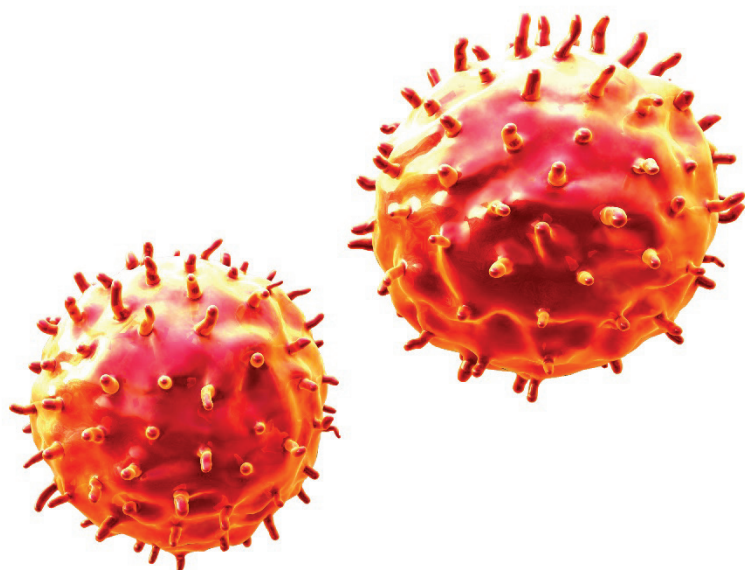


# Example Candidate Responses

## Paper 5

**Cambridge IGCSE™**

**Biology 0610**



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## Introduction

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

In this booklet candidate responses have been chosen to exemplify a range of answers. Each response is accompanied by a brief commentary explaining the strengths and weaknesses of the answers.

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

This document provides illustrative examples of candidate work. These help teachers to assess the standard required to achieve marks, beyond the guidance of the mark scheme. Some question types where the answer is clear from the mark scheme, such as short answers and multiple choice, have therefore been omitted.

The questions, mark schemes and pre-release material used here are available to download from the School Support Hub. These files are:

Question Paper 52, November 2016	
Question paper	0620_w16_qp_52.pdf
Mark scheme	0620_w16_ms_52.pdf

Other past papers, Examiner Reports and other teacher support materials are available on the School Support Hub [www.cambridgeinternational.org/support](http://www.cambridgeinternational.org/support)

## How to use this booklet

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

### Example Candidate Response – high, continued

### Examiner comments

You are going to measure the length of the coleoptiles and the total length of the seedlings visible above the soil. You will measure **all** the seedlings grown in the light and **all** the seedlings grown in the dark.

(b) (i) Prepare a table to record your results.

FEATURE	SEEDLINGS GROWN IN LIGHT (L)			SEEDLINGS GROWN IN DARK (D)		
	1	2	3	1	2	3
LENGTH OF COLEOPTILES (cm)	2.0	1.5	3.0	3.0	2.5	3.5
TOTAL LENGTH OF SEEDLINGS (cm)				0	42.0	43.0

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

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

2

**2** The table shows the expected features for the main columns in the table. The seedling with the seedling measurement rows, one for each measurement, and an acceptable unit. All the table cells are filled in and the results show the expected pattern.

**Examiner comments** are alongside the answers, linked to specific part of the answer. These explain where and why marks were awarded. This helps you to interpret the standard of Cambridge exams and helps your learners to refine exam technique.

[6] Mark awarded for (b) (i) = 6 out of 6

### How the candidate could have improved the answer

(a) The first feature needed only to be 'colour'. For the other features, the candidate could have included another **visible** feature such as the length of the plant.

(b) The format of the table was acceptable, although the candidate could have used 'Light condition' or 'place of growth'. Alternatively, the candidate could have used 'light and dark', and the current first column headed 'sample' should always go in the column or row heading.

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

### Common mistakes candidates made in this question

(a) Poor identification of the features being compared.

(b) (i) Failing to read the instructions so that tables could be drawn outside columns or rows, putting units in the body of the table.

This describes the common mistakes candidates made in answering each question. This will help your learners to avoid these mistakes at the exam and give them the best chance of achieving a high mark.

## Assessment at a glance

All candidates take three papers.

Candidates who have studied the Core subject content, or who are expected to achieve a grade D or below, should be entered for Paper 1, Paper 3 and either Paper 5 or Paper 6. These candidates will be eligible for grades C to G.

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

### Core candidates take:

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

### Extended candidates take:

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

### and Core candidates take:

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

### and Extended candidates take:

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

### All candidates take either:

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

### or:

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

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

# Paper 5 – Practical Test

## Question 1

### Example Candidate Response – high

### Examiner comments

- 1 Maize (corn) is an important food crop that produces grain. Fig. 1.1 shows a maize grain that has germinated to form a seedling.

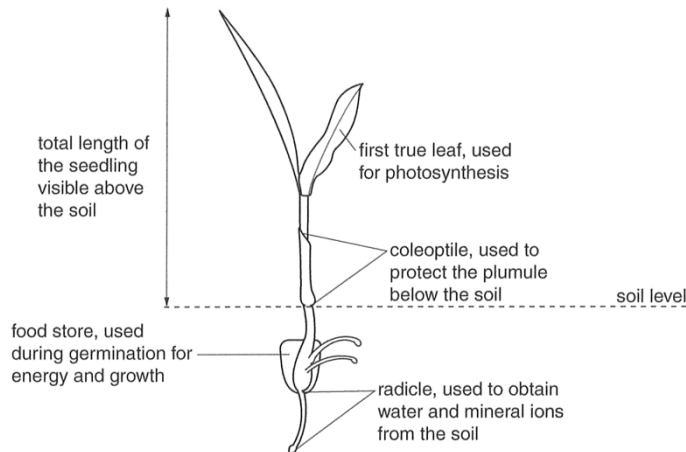


Fig. 1.1

You are going to investigate the effect of light on the germination and early growth of maize. You will measure and observe maize grown in the light and maize grown in the dark.

Three maize grains were planted in each of the two pots labelled **L** and **D**. One pot (**L**) was placed in the light and the other pot (**D**) placed in the dark. The seedlings were kept at a constant temperature.

Step 1 Observe the appearance of the seedlings carefully.

- (a) Complete Table 1.1 by recording two **visible** differences in the seedlings grown in the light and the seedlings grown in the dark.

Table 1.1

feature	seedlings grown in the light	seedlings grown in the dark
stem	upright, firm	bending, weak, floppy
leaves	green in colour	pale yellow in colour

[2]

**1** The candidate gives two acceptable answers. The feature 'leaves' is accepted because the description included a reference to colour.

