AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier
Biology Paper 1H

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator.

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

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0 1 Bacteria can cause a variety of diseases in humans.

0 1 . 1 What are **two** similarities between a bacterial cell and an animal cell?

[2 marks]

Tick (✓) **two** boxes.

Both have a cell membrane. ☐

Both have a cell wall. ☐

Both have a nucleus. ☐

Both have cytoplasm. ☐

Both have plasmids. ☐

0 1 . 2 Salmonella food poisoning is caused by bacteria in food.

Give **one** symptom of salmonella food poisoning.

Do **not** refer to vomiting or diarrhoea in your answer.

[1 mark]

Question 1 continues on the next page

Do not write outside the box

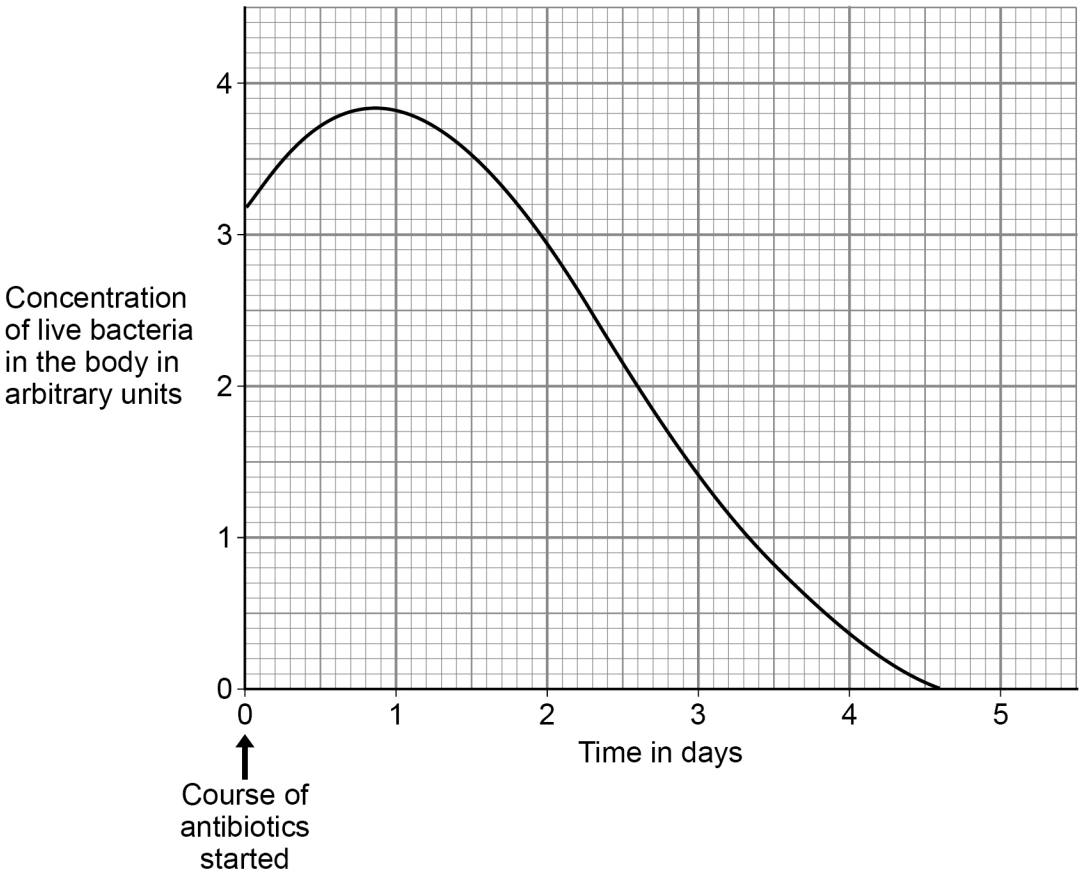
0 1 . 3 What is the name of the first antibiotic developed?

[1 mark]

A child with a severe bacterial infection was given a course of antibiotics.

Figure 1 shows how the concentration of live bacteria in the child's body changed when taking the course of antibiotics.

Figure 1



Do not write outside the box

0 1 . 4 The concentration of live bacteria in the body continued to increase after starting the course of antibiotics.

Suggest **one** reason why.

[1 mark]

0 1 . 5 After 3 days of taking the antibiotic:

- the child felt better
- there were still bacteria in the child's body.

Why did the child feel better?

[1 mark]

Tick (✓) **one** box.

Bacteria had become immune to the antibiotic. ☐

The child had become resistant to the bacteria. ☐

There were fewer toxins in the body than at day 0 ☐

0 1 . 6 Suggest why doctors do **not** give antibiotics to patients with minor infections.

[1 mark]

Question 1 continues on the next page

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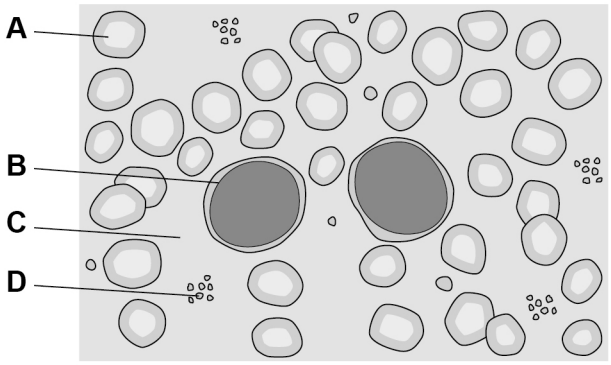
Figure 2 shows blood viewed using a microscope.

Figure 2



0 1 . 7 A vaccine will stimulate the production of antibodies.

Which part of the blood in **Figure 2** produces antibodies?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 8 Which part of the blood in **Figure 2** starts the clotting process?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

9

Do not write outside the box

0 2 This question is about cell division.

