



SPECIMEN F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

A163/01

BIOLOGY A / FURTHER ADDITIONAL SCIENCE A

Unit A163/01: Module B7 (Foundation Tier)

Candidates answer on the question paper
A calculator may be used for this paper

OCR Supplied Materials:

None

Duration: 1 hour

Other Materials Required:

- Pencil
- Ruler (cm/mm)

Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your centre number and candidate number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks for each question is given in brackets [] at the end of the question or part question.
- The total number of marks for this paper is **60**.
- This document consists of **16** pages. Any blank pages are indicated.

For Examiner's Use		
	Max	Mark
1	7	
2	12	
3	10	
4	7	
5	8	
6	1	
7	8	
8	7	
TOTAL	60	

Answer **all** the questions.

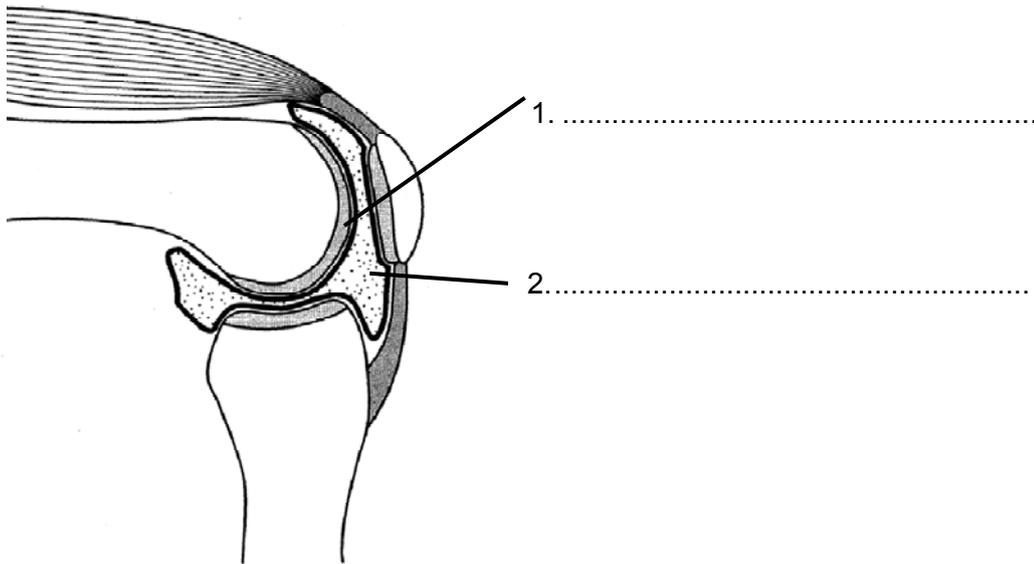
1 Vertebrates have an internal skeleton for support and movement.

(a) Bones are held together at joints.

(i) Complete the labelling of the diagram of a joint.

Choose from the following words.

- bone** **cartilage** **ligament** **synovial fluid** **tendon**



[1]

(ii) Each of these structures can be damaged.

Suggest what effect each of the following would have on the **functioning** of the joint.

structure 1 becomes worn away

.....

structure 2 increases in volume.....

..... [2]

(b) Taking part in athletics can be beneficial but risky.

Read the views of these people and then answer the following questions.

Liz
I nearly sprained my ankle last week when I was playing badminton.

Doug
The next Olympic Games are going to be held in Rio de Janeiro in 2016.

Gordon
It's a great feeling when you win a race and hear all the cheering.

Christina
I could get injured during training, but it's great feeling so fit and well.

(i) Which person is talking about a benefit to themselves without considering the risks?

answer [1]

(ii) Which **two** people are talking about a risk to themselves?

answers and [1]

(iii) Which person is talking about neither a benefit nor a risk to themselves?

