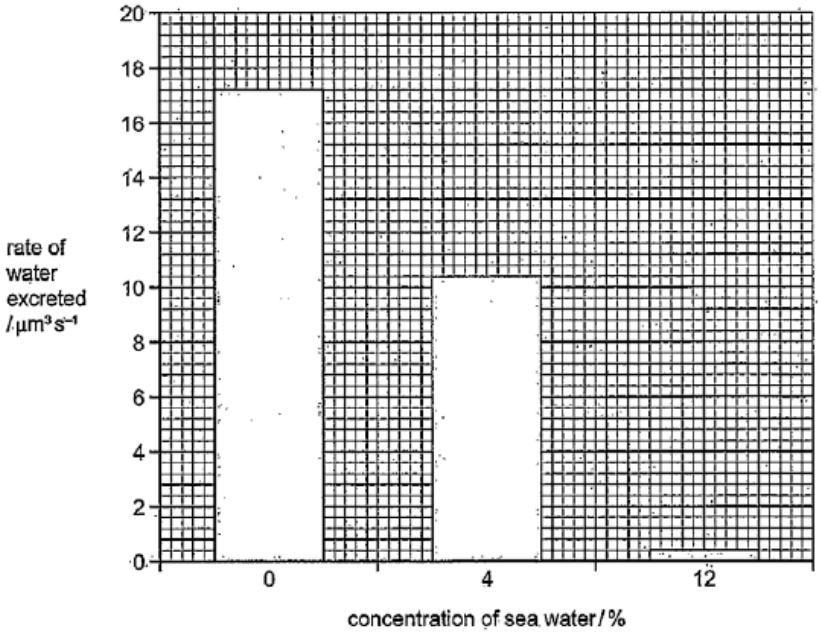


Fig. 4.2

(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.

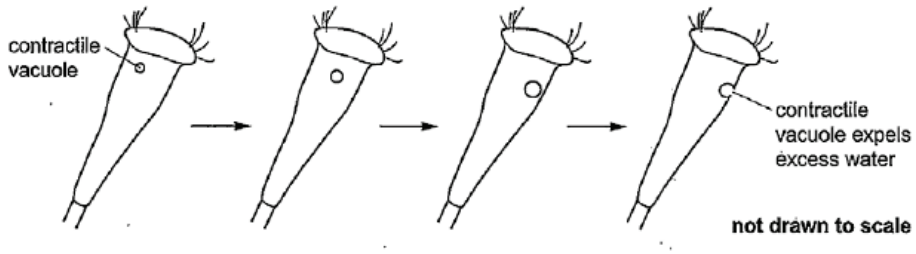


Fig. 4.1

(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.

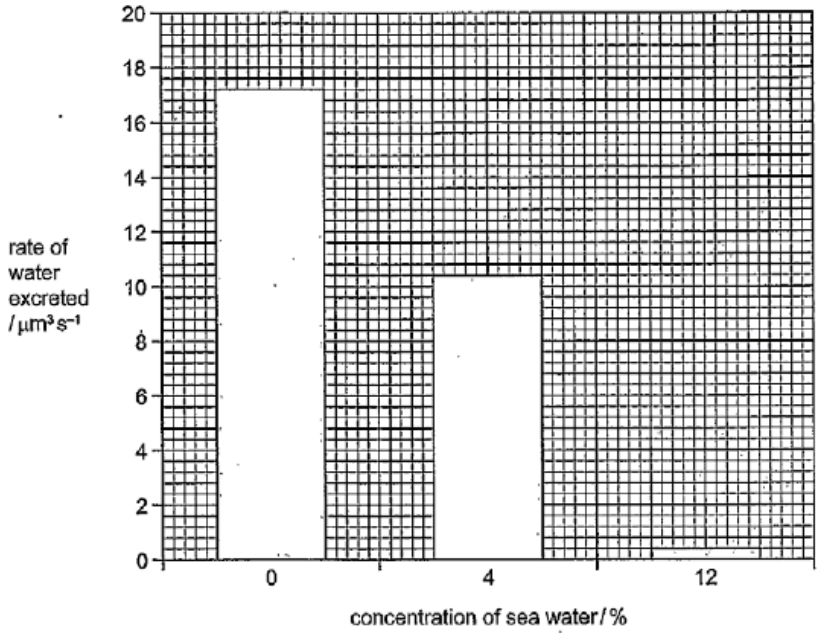


Fig. 4.2

(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.