0 2 . 1 Write the biological structures from the box in the correct order of size.

[1 mark]

cell	**chromosome**	**gene**	**nucleus**

Smallest

↓

Largest

_____

_____

_____

_____

Question 2 continues on the next page

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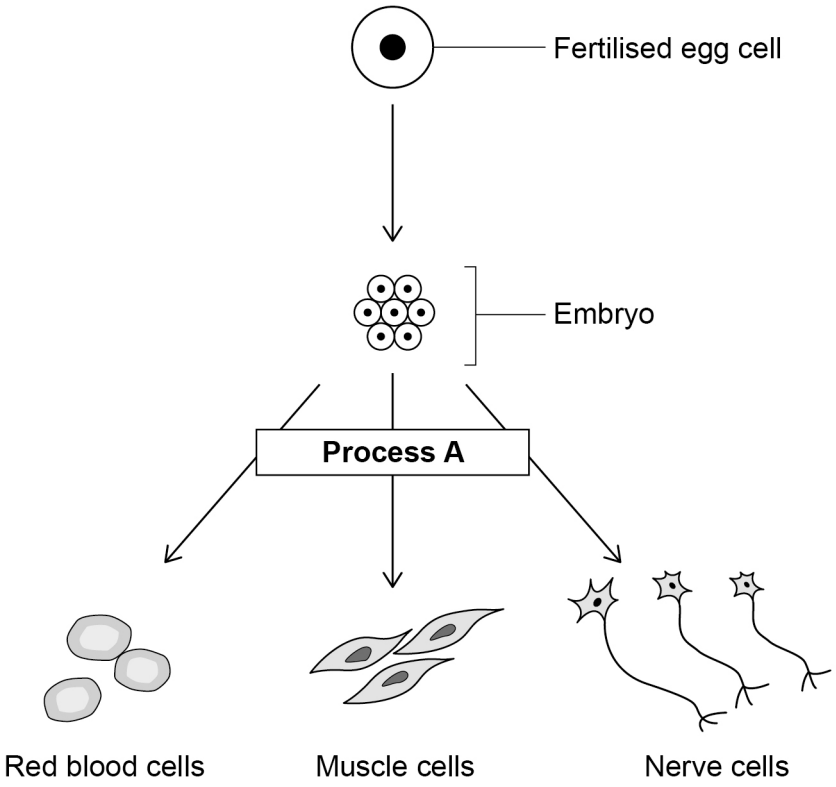
Figure 3 shows how a fertilised egg cell can produce specialised cells.

Figure 3



0 2 . 2 Name **Process A**.

[1 mark]

0 2 . 3 How many cell divisions are needed to form a 16-cell embryo from the original fertilised egg cell?

[1 mark]

Number of cell divisions = _____

Do not write outside the box

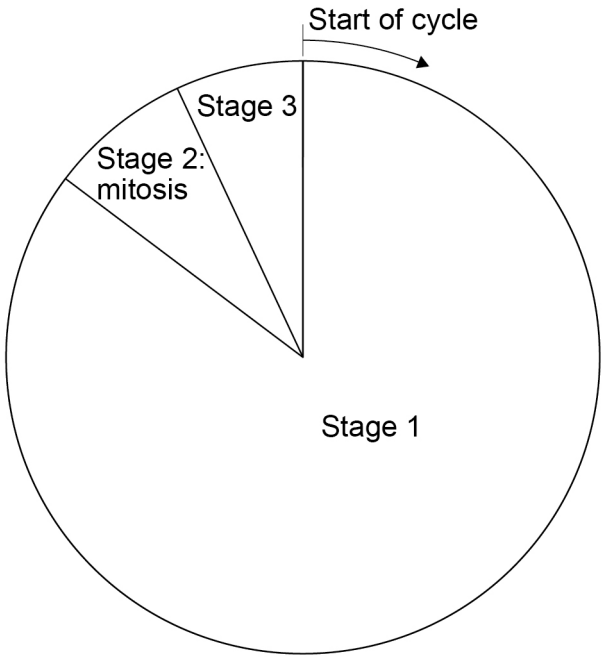
0 2 . 4 In humans a fertilised egg cell contains 23 pairs of chromosomes.

How many chromosomes will there be in each of the embryo cells?

[1 mark]

0 2 . 5 **Figure 4** represents a cell cycle for a human embryonic cell.

Figure 4



Describe **one** change in the cell that occurs during **each** of the stages of the cell cycle.

[3 marks]