Mark awarded for (a) = 2 out of 2

## Example Candidate Response – high, continued

## Examiner comments

You are going to measure the length of the coleoptiles and the total length of the seedlings visible above the soil. You will measure **all** the seedlings grown in the light and **all** the seedlings grown in the dark.

(b) (i) Prepare a table to record your results.

FEATURE	SEEDLINGS GROWN IN LIGHT (L)			SEEDLINGS GROWN IN DARK (D)		
	1	2	3	1	2	3
LENGTH OF COLEOPTILES (cm)	2.0	1.5	3.0	3.0	2.5	3.5
TOTAL LENGTH OF SEEDLING (cm)	39.0	41.0	41.0	42.0	42.0	43.0

2

2 The table shows all the expected features. There are two main columns identifying the type of seedling with sub-columns for each seedling measured. There are two rows, one for each of the expected measurements, and an acceptable unit. All the table cells are filled in and the results show the expected pattern.

[6]

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

Step 2 Use a ruler to measure the length of the coleoptile and the total length of the seedling visible above the soil for each seedling.

Record the results for the seedlings grown in pot L and in pot D in your table.

(ii) Look at Table 1.1 and the results of your measurements. State **two** conclusions that can be made about the effect of light on the germination and early growth of maize.

- 1 *Lack of light causes the lack of photosynthesis and the lack of production of auxin.* 3
- 2 *Lack of light causes the plant to be weaker.* 4

[2]

3 This answer is acceptable. Although not required, the candidate has used correct knowledge about the green colour to answer the question.

4 This answer is not accepted because the word 'weaker' is too vague and is re-stating the comparison made in (a).

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



Example Candidate Response – high, continued	Examiner comments
<p><b>Use gloves and eye protection while carrying out steps 3 to 14 of the practical work for question 1.</b></p> <p>Step 3 Use a marker pen to draw a line down the centre of a white tile. Label one side <b>L</b> and the other side <b>D</b>.</p> <p>Step 4 Use a spatula to carefully dig out from each pot, <b>two</b> of the seedlings grown in the light and <b>two</b> of the seedlings grown in the dark.</p> <p>Step 5 Use a scalpel or razor blade to cut the remains of the food store from each of the seedlings.</p> <p>Step 6 Use the water in the beaker labelled <b>water for washing</b> to wash each of these food stores and remove the outer covering. Put the outer covering in the beaker labelled <b>waste</b>.</p> <p>Step 7 Place the food stores from the seedlings grown in the light on the side of the tile labelled <b>L</b> and the food stores from seedlings grown in the dark on the side of the tile labelled <b>D</b>.</p> <p>Step 8 Wash the spatula in the beaker labelled <b>water for washing</b> and dry it with a paper towel. Use the spatula to crush together the two food stores from the seedlings grown in the light on the part of the tile labelled <b>L</b>.</p> <p>Separate the crushed food store into two equal parts spaced at least 2cm apart, as shown in Fig. 1.2.</p> <p>Step 9 Repeat step 8 using the two food stores from the seedlings grown in the dark on the part of the tile labelled <b>D</b>.</p> <div data-bbox="475 904 655 1012"> </div> <p><b>Fig. 1.2</b></p> <p>Step 10 Label two test-tubes, one with the letter <b>L</b> and the other with the letter <b>D</b>.</p> <p>Step 11 Scrape one of the food stores from the seedlings grown in the light into the test-tube labelled <b>L</b>. Add 2cm<sup>3</sup> of water from the beaker labelled <b>water</b>, taking care to wash the crushed food store to the bottom of the test-tube.</p> <p>Step 12 Repeat step 11 using one of the food stores from the seedlings grown in the dark and the test-tube labelled <b>D</b>.</p> <p>Step 13 Carry out a Benedict's test on the contents of test-tube <b>L</b> and test-tube <b>D</b>.</p> <p>Raise your hand when you are ready for hot water to be placed in the beaker labelled <b>water-bath</b>.</p> <p>Leave the test-tubes for 5 minutes.</p> <p>During this time carry out step 14 and answer question (c)(i).</p> <p>Step 14 Add 1 drop of iodine solution to the remaining two food stores on the white tile. Record your results in Table 1.2.</p>	

Example Candidate Response – high, continued

Examiner comments

(c) (i)

Describe how to carry out a biuret test on a crushed food store.

5

Crush up the food source and place it in a test tube. Add some water and shake the test tube. Add biuret solution and if it turns purple protein is present.

[1]

(ii)

The results of a biuret test are recorded in Table 1.2.  
Complete step 13 by recording the results of your Benedict's tests in Table 1.2.

Table 1.2

test	seedlings grown in light	seedlings grown in dark
biuret	purple	purple
Benedict's	blue	blue
iodine	dark brown	blue black

[2]

(iii)

State the conclusion for the results shown in Table 1.2.

7

Plants grown in the dark contain starch. Plants grown in the light don't

[1]

5

This is a correct answer.

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

6

The results for Benedict's test are accepted but the results for the iodine test are not accepted because the supervisor report gives different results from those of the candidate.

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

7

This conclusion does not include all the results.

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

## Example Candidate Response – high, continued

## Examiner comments

- (d) A group of students investigated the changes in dry mass during germination and growth of maize grown in the light and maize grown in the dark.

The dry mass is the total mass left after all the water has been evaporated.

Table 1.3 shows the results of the investigation for the maize seedlings grown in the light.

Table 1.3

	time / days										
	0	2	4	6	8	10	12	14	16	18	20
dry mass of 10 maize seedlings/g	22	20	17	12	10	8	11	13	14	15	17

- (i) Describe a method the students could have used to carry out this investigation.

Use the information on page 2 to help you.

Plant 10 seeds in a container with the same type of soil. Place a seed that has not been planted in the oven to remove the water and measure its dry mass. At 2 day intervals dig up 10 of the seeds you planted place it in the oven to dry out and measure its dry mass by weighing it on a scale. Record your readings. For the seeds that germinate cut off the leaves, stem and roots, and only measure the dry mass of the food store.

.....[6]

- (ii) Suggest why the students measured the dry mass instead of the mass including water in their investigation.

To have a more accurate result in how much actual mass is produced.

.....[1]

[Total: 21]

**8** The candidate gains credit for knowing the seeds have to be planted, but does not realise that there should be seeds in both light and dark, or that 10 seeds is not enough, as according to the information given 10 seedlings are removed every two days.