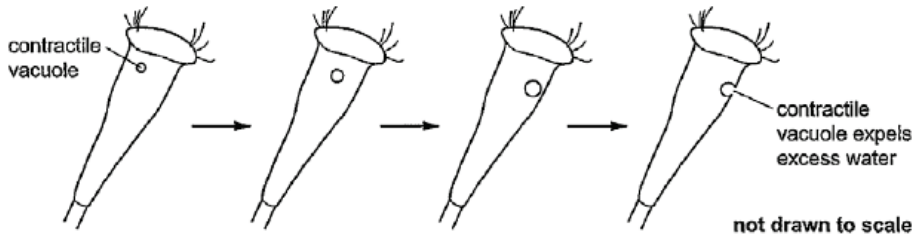


Fig. 4.1

(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.

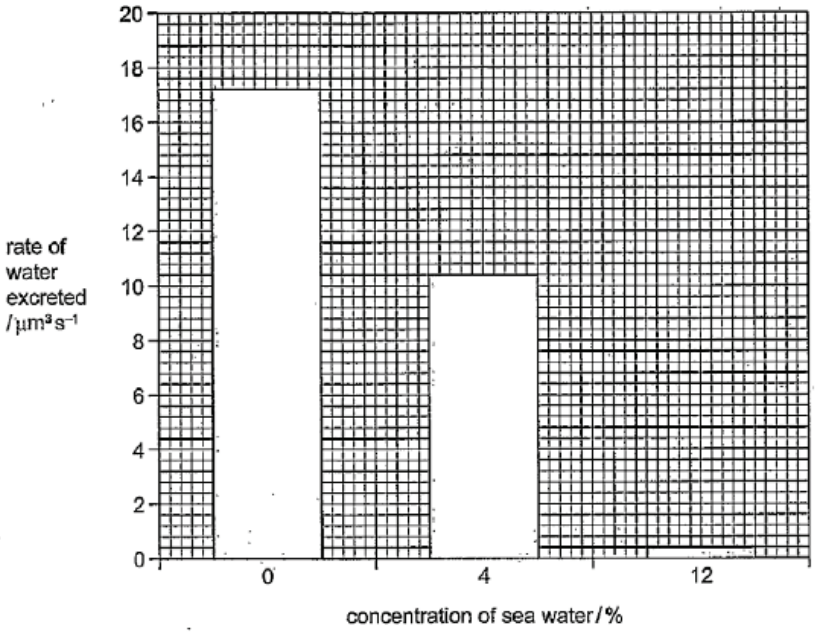


Fig. 4.2

(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.

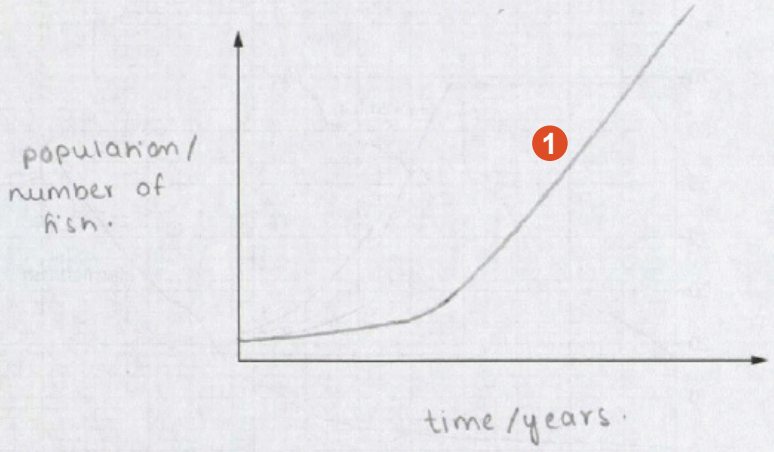
Question 5

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.