Stage 1

Stage 2

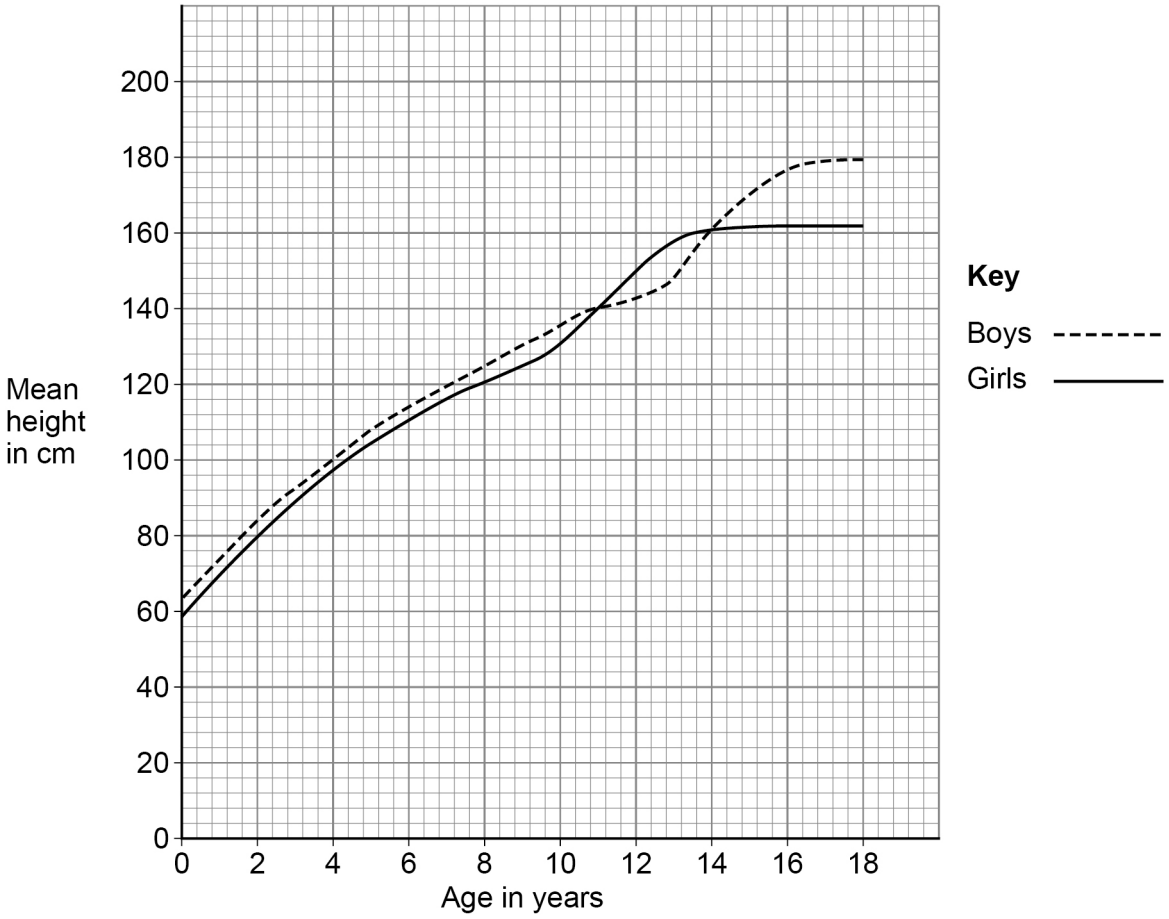
Stage 3

Do not write outside the box

Cell division is important in the growth of multicellular organisms.

0 2 . 6 **Figure 5** shows the mean height of boys and of girls from birth to age 18 years.

Figure 5



Do not write outside the box

Compare the growth of boys with the growth of girls.

Use data from **Figure 5** in your answer.

[6 marks]

0 2 . 7 Give **one** way that cell division by mitosis is important in **fully grown** animals.

[1 mark]

14

Do not write outside the box

0 3 Amylase is an enzyme that digests starch.

0 3 . 1 Which organs in the human digestive system produce amylase?

[1 mark]

Tick (✓) **one** box.

Liver, small intestine and large intestine ☐

Salivary glands, stomach and liver ☐

Salivary glands, pancreas and small intestine ☐

Stomach, pancreas and large intestine ☐

A student investigated the effect of pH on the activity of amylase.

This is the method used.

1. Prepare amylase solution at pH 5
2. Mix the amylase solution with starch in a boiling tube.
3. Remove a drop of the amylase-starch mixture every 30 seconds and test it for the presence of starch.
4. Record the time when all the starch has been digested.
5. Repeat steps 1 to 4 using amylase solution prepared at pH 6, then at pH 7 and then at pH 8

0 3 . 2 What was the independent variable in this investigation?

[1 mark]