**9** The candidate gains credit for a correct method of drying.

**10** mp9 could have been credited as an error carried forward for planting too few seeds but as the candidate then goes on to weigh only the food store, this mark is rejected (R).

**11** The candidate gains credit for understanding that the starting dry mass was needed.

Mark awarded for (d) (i) = 3 out of 6

**12** This is true, but to gain credit there must be more explanation of why the result is more accurate.

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

**Total mark awarded = 14 out of 21**

## How the candidate could have improved the answer

**(a)** For the first feature, 'colour' was enough to gain the mark. For the second feature, the candidate needed to choose another **visible** feature such as the length of the plant.

**(b)** The format of the table was acceptable although the labelling of the first column would have been better as 'light condition' or 'place of growth'. Alternatively, another column could have been added, with row headings 'light' and 'dark' and the current first column headed 'sample' or 'seedling'. Candidates need to remember that units always go in the column heading or row heading.

**(c) (i)** The results of the test were not required. Only the method of the test was required.

**(c) (ii)** The candidate's answer could not be allowed because the supervisor report was 'green'. This illustrates the importance of the supervisor report in this examination.

**(c) (iii)** The candidate's answer to (c) (ii) indicated they were expecting lilac as a positive result and that they did not realise lilac is a type of purple. Candidates need to know that the actual colour given by the biuret test is purple, which can also be described as lilac or violet.

**(d) (i)** The candidate needed to understand more clearly what the experiment was about and to make sure they knew what was being measured. The candidate needed to work out what the information in Table 1.3 told them about the number of seeds being measured and how often, so they could include this in their method. They also needed to include variables that needed to be kept constant and a method of drying the seedlings before measuring.

**(d) (ii)** Although this was a correct answer, it could have been written more succinctly.

## Example Candidate Response – middle

## Examiner comments

- 1 Maize (corn) is an important food crop that produces grain. Fig. 1.1 shows a maize grain that has germinated to form a seedling.

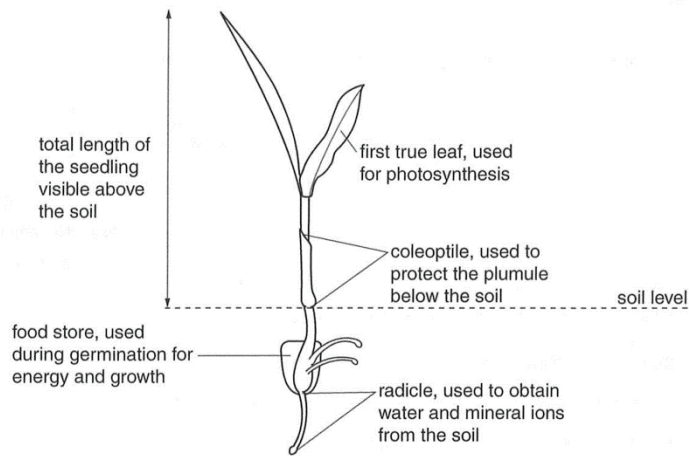


Fig. 1.1

You are going to investigate the effect of light on the germination and early growth of maize. You will measure and observe maize grown in the light and maize grown in the dark.

Three maize grains were planted in each of the two pots labelled **L** and **D**. One pot (**L**) was placed in the light and the other pot (**D**) placed in the dark. The seedlings were kept at a constant temperature.

Step 1 Observe the appearance of the seedlings carefully.

- (a) Complete Table 1.1 by recording two **visible** differences in the seedlings grown in the light and the seedlings grown in the dark.

Table 1.1

feature	seedlings grown in the light	seedlings grown in the dark
Leaves	Fresh (green)	Pale (yellowish) 1
Coleoptile	green coloured	White coloured

1 The candidate gains credit for both answers, although the features are not clearly stated.

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

[2]

## Example Candidate Response – middle, continued

## Examiner comments

You are going to measure the length of the coleoptiles and the total length of the seedlings visible above the soil. You will measure **all** the seedlings grown in the light and **all** the seedlings grown in the dark.

(b) (i) Prepare a table to record your results.

	Seedlings grown <sup>(L)</sup> in the light	Seedlings grown <sup>(D)</sup> in the dark
length of coleoptiles (cm)	3 cm	9.5 cm
Total length of the seedlings (cm)	22.7 cm	30.8 cm

2

[6]

Step 2 Use a ruler to measure the length of the coleoptile and the total length of the seedling visible above the soil for each seedling.

Record the results for the seedlings grown in pot L and in pot D in your table.

(ii) Look at Table 1.1 and the results of your measurements.

State **two** conclusions that can be made about the effect of light on the germination and early growth of maize.

1. If the light is where the place the maize grown, the coleoptiles is smaller than it is grown in the dark.

2. ~~The~~ The growth of maize that is grown in light is more rapid/faster compare to the maize grown in the dark.

[2]

2 The table has two clear columns for the independent variables and two rows for the dependent variables, gaining some credit. The units are in the row headings, but also in the body of the table, so invalidating the mark. There are insufficient spaces for all the expected results. The candidate appears to only record one result for each measurement. Because the supervisor report does not indicate a problem in providing sufficient plants, credit is not given for recording results.

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

3 This answer is not accepted because it only describes the results.

4 This answer is not accepted because no information is provided about the age of the plants grown in the dark in comparison to the plants grown in the light. Also the evidence indicates that plants grown in the dark are taller than plants grown in the light.