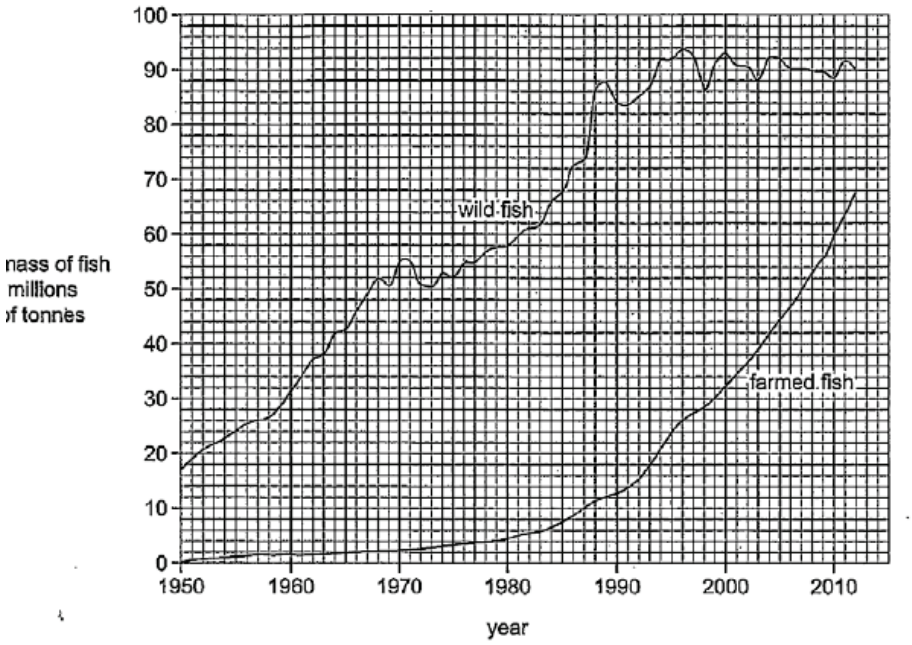


Fig. 5.1

(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

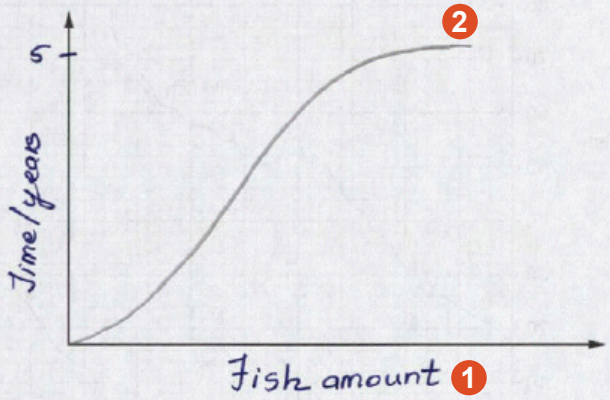
Example Candidate Response – Question 5, High	Examiner comments
(c) It is predicted that wild fish stocks will decrease and become depleted because of overfishing. Suggest ways in which governments can try to maintain the stocks of wild fish. ~~Governments should try to reduce the effect of limiting 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.

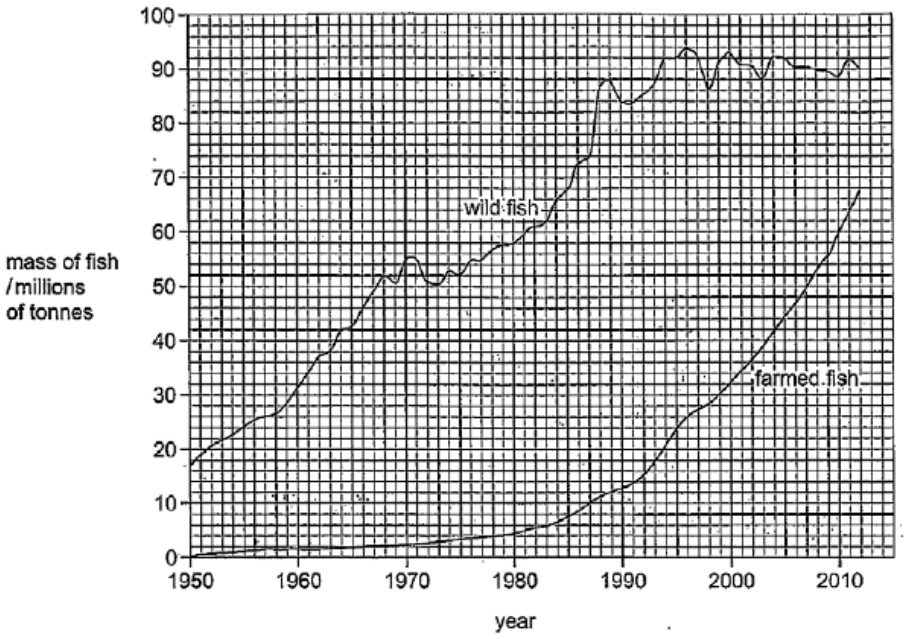


Fig. 5.1

(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.