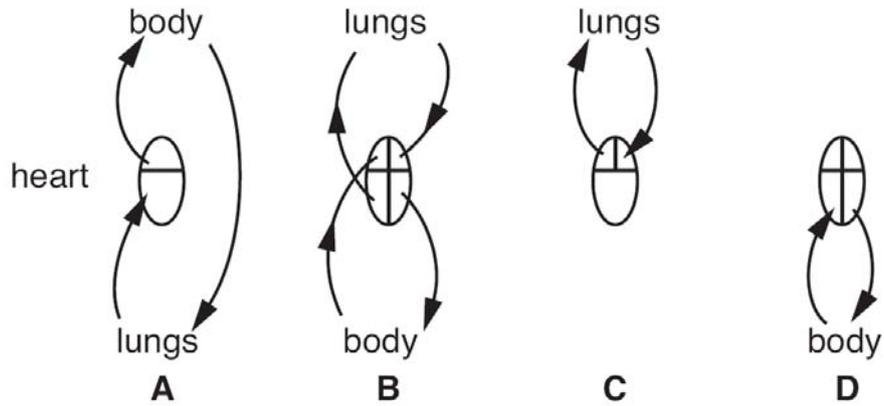
answer [1]

(iv) Which person is talking about the benefits and risks to themselves?

answer [1]

[Total: 7]

2 Mammals have a double circulatory system.



(a) Which diagram, **A**, **B**, **C** or **D**, shows a double circulatory system?

Write down the letter of the correct diagram and explain why you have chosen this diagram.

.....
 [2]

(b) The heart is a muscular pump.

Describe the role of the coronary artery.

.....

 [2]

(d) Suggest why the walls of the left ventricle have thicker muscles than the walls of the left atrium.

.....

.....

..... [2]

[Total: 12]

(c) Read the article about diabetes.

The article was written by a doctor.

Each line of the article has been numbered.

Diet and diabetes

- 1 The number of cases of diabetes is increasing.
- 2 We need to persuade people to have a better lifestyle.
- 3 There is a direct correlation between being overweight and developing diabetes.
- 4 Some people think they can eat whatever they like and it will not affect their chances of developing diabetes.
- 5 If you develop diabetes you may need to have insulin injections every day.
- 6 If only the Government could insist that we all ate a low fat diet, we could reduce the risk of developing diabetes later in life to almost zero.

(i) Which **two** lines of the article are statements based on data?

lines and [1]

(ii) Which lines of the article are statements based on the doctor's opinions or values?

lines [2]

[Total: 10]

4 This question is about closed loop ecosystems.

(a) Complete the following sentences.

Put a **ring** around the correct choice to complete each sentence.

A closed loop system **has waste / does not have waste**.

This is because the **products / reactants** from one part of the system

become / do not become the **products / reactants** for another part of the system.

[2]

(b) Write down **one** example of a closed loop system and describe examples of how the system is a closed loop.

.....
.....
.....
..... [3]

(c) An oak tree produces many more seeds (acorns) than it needs to replace itself when it dies. Use ideas about closed loop systems to suggest why this overproduction of acorns is not wasteful.

.....
.....
.....
..... [2]

[Total: 7]

(b) Wheat can be genetically modified to be resistant to weed killer.

Look at the statements about the implications of genetic modification of crops.

- A It is morally wrong to alter the DNA of living things.
- B Farmers may make more profit from their crops.
- C Local communities should be able to decide if genetically modified organisms should be released into the environment.
- D People can buy a bigger range of fruit and vegetables all year round.
- E Because the crops produce bigger yields, the food can be sold more cheaply in the shops.
- F Some people believe it is wrong to tamper with nature.

For each statement, identify whether it is an **economic** consideration, a **social** consideration or an **ethical** consideration.

Put each letter, **A**, **B**, **C**, **D**, **E** and **F**, in the correct column of the table.

economic	social	ethical

[2]

[Total: 8]

- 6 We need to make decisions about the risk of using nanotechnology in the food industry.
Which two of the following should we use to assess the size of the risk?