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



Example Candidate Response – middle, continued	Examiner comments
<p>Use gloves and eye protection while carrying out steps 3 to 14 of the practical work for question 1.</p> <p>Step 3 Use a marker pen to draw a line down the centre of a white tile. Label one side <b>L</b> and the other side <b>D</b>.</p> <p>Step 4 Use a spatula to carefully dig out from each pot, <b>two</b> of the seedlings grown in the light and <b>two</b> of the seedlings grown in the dark.</p> <p>Step 5 Use a scalpel or razor blade to cut the remains of the food store from each of the seedlings.</p> <p>Step 6 Use the water in the beaker labelled <b>water for washing</b> to wash each of these food stores and remove the outer covering. Put the outer covering in the beaker labelled <b>waste</b>.</p> <p>Step 7 Place the food stores from the seedlings grown in the light on the side of the tile labelled <b>L</b> and the food stores from seedlings grown in the dark on the side of the tile labelled <b>D</b>.</p> <p>Step 8 Wash the spatula in the beaker labelled <b>water for washing</b> and dry it with a paper towel. Use the spatula to crush together the two food stores from the seedlings grown in the light on the part of the tile labelled <b>L</b>.</p> <p>Separate the crushed food store into two equal parts spaced at least 2cm apart, as shown in Fig. 1.2.</p> <p>Step 9 Repeat step 8 using the two food stores from the seedlings grown in the dark on the part of the tile labelled <b>D</b>.</p> <div data-bbox="475 898 654 1005" data-label="Image"> </div> <p>Fig. 1.2</p> <p>Step 10 Label two test-tubes, one with the letter <b>L</b> and the other with the letter <b>D</b>.</p> <p>Step 11 Scrape one of the food stores from the seedlings grown in the light into the test-tube labelled <b>L</b>. Add 2cm<sup>3</sup> of water from the beaker labelled <b>water</b>, taking care to wash the crushed food store to the bottom of the test-tube.</p> <p>Step 12 Repeat step 11 using one of the food stores from the seedlings grown in the dark and the test-tube labelled <b>D</b>.</p> <p>Step 13 Carry out a Benedict's test on the contents of test-tube <b>L</b> and test-tube <b>D</b>.</p> <p>Raise your hand when you are ready for hot water to be placed in the beaker labelled <b>water-bath</b>.</p> <p>Leave the test-tubes for 5 minutes.</p> <p>During this time carry out step 14 and answer question (c)(i).</p> <p>Step 14 Add 1 drop of iodine solution to the remaining two food stores on the white tile. Record your results in Table 1.2.</p>	

Example Candidate Response – middle, continued

Examiner comments

(c) (i) Describe how to carry out a biuret test on a crushed food store.

Drop the solution into the crushed food store

5 [1]

(ii) The results of a biuret test are recorded in Table 1.2.  
Complete step 13 by recording the results of your Benedict's tests in Table 1.2.

Table 1.2

test	seedlings grown in light	seedlings grown in dark
biuret	purple	purple
Benedict's	yellow	yellow
iodine	Black	Black

6 [2]

(iii) State the conclusion for the results shown in Table 1.2.

The starch is present in the maize

7 [1]

5 Benefit of the doubt is given that 'the solution' is the biuret solution.

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

6 Both marks are awarded as the candidate's results agree with those of the supervisor.

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

7 This answer is not accepted because not all the results in Table 1.2 have been considered.

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



## Example Candidate Response – middle, continued

## Examiner comments

- (d) A group of students investigated the changes in dry mass during germination and growth of maize grown in the light and maize grown in the dark.

The dry mass is the total mass left after all the water has been evaporated.

Table 1.3 shows the results of the investigation for the maize seedlings grown in the light.

Table 1.3

	time / days										
	0	2	4	6	8	10	12	14	16	18	20
dry mass of 10 maize seedlings/g	22	20	17	12	10	8	11	13	14	15	17

- (i) Describe a method the students could have used to carry out this investigation.

Use the information on page 2 to help you.

Students should grow the maize grown in light and maize grown in dark with the constant temperature. every 2 days, the students should measure the weight in grams and make the record.

.....[6]

- (ii) Suggest why the students measured the dry mass instead of the mass including water in their investigation.

If the water is counted, the result will not be specific & the weight of water may vary.

[Total: 21]

**8** The candidate gains credit for growing seeds in the light and the dark. The number of seeds and how they are grown is not considered.

**9** The candidate gains credit for one controlled variable.

**10** There is not enough information for credit. The candidate does not mention the number of seedlings nor any method of drying the seedlings.

Mark awarded for (d) (i) = 2 out of 6

**11** This answer is acceptable.

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

**Total mark awarded = 10 out of 21**

### How the candidate could have improved the answer

- (a)** The features could have been more clearly shown and the descriptions could have been more precise. The colour in brackets for the 'leaves' gained credit. The comparison 'fresh and pale' was not valid.
- (b) (i)** The candidate needed to read the instructions before answering the question in order to prepare a suitable table and to put units only in the table headings.
- (b) (ii)** The candidate needed to give an effect that light or lack of light might have on the germination, growth or colour of the seedlings.
- (c) (i)** The answer would have been clearer if the candidate had specified biuret solution in their answer and included the apparatus in which the test was done.
- (c) (ii)** The candidate needed to use 'blue-black' to describe the colour of iodine with starch.
- (c) (iii)** The answer should have included the conclusions for the biuret test and Benedict's test.
- (d) (i)** The answer should have contained more detail, e.g. the number of seeds needed, the number of seedlings weighed and how the seedlings were dried.
- (d) (ii)** The candidate needed to make it clearer that the water content of seedlings varied all the time.

### Common mistakes candidates made in this question

- (a)** Poor identification of the features being compared, e.g. 'leaf' instead of 'colour of leaf'.
- (b) (i)** Failing to read the instructions so that tables contained the wrong number of results, writing headings outside columns or rows, putting units in the body of the table.
- (b) (ii)** Re-stating the comparisons from (a).
- (c) (i)** Heating the biuret solution to obtain a colour change.
- (c) (ii)** Imprecise colours, e.g. brown-black, red-purple.
- (c) (iii)** Omitting some of the results from the conclusion, commonly biuret.
- (d) (i)** Poor comprehension of the information given resulting in methods that did not make sense, e.g. uprooting seedlings, drying and weighing them, replanting them to grow for another two days.

## Question 2

## Example Candidate Response – high

## Examiner comments

- 2 (a) A group of students investigated the effect of two different exercises on the heart rate of ten male and ten female students.

Before the first exercise, the pulse rate at rest was measured and the group then jumped on the same spot for two minutes without moving their arms. Every two seconds an investigator shouted 'jump'.

After two minutes the pulse rate was measured and the students were allowed ten minutes to rest.

Before the second exercise, the pulse rate at rest was measured again and the group was asked to do a different exercise.

The students jumped on the same spot for two minutes lifting their arms above their head as they jumped up and dropping their arms as they came down. Every two seconds an investigator shouted 'jump'.

Table 2.1 shows the results of this investigation.

Table 2.1

activity	average pulse rate/beats per minute		
	male students	female students	all students
resting	68	74	71
after jumping	96	92	94
after jumping and moving arms	128	140	134

- (i) Complete Table 2.1 by writing in the average pulse rate for all students after both forms of exercise.

[2]

- (ii) Describe **two** variables in this investigation that have been controlled.

1 the duration of both forms of exercise were kept constant at 2 minutes.  
2 the investigator shouted the word jump every 2 seconds for each form of exercise.