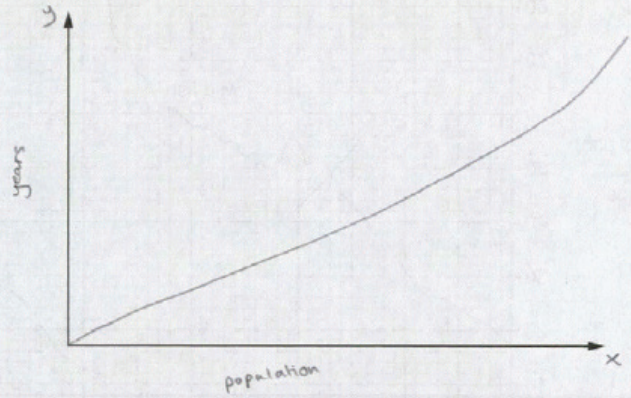
(d) The candidate has provided a reasonable answer but repeats the fact that the resource is renewable in slightly different ways. To improve, the candidate could have stated that a renewable resource does not run out ('*remains in our ecosystem*' was considered too vague to be equivalent). Quoting the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

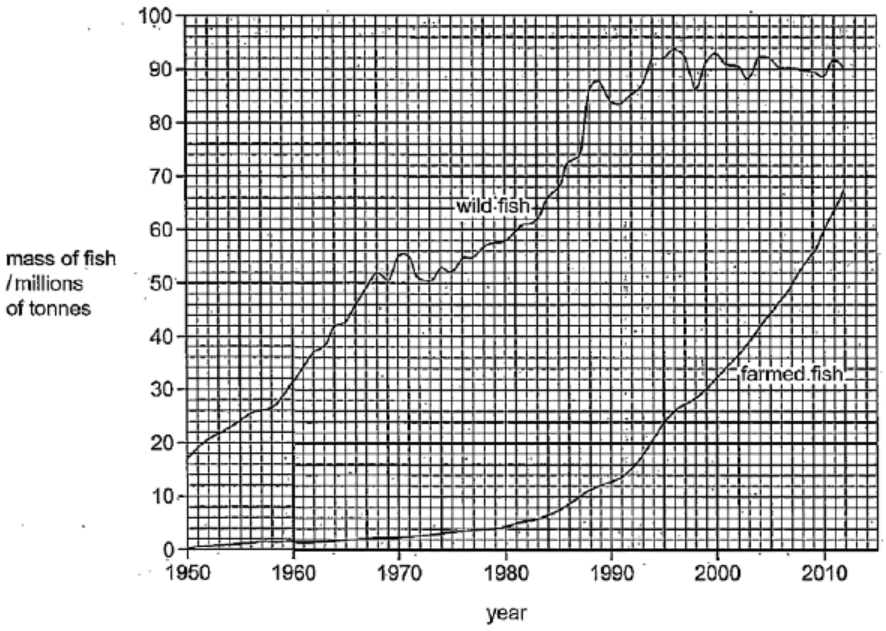


Fig. 5.1

(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.

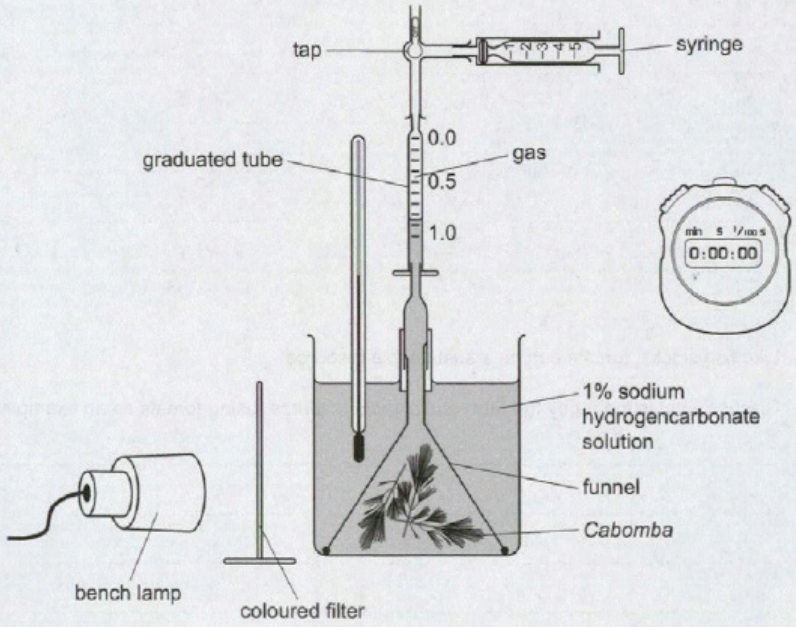
Some candidates did not provide enough suggestions. The number of marks available for a question is a good indication of the minimum number of points that need to be made.