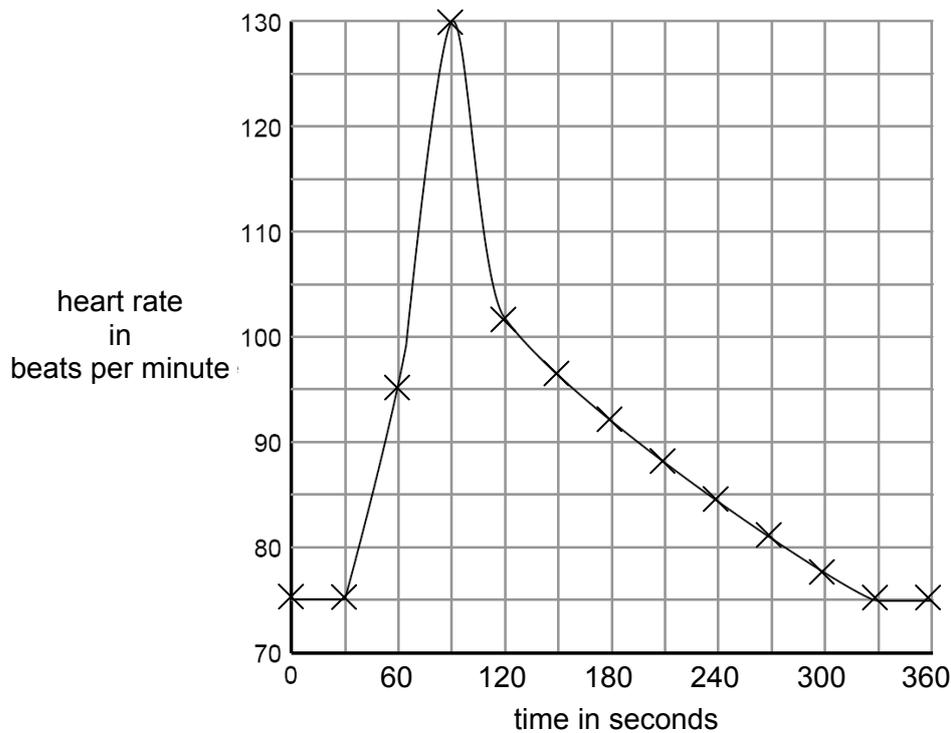
Put ticks (✓) in the boxes next to the **two** correct answers.

- | | |
|---|--------------------------|
| the chance of a problem occurring | <input type="checkbox"/> |
| the benefits of using nanotechnology | <input type="checkbox"/> |
| how much nanotechnology will cost | <input type="checkbox"/> |
| how many people are in favour of using nanotechnology | <input type="checkbox"/> |
| the consequences of a problem occurring | <input type="checkbox"/> |

[1]

[Total: 1]

- 7 The heart rate of an athlete is measured during a training session.
A measurement is taken once every 30 seconds.
The graph shows the results.



(a) Write down the athlete's resting heart rate in beats per minute.

answer beats per minute [1]

(b) Express as a simple ratio the maximum heart rate compared to the resting heart rate.

answer [1]

(c) Look at the graph.

(i) At what time did the athlete **start** exercising?

answer s

At what time did the athlete **finish** exercising?

answer s

[1]

(ii) How long after stopping exercising did it take for the heart rate to return to normal?

answer..... s [1]

(d) Examine the graph carefully.

Explain why the graph does not fully display the heart rate of the athlete.

.....
.....
..... [2]

(e) How could the data collected in parts (a), (b) and (c) be useful to the athlete in assessing his progress over several months of training?

.....
.....
..... [2]

[Total: 8]

8 Jake is concerned about his weight.

(a) He is 200 cm tall and has a body mass of 76 kg.

Use this formula to calculate Jake's body mass index (BMI).

$$\text{BMI} = \frac{\text{mass (kg)}}{[\text{height (m)}]^2}$$

Show your working.

BMI = [2]

(b) Look at the body mass index (BMI) table.

BMI	condition
less than 19	underweight
19 – 24	normal weight
25 – 29	overweight
30 – 40	obese
over 40	severely obese

Should Jake be concerned about his body mass?

Explain your answer.

.....

.....