[2]

- (iii) Explain why the students had to rest before carrying out the second exercise.

to ensure the pulse rate would reduce back down to the rate before the exercise.

[1]

- (iv) State **one** variable that cannot be controlled during the exercise and describe the effect of this variable on the results of the investigation.

variable the different pulse rates of each student  
effect on results the average pulse rate may significantly drop or rise because of one student's pulse rate which may be totally different to the other students.

[2]

1 Both calculations are correct.

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

2 Both answers are correct and stated clearly.

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

3 This answer is correct and written succinctly.

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

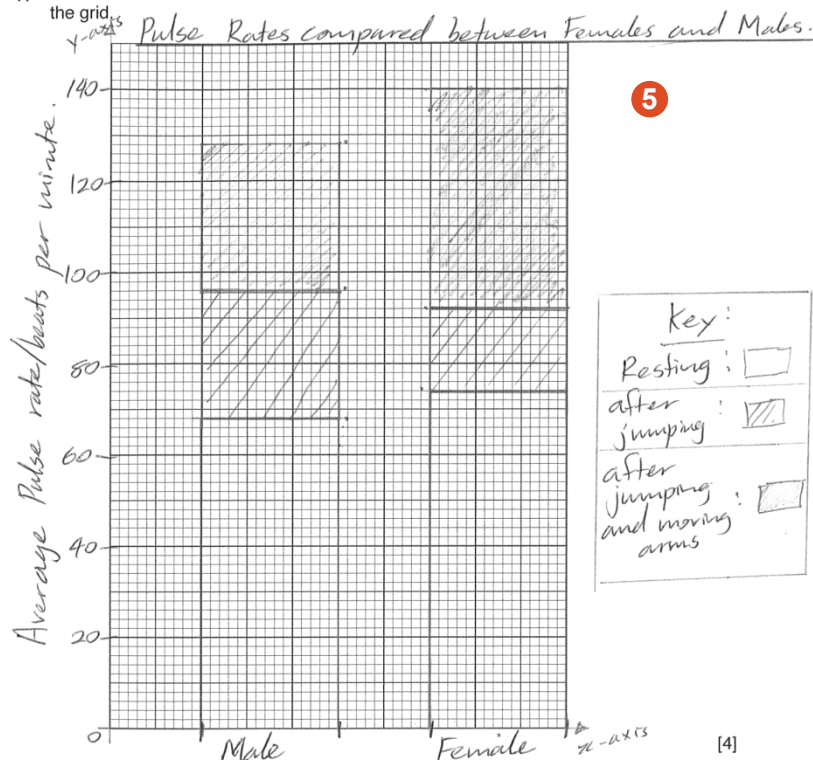
4 This answer is not accepted because the candidate describes the dependent variable in the investigation.

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

## Example Candidate Response – high, continued

## Examiner comments

- (b) (i) Plot a bar chart of the data in Table 2.1, for both the male and the female students, on the grid.



5 There is a suitably labelled scale on the y-axis and the bars are plotted accurately. The candidate also identifies and separates the two main categories on the x-axis and identifies the individual bars by a key.

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

- (ii) State **one** similarity and **one** difference the effect of exercise has on males and females.

similarity *they their pulse rates both increase with exercise.*

difference *the Females pulse rate increases higher than the males pulse rate with exercise.*

6

6 The similarity is acceptable, but the difference given is not precise enough because the female heart rate does not always increase more than the male heart rate.

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

## Example Candidate Response – high, continued

## Examiner comments

(c) Fig. 2.1 shows a photomicrograph of a cross section of an artery from a mammal.

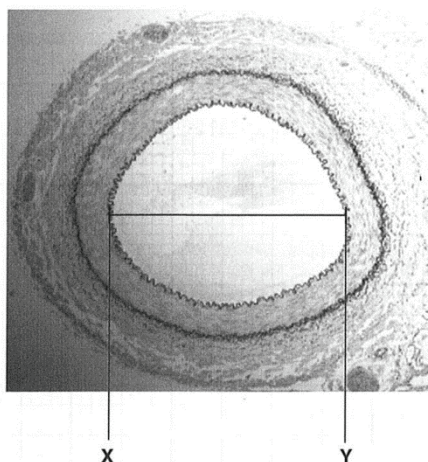
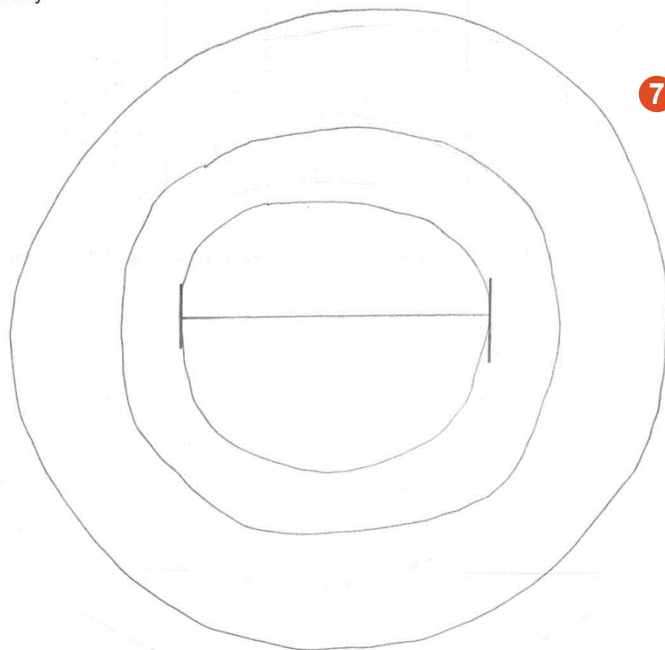


Fig. 2.1

(i) Make a large diagram of this cross section to show the layers forming the wall of the artery.



**7** The candidate gains credit for a drawing with clear and continuous lines and because the diagram is large enough to occupy most of the space provided. Their observation is not sufficient to gain credit because the drawing does not show the irregular appearance of the inner layer.