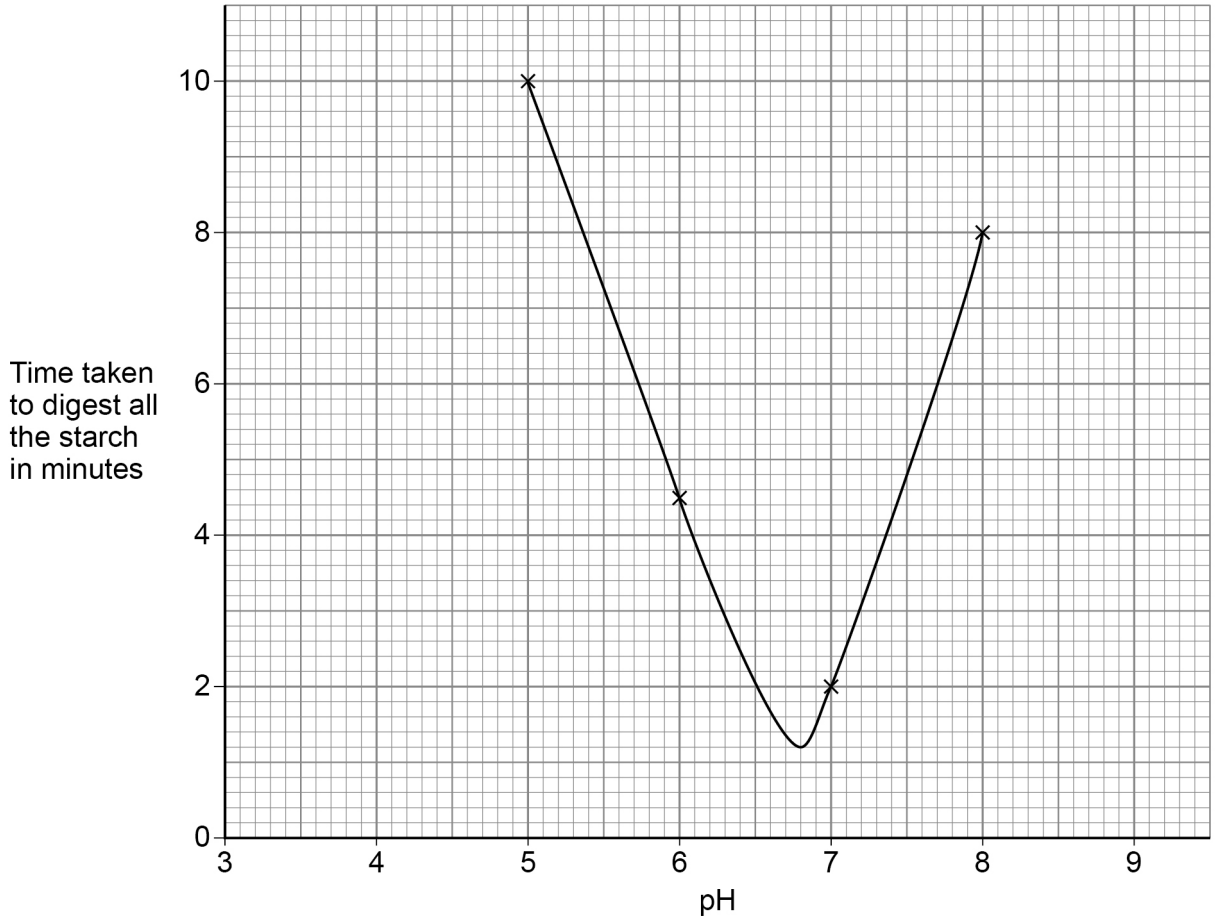
Do not write outside the box

0 3 . 3 Describe how the student would know when all the starch had been digested.

[1 mark]

0 3 . 4 **Figure 6** shows the student's results.

Figure 6



What was the optimum pH for the amylase?

Use **Figure 6**.

[1 mark]

Optimum pH = _____

Turn over ►

Do not write outside the box

A scientist did a different investigation.

This is the method used.

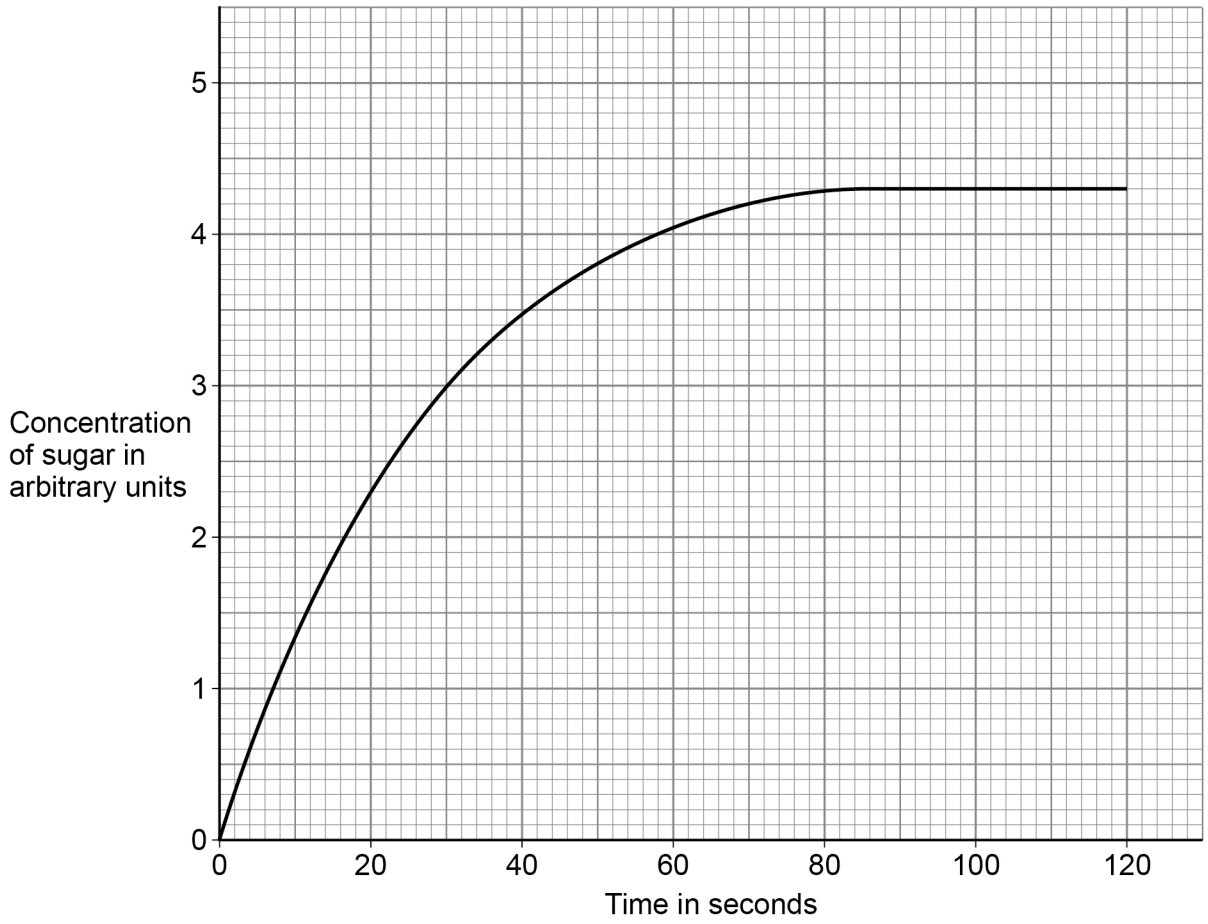
1. Prepare amylase solution at the optimum pH.

2. Mix the amylase solution with starch in a boiling tube.

3. Measure the concentration of sugar every 10 seconds for 2 minutes.

Figure 7 shows the scientist's results.

Figure 7



0 3 . 5 How much time did it take for the amylase to digest all the starch?

Use **Figure 7**.