..... [2]

(c) Suggest reasons why the BMI table may not be an accurate way of evaluating whether a person is overweight or underweight.

.....

.....

..... [3]

[Total: 7]

END OF QUESTION PAPER

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TWENTY FIRST CENTURY SCIENCE

BIOLOGY A / FURTHER ADDITIONAL SCIENCE A

A163/01

Unit A163/01: Module B7 (Foundation Tier)

MARK SCHEME

Duration: 1 hour

MAXIMUM MARK 60

Guidance for Examiners

Additional guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, e.g. mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

/	=	alternative and acceptable answers for the same marking point
(1)	=	separates marking points
not/reject	=	answers which are not worthy of credit
ignore	=	statements which are irrelevant - applies to neutral answers
allow/accept	=	answers that can be accepted
(words)	=	words which are not essential to gain credit
<u>words</u>	=	underlined words must be present in answer to score a mark
ecf	=	error carried forward
AW/owtte	=	alternative wording / or words to that effect
ORA	=	or reverse argument

E.g. mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)

work done	=	0 marks
work done lifting	=	1 mark
change in potential energy	=	0 marks
gravitational potential energy	=	1 mark
5. Annotations:
The following annotations are available on SCORIS.

✓	=	correct response
×	=	incorrect response
bod	=	benefit of the doubt
nbod	=	benefit of the doubt not given
ECF	=	error carried forward
^	=	information omitted
I	=	ignore
R	=	reject
6. If a candidate alters his/her response, examiners should accept the alteration.

7. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

E.g.

For a one mark question, where ticks in boxes 3 and 4 are required for the mark:

Put ticks (✓) in the two correct boxes.

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

This would be worth 0 marks.

Put ticks (✓) in the two correct boxes.

<input type="checkbox"/>
<input type="checkbox"/>
<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>
<input type="checkbox"/>

This would be worth one mark.

Put ticks (✓) in the two correct boxes.

<input checked="" type="checkbox"/>
<input type="checkbox"/>

This would be worth one mark.

8. The list principle:
If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.
9. Marking method for tick boxes:
Always check the additional guidance.

If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.

If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, e.g. shading or crosses.

Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

E.g. If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	x	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	x		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

10. For answers marked by levels of response:
- Read through the whole answer from start to finish**
 - Decide the level** that **best fits** the answer – match the quality of the answer to the closest level descriptor
 - To determine the mark within the level**, consider the following:

Descriptor	Award mark
A good match to the level descriptor	The higher mark in the level
Just matches the level descriptor	The lower mark in the level

- Use the **L1**, **L2**, **L3** annotations in SCORIS to show your decision; do not use ticks.

Question			Expected answers	Marks	Additional guidance
1	(a)	(i)	<i>structure 1</i> : cartilage <i>structure 2</i> : synovial fluid	[1]	both required for 1 mark
		(ii)	<i>structure 1 becomes worn away</i> : bones would grind together so movement would be more difficult / owtte (1) <i>structure 2 increases in volume</i> : swelling/increase in pressure so movement would be more difficult / owtte (1)	[2]	
	(b)	(i)	Gordon	[1]	
		(ii)	Liz <u>and</u> Christina	[1]	both required for 1 mark; any order
		(iii)	Doug	[1]	
		(iv)	Christina	[1]	
			Total	[7]	

Question			Expected answers	Marks	Additional guidance
2	(a)		B (1) idea that blood passes through heart twice / goes to lungs, then back to heart, then to body (1)	[2]	
	(b)		carries oxygen/glucose (1) to the heart muscles (1)	[2]	