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

[3]

Example Candidate Response – high, continued	Examiner comments
<p>(ii) Measure the diameter of the lumen of the artery between points X and Y on Fig. 2.1. <b>Include the unit.</b></p> <p>Diameter of the lumen on Fig. 2.1 ..... 4.7mm ..... <b>8</b></p> <p>Draw a line in the same position on your drawing and measure the diameter of the lumen on your drawing. <b>9</b></p> <p>Diameter of the lumen on your drawing ..... 6.2mm ..... <b>9</b></p> <p>magnification = <math>\frac{\text{diameter of the lumen on your drawing}}{\text{diameter of the lumen on Fig. 2.1}}</math></p> <p>Calculate the magnification of your drawing using the equation given and your answers.</p> <p>Show your working.</p> <p>Magn = <math>\frac{\text{Drawing}}{\text{Actual}}</math></p> <p>= <math>\frac{6.2\text{mm}}{4.7\text{mm}} = 1.319148936</math></p> <p>magnification ..... x 1.32 ..... <b>10</b></p> <p>[3]</p> <p>[Total: 19]</p>	<p><b>8</b> This is a correct measurement and unit.</p> <p><b>9</b> The line drawn is in the correct position and the measurement is correct.</p> <p><b>10</b> The calculation is correct and the candidate has rounded to a sensible value although this is not required by the question.</p> <p>Mark awarded for (c) (ii) = 3 out of 3</p> <p><b>Total mark awarded = 15 out of 19</b></p>

### How the candidate could have improved the answer

(a) (ii) to (iii) A capital letter at the start of the sentences would have been grammatically correct.

(a) (iv) The candidate needed to think about the actual exercise and what might vary while it was being carried out, not what would change as a result of the exercise.

(b) (i) Although the type of bar chart was acceptable, separate bars for each activity would have conveyed the information more clearly. It was not necessary to identify the x-axis and y-axis with labels. The arrow heads added to the axes were ignored but these should not be added to a scale with numerical values or a bar chart axis.

(b) (ii) The candidate needed to state which of the exercises resulted in a higher pulse rate in females.

(c) The candidate needed to observe more carefully and draw a wavy line for the inner layer of the drawing.



## Example Candidate Response – middle

## Examiner comments

- 2 (a) A group of students investigated the effect of two different exercises on the heart rate of ten male and ten female students.

Before the first exercise, the pulse rate at rest was measured and the group then jumped on the same spot for two minutes without moving their arms. Every two seconds an investigator shouted 'jump'.

After two minutes the pulse rate was measured and the students were allowed ten minutes to rest.

Before the second exercise, the pulse rate at rest was measured again and the group was asked to do a different exercise.

The students jumped on the same spot for two minutes lifting their arms above their head as they jumped up and dropping their arms as they came down. Every two seconds an investigator shouted 'jump'.

Table 2.1 shows the results of this investigation.

Table 2.1

activity	average pulse rate/beats per minute		
	male students	female students	all students
resting	68	74	71
after jumping	96	92	94
after jumping and moving arms	128	140	134

- (i) Complete Table 2.1 by writing in the average pulse rate for all students after both forms of exercise. [2]

- (ii) Describe **two** variables in this investigation that have been controlled.

1 Time

2 Where the students jumped, they must land on the same spot.

- (iii) Explain why the students had to rest before carrying out the second exercise.

So their pulse rate can go back to normal or at

- (iv) State **one** variable that cannot be controlled during the exercise and describe the effect of this variable on the results of the investigation. [1]

variable How high the students jump

effect on results This will alter the results, as the students will jump at different heights.

- 1 Both calculations are correct.

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

- 2 This answer is not accepted because the candidate does not state the aspect of the investigation which has a controlled time.

- 3 This is not an acceptable variable because it is unlikely to affect the dependent variable.

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

- 4 This answer is acceptable.

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

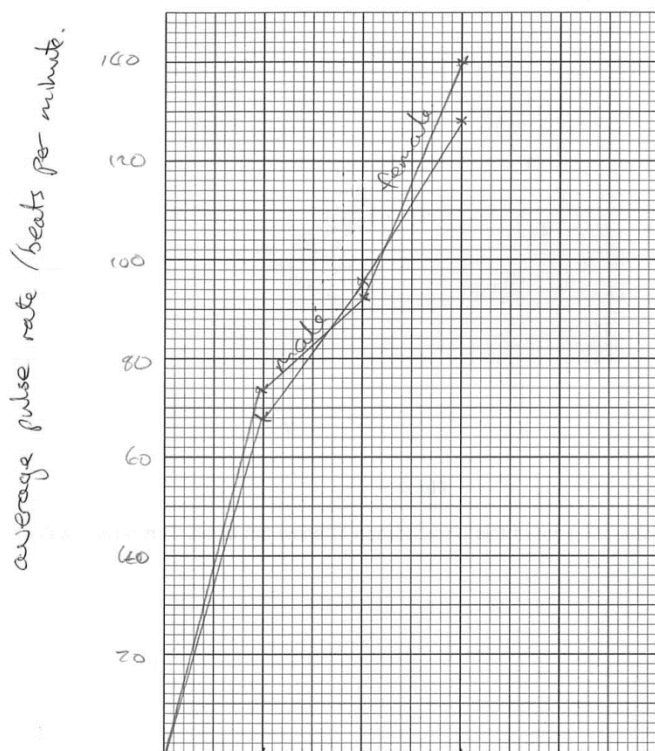
- 5 The variable is acceptable but the effect on results is too vague for credit. The candidate does not say how the results would be affected.

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

## Example Candidate Response – middle, continued

## Examiner comments

- (b) (i) Plot a bar chart of the data in Table 2.1, for both the male and the female students, on the grid.



6

6 The candidate gains some credit but because they draw a line graph instead of a bar chart, maximum credit is not available. The axes and the scale on the y-axis are suitable. The y-axis label is correct and the different exercises are identified on the x-axis. The plots are incorrect – some of them are misidentified by incorrect labels on the lines.

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

- (ii) State **one** similarity and **one** difference the effect of exercise has on males and females.

similarity heart beat per minute increases

7

difference male heart rate increases less than females

[2]

7 The similarity is acceptable even though the candidate refers to heart beat rather than what is actually being measured (pulse/heart rate). The difference given is not precise enough.

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



## Example Candidate Response – middle, continued

## Examiner comments

- (c) Fig. 2.1 shows a photomicrograph of a cross section of an artery from a mammal.