[1 mark]

Time to digest all the starch = _____ seconds

Do not write outside the box

0 3 . 6 Determine the rate of sugar production per minute at 40 seconds.

[4 marks]

Rate = _____ arbitrary units per minute

0 3 . 7 Explain how the structure of enzyme molecules is related to the effect of pH on the activity of amylase.

[6 marks]

15

Do not write outside the box

0 4 Photosynthesis is an important chemical reaction in plants.

0 4 . 1 Why is light needed for photosynthesis?

[1 mark]

0 4 . 2 What is the equation for photosynthesis?

[1 mark]

Tick (✓) **one** box.

$C_6H_{12}O_6 + CO_2 \rightarrow 6\,O_2 + 6\,H_2O$ ☐

$CO_2 + H_2O \rightarrow CH_2O + O_2$ ☐

$6\,CO_2 + 6\,H_2O \rightarrow C_6H_{12}O_6 + 6\,O_2$ ☐

$6\,O_2 + 6\,H_2O \rightarrow C_6H_{12}O_6 + 6\,CO_2$ ☐

Do not write outside the box

0 4 . 3 A student investigated the effect of different colours of light on the rate of photosynthesis at room temperature.

The student used pondweed in water.

A piece of pondweed was placed in red light, then in blue light and then in green light.

Each colour of light was the same intensity.

Describe how the student should make accurate measurements to obtain valid results for the rate of photosynthesis.

[4 marks]

Question 4 continues on the next page

A scientist investigated the effect of different wavelengths of light on the rate of photosynthesis.

The wavelength of light determines the colour of the light.

Figure 8 shows the student's results.

Figure 9 shows the scientist's results.