Question		Expected answers	Marks	Additional guidance
2	(c) 	<p>[Level 3] Answer correctly uses labels from the diagram and the underlined terms to clearly explain, in the correct order, the sequence of events. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Answer uses labels from the diagram to explain, mostly in the correct order, the sequence of events. Answer may not use the underlined terms. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Answer describes some stages correctly, but omits other stages and/or confuses the order, and may not use the underlined terms. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	[6]	<p>relevant points include:</p> <ul style="list-style-type: none"> • right atrium contracts (which pushes valve open) and blood flows into <u>right ventricle</u> • right ventricle contracts, pushing blood into pulmonary artery (to the lungs) • idea that <u>valves</u> stop blood flowing backwards (from right ventricle into right atrium, and from pulmonary artery into right ventricle) • (oxygenated) blood (from the lungs) returns to the heart via the pulmonary vein into the <u>left atrium</u> • left atrium contracts (which pushes valve open) pushing blood into left ventricle • left ventricle contracts, pushing blood into aorta (to the body) • blood returns to the right atrium through the vena cava • (idea that <u>valves</u> stop blood flowing backwards from left ventricle into left atrium, and from aorta into left ventricle)
	(d)	<p>left ventricle needs to push blood around whole body / owtte (1)</p> <p>left atrium only needs to push blood into the left ventricle / owtte (1)</p>	[2]	
		Total	[12]	

Question		Expected answers	Marks	Additional guidance
3	(a)		[1]	all lines must be correct for 1 mark five or more lines = 0 marks

Question		Expected answers	Marks	Additional guidance
3	(b) 	<p>[Level 3] Answer clearly shows good understanding of how eating complex carbohydrates and fibre can help maintain a constant blood sugar level. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Answer shows partial understanding of how eating complex carbohydrates and fibre can help maintain a constant blood sugar level. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Answer shows a limited understanding of how eating complex carbohydrates and fibre can help maintain a constant blood sugar level. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	[6]	<p>relevant points include:</p> <ul style="list-style-type: none"> • (complex carbohydrates and fibre are) digested more slowly than, simple carbohydrates / sugars • idea that this results in sugar being absorbed, over longer time period / more gradually • blood sugar level rises more slowly • body can remove the sugar from the blood (before the blood sugar level becomes too high) • idea of balance between, rate of sugar absorption / rate of increase in blood sugar level, and, use of sugar / removal of sugar from blood • this, keeps the blood sugar level constant / minimises highs and lows

Question			Expected answers	Marks	Additional guidance
3	(c)	(i)	1 <u>and</u> 3	[1]	both required for 1 mark; any order three or more responses = 0 marks
		(ii)	2 and 4 and 6	[2]	any order three correct = 2 marks two or one correct = 1 mark if more than three responses are given, accept any correct responses and then apply the following rule: four responses = max. 1 mark five or six responses = 0 marks
			Total	[10]	

Question		Expected answers	Marks	Additional guidance
4	(a)	does not have waste products become reactants	[2]	4 correct = 2 marks 3 or 2 correct = 1 marks 1 correct = 0 marks
	(b)	lake / woodland / grassland / beach / coral reef (1) named waste product (1) correct explanation of how the named waste product becomes food/reactant for other animals/plants/microorganisms in the system (1)	[3]	credit any correct example of a closed loop system
	(c)	used as food source for animals (1) seeds/acorns that are not used decompose so the resources in them are recycled (1)	[2]	credit any relevant suggestion that addresses the question
Total			[7]	

Question	Expected answers	Marks	Additional guidance
5 (a) 	<p>[Level 3] Answer correctly uses the words ‘isolate’, ‘replicate’, ‘transfer’ and ‘vector’ to explain all of the steps in the process in the correct sequence. Suggested benefits of using human insulin are described clearly. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Answer uses most of the underlined words to explain the process, but may omit a step or describe a step out of order. Possible benefits of using human insulin are included in the answer. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Answer describes some stages correctly, but omits other stages and/or confuses the order, and may not use the underlined terms. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	[6]	<p>relevant points include:</p> <ul style="list-style-type: none"> • <u>isolate</u> gene (that codes for) human insulin • <u>replicate</u> the gene • put the gene into a <u>vector</u> • such as a virus or plasmid • use vector to <u>transfer</u> the gene into bacteria • idea that DNA is a universal language that can be interpreted by any organism • idea of expression of the gene in the bacteria (to produce human insulin) • human insulin is the exact match for the required hormone / animal insulin may have some differences • less problem of allergy/adverse reaction to human insulin