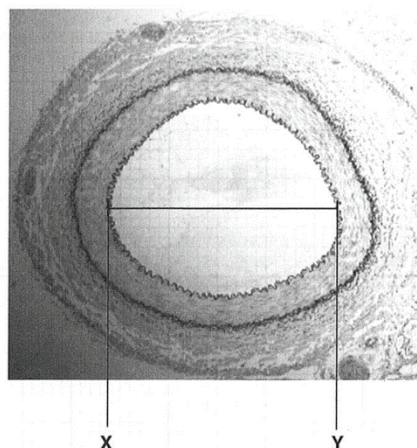
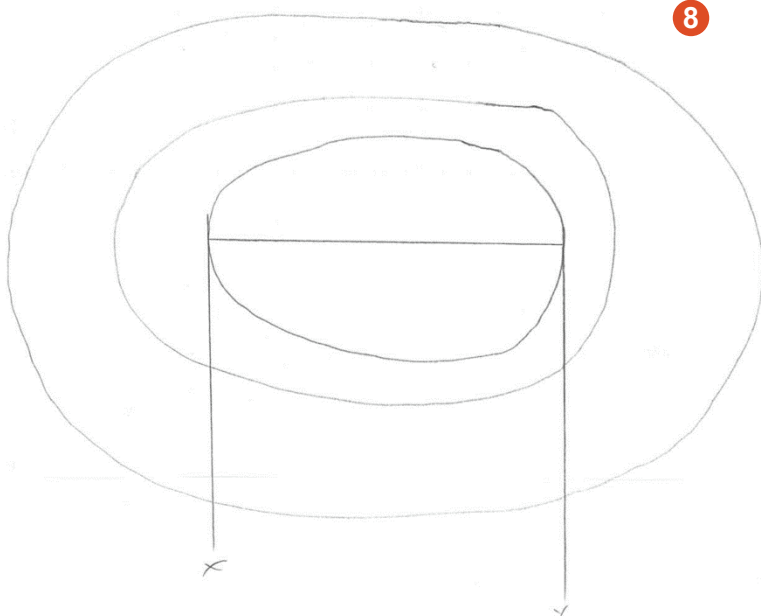


Fig. 2.1

- (i) Make a large diagram of this cross section to show the layers forming the wall of the artery.



8

**8** The drawing is large enough and drawn with clear lines but the inner line does not show sufficient detail for any credit.

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

[3]

Example Candidate Response – middle, continued	Examiner comments
<p>(ii) Measure the diameter of the lumen of the artery between points X and Y on Fig. 2.1. Include the unit.</p> <p>Diameter of the lumen on Fig. 2.1 ..... 4.7 cm <b>9</b></p> <p>Draw a line in the same position on your drawing and measure the diameter of the lumen on your drawing.</p> <p>Diameter of the lumen on your drawing ..... 7.2 cm <b>10</b></p> <p>magnification = <math>\frac{\text{diameter of the lumen on your drawing}}{\text{diameter of the lumen on Fig. 2.1}}</math></p> <p>Calculate the magnification of your drawing using the equation given and your answers. Show your working.</p> <p><math>\frac{7.2 \text{ cm}}{4.7 \text{ cm}} = 1.5 \text{ cm}</math></p> <p>magnification x 1.5 cm <b>11</b></p> <p>[3]</p> <p>[Total: 19]</p>	<p><b>9</b> The candidate gives a correct measurement with a suitable unit for Fig. 2.1.</p> <p><b>10</b> The measurement of the drawing is accepted because it is within 1 mm of the measurement made by the supervisor.</p> <p><b>11</b> The candidate uses the correct figures and calculates correctly but includes a unit in their answer, invalidating the mark.</p> <p>Mark awarded for (c) (ii) = 2 out of 3</p> <p><b>Total mark awarded = 11 out of 19</b></p>

### How the candidate could have improved the answer

**(a) (ii)** The candidate needed to include the time interval they were referring to. Because there were three possible situations where time was being measured, maximum credit could have been obtained by a clear statement about two of them. In choosing a controlled variable the candidate needed to think more carefully about which variables would affect the reliability of the results.

**(a) (iii)** The sentence construction could have been more grammatically correct.

**(a) (iv)** The candidate needed to answer the question instead of rephrasing their answer to 'variable' part.

**(b) (i)** The candidate needed to read the question more carefully and follow the instruction about the type of graph to plot.

**(b) (ii)** The candidate needed to state the exercise during which the male pulse rate increased at a slower rate than the female pulse rate.

**(c) (i)** The candidate should have used a sharper pencil – some of the lines are quite thick. They also needed to observe the appearance of the inner lining of Fig. 2.1 more carefully and draw a wavy line.

**(c) (ii)** The unit should have been omitted from the magnification.

## Example Candidate Response – low

## Examiner comments

- 2 (a) A group of students investigated the effect of two different exercises on the heart rate of ten male and ten female students.

Before the first exercise, the pulse rate at rest was measured and the group then jumped on the same spot for two minutes without moving their arms. Every two seconds an investigator shouted 'jump'.

After two minutes the pulse rate was measured and the students were allowed ten minutes to rest.

Before the second exercise, the pulse rate at rest was measured again and the group was asked to do a different exercise.

The students jumped on the same spot for two minutes lifting their arms above their head as they jumped up and dropping their arms as they came down. Every two seconds an investigator shouted 'jump'.

Table 2.1 shows the results of this investigation.

Table 2.1

activity	average pulse rate/beats per minute		
	male students	female students	all students
resting	68	74	71
after jumping	96	92	94
after jumping and moving arms	128	140	134

- (i) Complete Table 2.1 by writing in the average pulse rate for all students after both forms of exercise.

[2]

- (ii) Describe **two** variables in this investigation that have been controlled.

1 Resting, it is in low com

2

2 After jumping and moving arms

[2]

- (iii) Explain why the students had to rest before carrying out the second exercise.

To reduce heart beats

3

[1]

- (iv) State **one** variable that cannot be controlled during the exercise and describe the effect of this variable on the results of the investigation.

variable ~~The heart beating fast~~ After jumping and moving arms

effect on results the average pulse rate (beats

per minutes is high in all students it

is 134 beats per minutes.