Figure 8

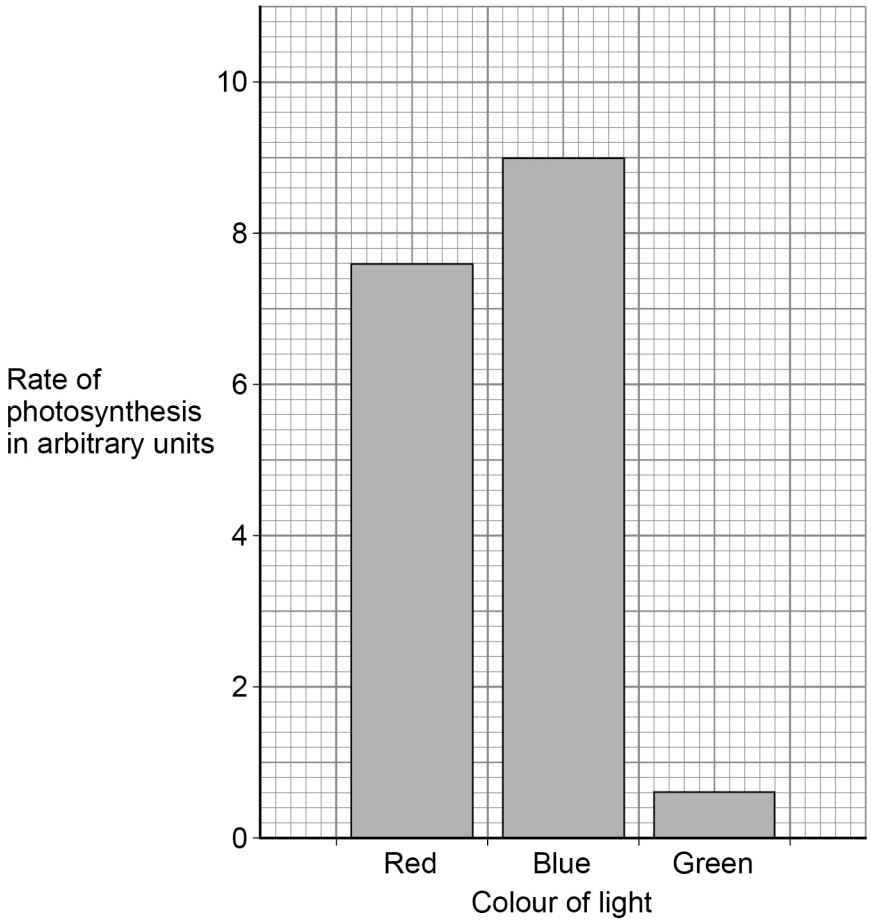


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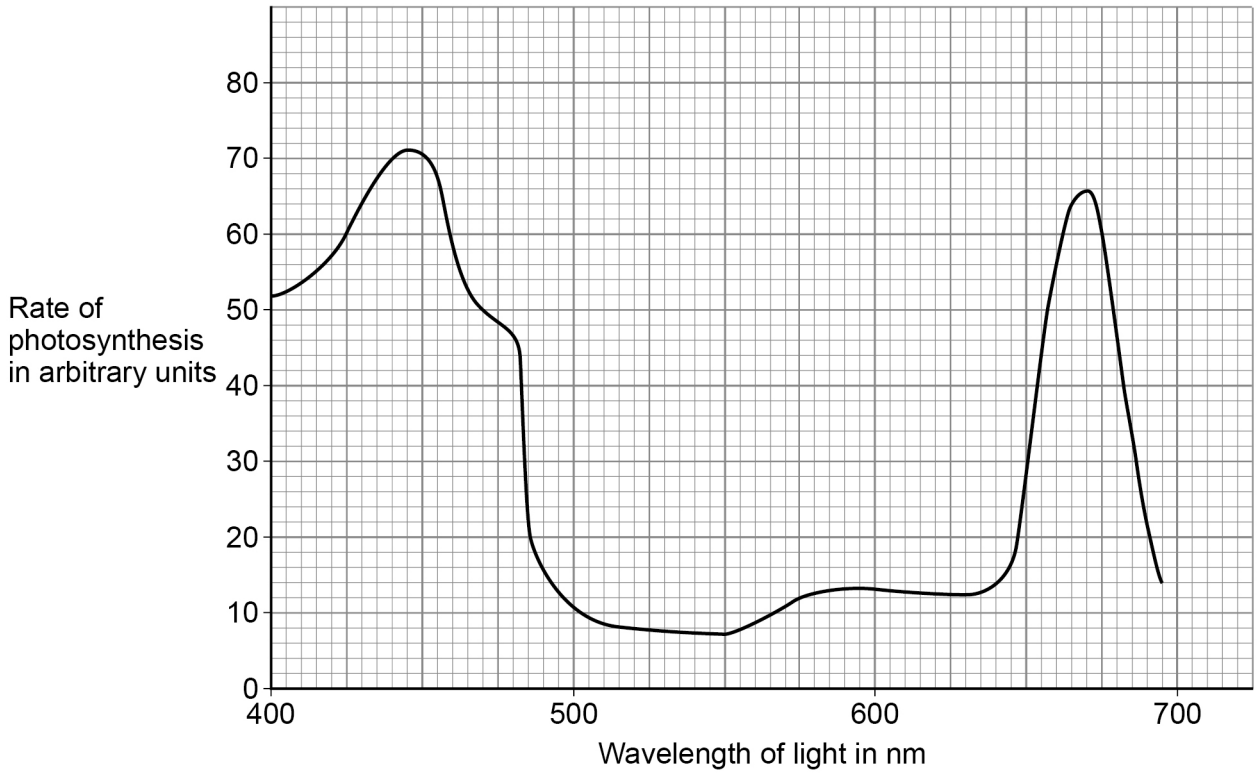
Figure 9



0 4 . 4 Why are the results for the two investigations presented differently?

[2 marks]

0 4 . 5 Suggest the range in wavelength of green light.

Use **Figure 8** and **Figure 9**.

[1 mark]

Range in wavelength of green light = from _____ nm to _____ nm

9

Turn over ►

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ANSWER IN THE SPACES PROVIDED

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0 5 This question is about tumours.

0 5 . 1 Describe the similarities and differences between benign tumours and malignant tumours.

[4 marks]

Question 5 continues on the next page

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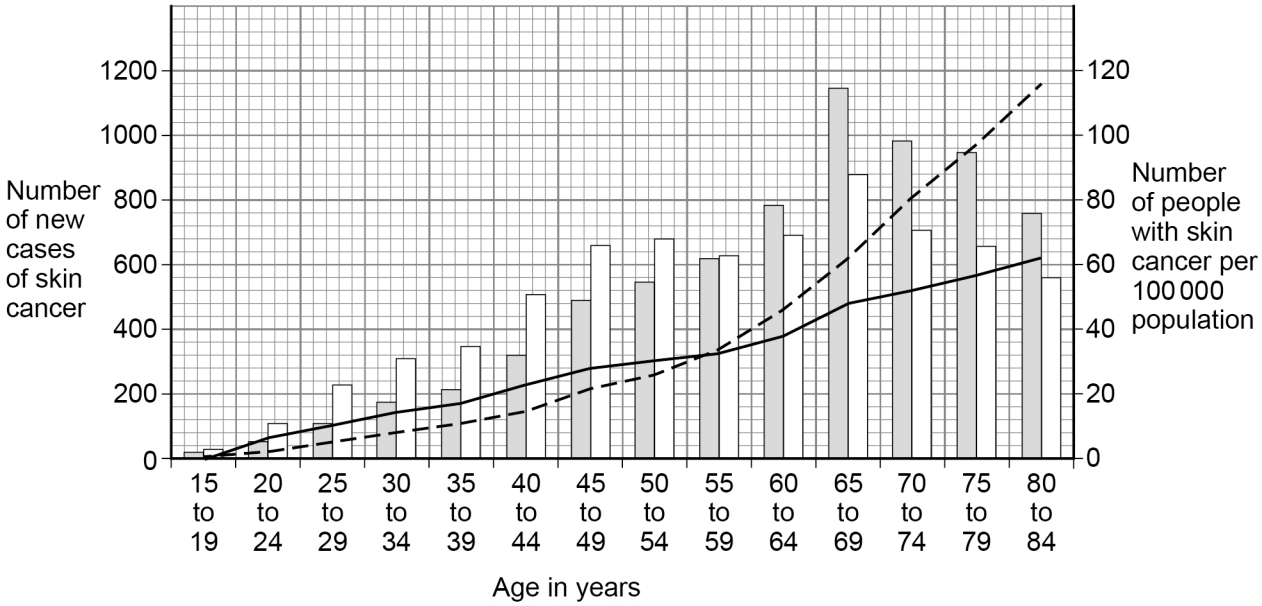
Figure 10 shows data about skin cancer in males and females for different age groups in the UK.

It shows:

- the number of new cases of skin cancer in 1 year
- the number of people with skin cancer per 100 000 population in 1 year.

Figure 10



Key

New male cases

New female cases

– – – Number of males with skin cancer per 100 000

—— Number of females with skin cancer per 100 000

Do not write outside the box

0 5 . 2 There are no new cases of skin cancer diagnosed in people younger than 15 years of age.

Explain why.

[2 marks]

0 5 . 3 Give **two** conclusions about the number of **new cases** of skin cancer.

Use **Figure 10**.

[2 marks]

1

2

0 5 . 4 The data for the number of people with skin cancer is given per 100 000 population.

Suggest why the data is **not** given as the total number of people.