Question		Expected answers			Marks	Additional guidance									
5	(b)	<table border="1"> <thead> <tr> <th>economic</th> <th>social</th> <th>ethical</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>C</td> <td>A</td> </tr> <tr> <td>E</td> <td>D</td> <td>F</td> </tr> </tbody> </table>			economic	social	ethical	B	C	A	E	D	F	[2]	6 correct = 2 marks 4 or 5 correct = 1 mark
		economic	social	ethical											
		B	C	A											
E	D	F													
Total			[8]												

Question		Expected answers		Marks	Additional guidance
6		the chance of a problem occurring	<input checked="" type="checkbox"/>	[1]	both correct for 1 mark three or more ticks = 0 marks
			<input type="checkbox"/>		
		the consequences of a problem ...	<input checked="" type="checkbox"/>		
Total				[1]	

Question		Expected answers	Marks	Additional guidance
7	(a)	75	[1]	
	(b)	1.7 / 1.73	[1]	
	(c) (i)	30 (s) 90 (s)	[1]	both correct for 1 mark accept any number from 15 to 30 accept any number from 75 to 90
	(ii)	240 (s)	[1]	credit answer calculated correctly from candidate's answer to (c)(i)
	(d)	the heart rate was only taken at timed intervals / once every 30 seconds (1) so it could have varied (between measurements) in ways that are not shown on the graph (1)	[2]	credit an example, e.g. "the rate could have been greater than 130 between 60 and 120 seconds"
	(e)	idea that the data/measurements give information about fitness (1) idea that comparing data/measurements over time shows whether fitness is improving (1)	[2]	credit this idea expressed either generically or using specific examples of data/measurements (e.g. resting heart rate / maximum heart rate / recovery time)
Total			[8]	

Question		Expected answers	Marks	Additional guidance
8	(a)	$\frac{76}{2^2}$ or $\frac{76}{2 \times 2}$ or $\frac{76}{4}$ (1) 19 (1)	[2]	
	(b)	he is (in the range for) normal weight (1) (but) if he loses any body mass he will become underweight (1)	[2]	no marks for “yes/no” or “he should be concerned / should not be concerned”; marks are awarded for the explanation(s) credit any explanation, linked to the data, that justifies whether or not he should be concerned about his body mass

Question		Expected answers	Marks	Additional guidance
8	(c)	<p>credit any suggestions that answer the question, including but not limited to:</p> <p>any three from:</p> <p>height will differ if measured with shoes on/off ;</p> <p>mass will differ before/after eating / at different times of day / level of dehydration / clothes on/off ;</p> <p>idea that a small change at the borderline between categories may shift the BMI into a different category ;</p> <p>accuracy / calibration of measuring instruments (affects calculated BMI) ;</p> <p>rounding measurements to whole numbers (affects calculated BMI) ;</p> <p>BMI table does not take age into account ;</p> <p>some people have larger / thicker bones ;</p> <p>different BMI tables for males and females</p>	[3]	
		Total	[7]	

Assessment Objectives (AO) Grid

(includes quality of written communication )

Question	AO1	AO2	AO3	Total
1(a)(i)	1			1
1(a)(ii)		2		2
1(b)(i)	1			1
1(b)(ii)	1			1
1(b)(iii)	1			1
1(b)(iv)	1			1
2(a)	1	1		2
2(b) 	2			2
2(c)	5	1		6
2(d)		2		2
3(a)	1			1
3(b) 	4	2		6
3(c)(i)		1		1
3(c)(ii)			2	2
4(a)	2			2
4(b)		3		3
4(c)		1	1	2
5(a) 	5	1		6
5(b)		2		2
6		1		1
7(a)		1		1
7(b)		1		1
7(c)(i)		1		1
7(c)(ii)		1		1
7(d)			2	2
7(e)		1	1	2
8(a)		2		2
8(b)			2	2
8(c)		2	1	3
Totals	25	26	9	60