(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.

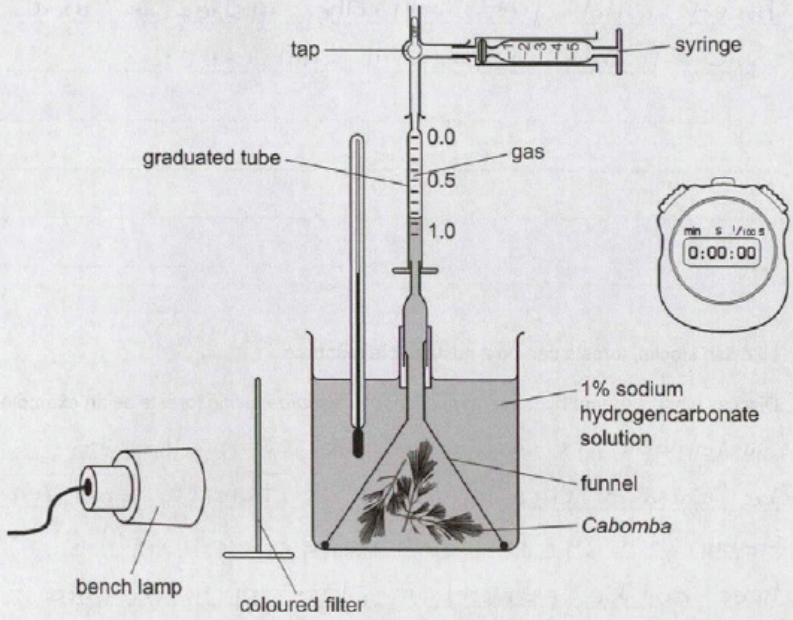


Fig. 6.1

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.

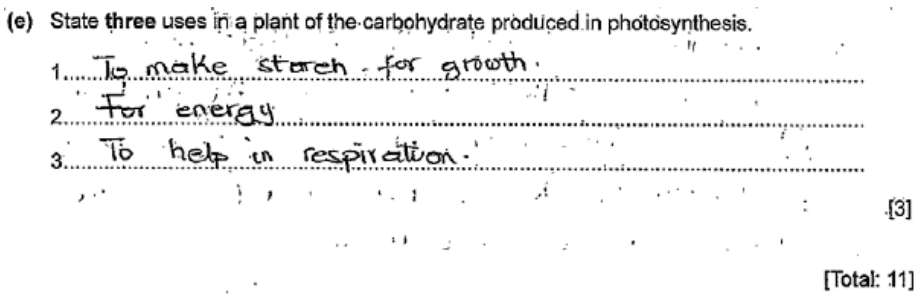
Mark awarded for 6(c) = 0 out of 1

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.

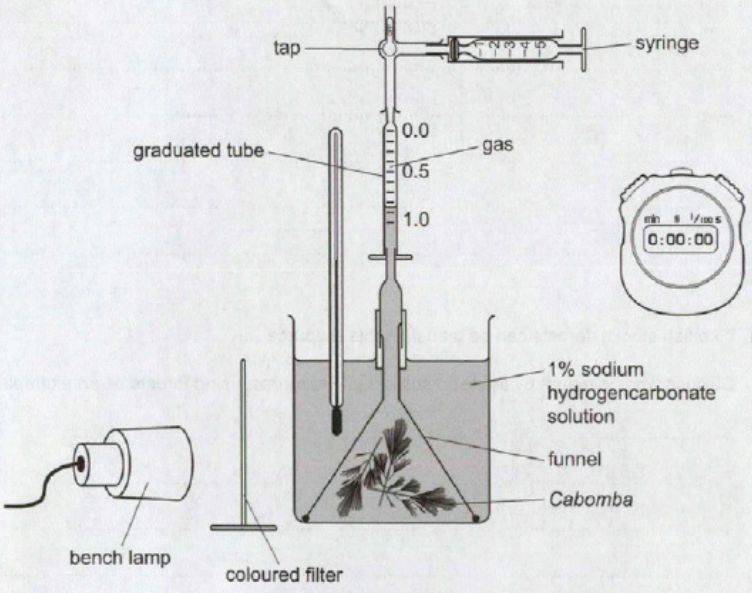


Fig. 6.1

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.

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