[1 mark]

Question 5 continues on the next page

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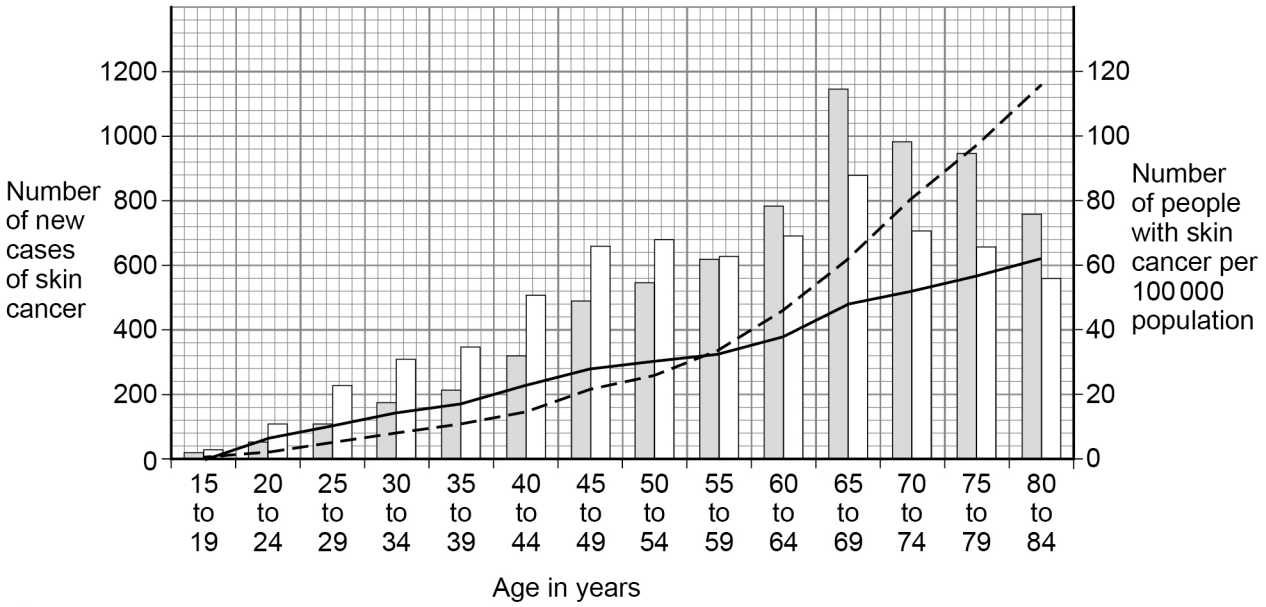
Figure 10 is repeated below.

Figure 10



Key

- New male cases
- New female cases
- – – – Number of males with skin cancer per 100 000
- —— Number of females with skin cancer per 100 000

0 5 . 5 Describe **two** trends shown in **Figure 10**.

Use **only** the data for the number of people with skin cancer per 100 000 population.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Do not write outside the box

0 5 . 6 The estimated population of males aged 80 to 84 years was 694 000

Calculate the number of males aged 80 to 84 years with skin cancer in that year.

Use **Figure 10**.

Give your answer to 3 significant figures.

[3 marks]

Number of males with skin cancer (3 significant figures) = _____

14

Turn over for the next question

Do not write outside the box

0 6 This question is about the heart.

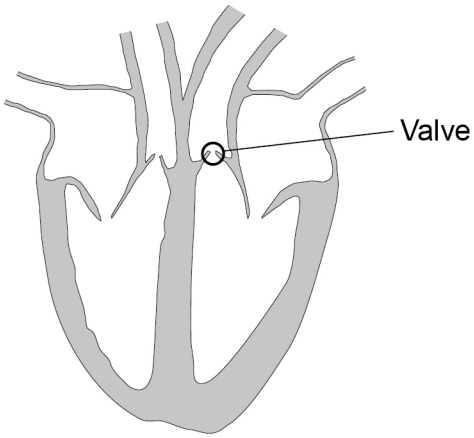
0 6 . 1 Why is the heart described as an organ?

[1 mark]

0 6 . 2 Valves in the heart keep the blood flowing through the heart in one direction.

Figure 11 shows the heart with one of the valves labelled.

Figure 11



Explain the effects on a person if the valve labelled in **Figure 11** developed a leak.

[4 marks]

Do not write outside the box

0 6 . 3 Faulty heart valves can be replaced using biological or mechanical valves.

The faulty valve is replaced during an operation.

Biological valves:

- are from animals or human donors
- allow blood to flow through them normally
- wear out and stiffen over time, so may need to be replaced.

Mechanical valves:

- are made from synthetic materials
- may cause blood clots on the surface of the valve
- require anti-clotting drugs to be taken for the rest of the patient's life
- can last for a very long time in ideal conditions.

A young woman enjoys extreme sports and would like to start a family.

The woman needs a heart valve replacing.

Describe the advantages and disadvantages for this young woman of having a biological heart valve instead of a mechanical heart valve.

[4 marks]

9

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

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GCSE
COMBINED SCIENCE: TRILOGY
8464/B/1H

Biology Paper 1H

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme

226G8464B1H/MS

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the examiner make their judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**.
Alternative words in the mark scheme are shown by a solidus eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name **two** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks are **not** awarded for a correct final answer from incorrect working.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do <u>not</u> accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and, if necessary, annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level.