4

[2]

1 Both calculations are correct.

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

2 There is nothing relevant in this answer. Responses appear to be copies of row headings.

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

3 There is not quite enough in this answer to gain credit.

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

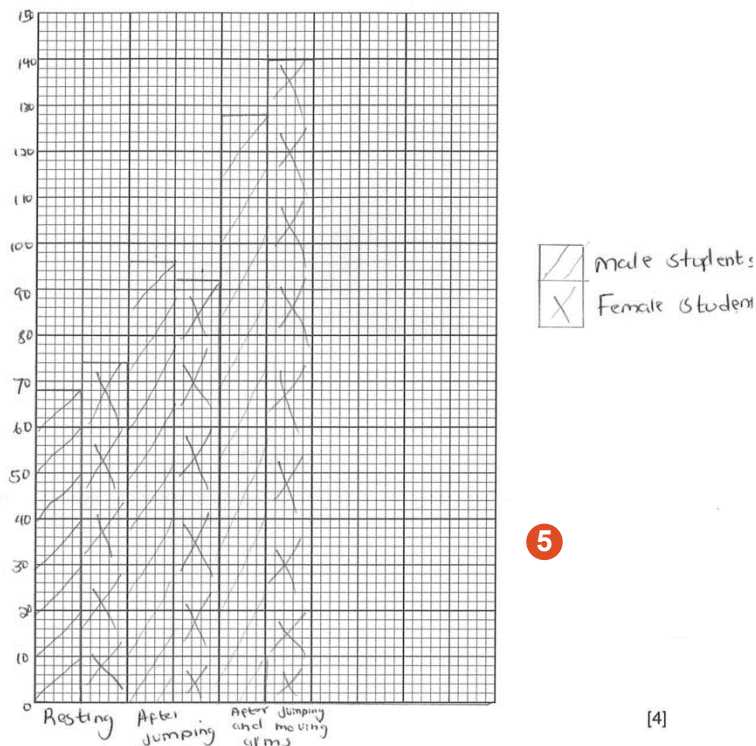
4 The candidate's answer is one aspect of the independent variable, but they have not said how it might not be controlled. The rest of the answer is a description of the effect of the independent variable on the dependent variable.

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

## Example Candidate Response – low, continued

## Examiner comments

- (b) (i) Plot a bar chart of the data in Table 2.1, for both the male and the female students, on the grid.



5

5 Credit is given for a suitable scale and correct plots.

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

- (ii) State **one** similarity and **one** difference the effect of exercise has on males and females.

similarity After jumping that exercise almost has the same average pulse rate/beats per minute. There are both in the 90's. female students have 92 male students have 92

difference Resting females rest more compared to males. Females have 74 beats per minutes while males have 68 beats per minutes

[2]

6

6 The similarity is acceptable but the difference is related to resting, not to an effect of exercise.

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

## Example Candidate Response – low, continued

## Examiner comments

(c) Fig. 2.1 shows a photomicrograph of a cross section of an artery from a mammal.

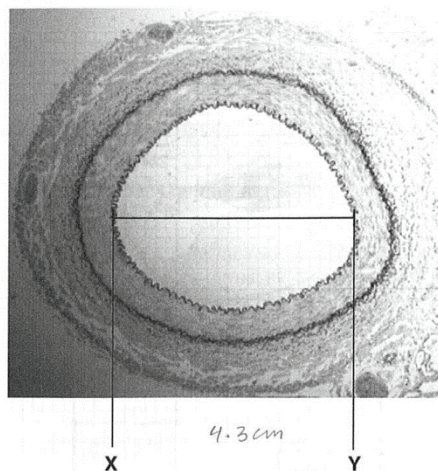
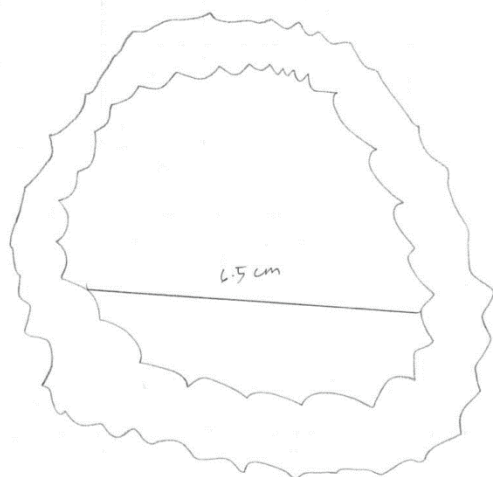


Fig. 2.1

- (i) Make a large diagram of this cross section to show the layers forming the wall of the artery.



**7** The drawing is a suitable size but it is incomplete.

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

[3]

Example Candidate Response – low, continued	Examiner comments
<p>(ii) Measure the diameter of the lumen of the artery between points X and Y on Fig. 2.1. <b>Include the unit.</b></p> <p>Diameter of the lumen on Fig. 2.1 ..... 4.3 cm <b>8</b></p> <p>Draw a line in the same position on your drawing and measure the diameter of the lumen on your drawing.</p> <p>Diameter of the lumen on your drawing ..... 6.5 cm</p> <p>magnification = <math>\frac{\text{diameter of the lumen on your drawing}}{\text{diameter of the lumen on Fig. 2.1}}</math></p> <p>Calculate the magnification of your drawing using the equation given and your answers.</p> <p>Show your working.</p> <p>magnification: <math>\frac{6.5 \text{ cm}}{4.3 \text{ cm}}</math></p> <p>= 1.51162791x <b>9</b></p> <p>~ 1.51 x</p> <p>magnification ..... 1.51 x [3]</p> <p>[Total: 19]</p>	<p><b>8</b> The measurement is incorrect for Fig. 2.1. The measurement on the drawing is acceptable but the line drawn is not in the correct place.</p> <p><b>9</b> The mark for calculating the magnification is allowed because the candidate has used correct measurements.</p> <p>Mark awarded for (c) (ii) = 2 out of 3</p> <p><b>Total mark awarded = 8 out of 18</b></p>



## How the candidate could have improved the answer

**(a)** The candidate needed to be clearer about the different types of variable in the investigation to avoid confusion in the answer.

**(a) (ii)** The candidate needed to read the information more carefully to choose the correct variables.

**(a) (iii)** The candidate needed to be more precise to qualify how far the heart beat should be reduced. The answer should be linked more clearly to the investigation which was measuring pulse rate.

**(a) (iv)** The candidate needed to choose a suitable variable in order to answer this question.

**(b) (i)** The candidate needed to label the y axis using the heading in Table 2.1. They should have drawn the pairs of bars for each activity separated from each other.

**(b) (ii)** The difference should have been about an effect of jumping and moving arms on the pulse rates of males and females.

**(c) (i)** The candidate needed to draw in the outer layer present in Fig. 2.1. They should have drawn the wavy appearance of the inner lining more accurately.

**(c) (ii)** The candidate needed to measure more carefully. Their measurement was 4 mm different from the actual measurement.

## Common mistakes candidates made in this question

**(a) (i)** Poorly written figures.

**(a) (ii) and (iv)** Poor comprehension of the investigation leading to incorrect identification of variables. Imprecise descriptions of variables.

**(b) (i)** Failing to separate the bars of the graph from each other.

**(b) (ii)** Using the data from resting pulse rates.

**(c) (i)** Poor observation of the detail of the inner surface of Fig. 2.1.

**(c) (ii)** Incorrect positioning of the line on the drawing. Including units with magnification.

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