The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	both have a cell membrane both have cytoplasm		1 1	AO1 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	any **one** from: • fever • abdominal / stomach cramps	ignore vomiting / sickness / diarrhoea ignore feel unwell unqualified ignore rashes allow high temperature allow sweating / chills	1	AO1 4.3.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	penicillin	allow phonetic spelling	1	AO2 4.3.1.9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	any **one** from: • only a few bacteria killed so live bacteria continued to reproduce • time delay before antibiotic reached bacteria • time delay before antibiotic could kill bacteria	allow bacteria reproducing when course started allow takes time (for antibiotic) to travel through the body allow takes time (for antibiotic) to work	1	AO3 4.3.1.1 4.3.1.3 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	there were fewer toxins in the body than at day 0		1	AO2 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	to reduce / prevent resistant strains / bacteria developing **or** to reduce / prevent antibiotic resistance (in bacteria)	ignore references to bacteria becoming immune allow because they will get better without taking any antibiotics ignore body will fight the infection unqualified allow some infections are caused by viruses allow because they have been told not to by NHS / NICE	1	AO1 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	B		1	AO2 4.2.2.3 4.3.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	D		1	AO2 4.2.2.3

Total Question 1		**9**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	gene chromosome nucleus cell	must be in this order	1	AO1 4.1.1.1 4.1.1.2 4.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	differentiation	ignore specialisation	1	AO1 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	4	allow 15	1	AO2 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	46	allow 23 pairs (of chromosomes)	1	AO2 4.1.2.1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	**Stage 1** any **one** from: • (cell) growth • increase in number of sub-cellular structures • DNA replicates • chromosomes double / duplicate / replicate	 allow increase in number of organelles / ribosomes / mitochondria allow genetic material for DNA allow DNA doubles / duplicates	1	AO1 4.1.2.2
	Stage 2 any **one** from: • (one set of) chromosomes pulled to each end of cell • two nuclei form	ignore mitosis occurs allow chromosomes line up across the centre of the cell allow chromosomes move to opposite ends of the cell allow nucleus divides / splits (into two)	1	
	Stage 3 any **one** from: • cytoplasm / membrane divides • two identical cells formed	 allow cytokinesis	1	

Question	Answers	Mark	AO / Spec. Ref.
02.6	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.	4–6	AO3
	Level 1: Relevant features are identified and differences noted.	1–3	AO2
	No relevant content	0	

	Indicative content General comparisons: • boys height at birth (slightly) greater than girls height • boys are (slightly) taller than girls up to age 11 • correct height comparisons eg boys are approximately 4 / 5 cm taller than girls up to age 11 • girls and boys are the same height at age 11 • girls are taller than boys between age 11 and age 14 • girls and boys are the same height at age 14 • boys are taller than girls above age 14 • correct height comparisons eg boys are 5 to 18 cm taller than girls above age 14 • boys (eventually) grow taller than girls • boys carry on growing for a longer time than girls • girls stop growing age 13 / 14 / 15 **and** boys stop growing age 17 / 18 Rate comparisons: • rate of growth similar up to age 10 / 11 • girls grow faster than boys between 10 / 11 and 14 allow girls have a greater increase in height between 11 and 14 • growth spurt occurs at a younger age in girls • growth spurt starts age 10 / 11 in girls **and** age 13 / 14 in boys • increased rate of growth in girls aged 10 to 13 /14 **and** in boys aged 13 to 17 / 18 Key points for Level 2 are correct reference to 0-11 year period, 11-14 period and after age 14, with at least one correct reference to rate of growth or use of correct values of height and age to illustrate rate.		4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	repair of tissues **or** replacement of cells	ignore growth allow repair of organs ignore repair of cells allow replacement of tissues ignore replacement of organs	1	AO1 4.1.1.4

Total Question 2		**14**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	salivary glands, pancreas and small intestine		1	AO1 4.2.1 4.2.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	pH (of amylase / solution / buffer)	ignore upper and lower case letters allow hydrogen ion / H^+ concentration ignore acidity / alkalinity	1	AO1 4.2.2.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	iodine (solution / reagent) would **not** turn black / blue-black **or** iodine (solution / reagent) would stay orange / brown	allow iodine (solution / reagent) would **not** turn dark blue / dark purple ignore iodine solution / reagent would not turn blue / purple allow iodine (solution / reagent) would not change colour	1	AO1 4.2.2.1 RPA3 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	6.8	answer line takes precedence allow answer in range 6.75 to 6.85	1	AO3 4.2.2.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	82 (seconds)	answer line takes precedence allow answer in range 80 to 84 (seconds)	1	AO3 4.2.2.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6 View with **Figure 7**	tangent drawn at 40 seconds		1	AO2 4.2.2.1 RPA4
	(rate =) $\frac{\text{value for dy}}{\text{value for dx}}$	eg (rate =) $\frac{2.25}{60}$	1	
	calculation of rate at 40 seconds	(rate =) 0.0375 (arbitrary units per second) allow an answer in the range 0.035 to 0.042 (arbitrary units per second)	1	
	(0.0375 × 60 =) 2.25 (arbitrary units per minute)	allow an answer in the range 2.1 to 2.5 (arbitrary units per minute)	1	
		if no other marks awarded allow **1** mark for $\left(\frac{3.5}{40} \times 60 =\right)$ 5.25 (arbitrary units per minute) allow an answer in the range 5.175 to 5.25 (arbitrary units per minute) for this mark only		

Question	Answers	Mark	AO / Spec. Ref.
03.7	**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	
	Indicative content • enzymes are protein molecules • (so) have a 3D structure • lock and key theory • have an active site • (which) has a specific shape • shape of active site will only match shape of substrate • starch is substrate for amylase • at pH values above or below the optimum the shape of active site is changed (in some molecules) • (so) substrate can no longer fit the active site • at extreme pH values enzyme is denatured • (so) shape of active site is changed • (so) amylase can no longer digest starch • (so) rate of digestion decreases For Level 3 reference to enzyme structure and effect of pH on enzyme activity are needed		4.2.2.1

Total Question 3		**15**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	to transfer energy **or** photosynthesis is an endothermic reaction	allow idea that light is the source of energy (for the reaction) do **not** accept to produce / make / create / use energy	1	AO1 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$		1	AO1 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	allow the pondweed to equilibrate in the light	allow leave the pondweed in the light (for a few minutes) before taking measurements allow use the same concentration of sodium hydrogen carbonate solution ignore control carbon dioxide concentration unless method described ignore use same intensity / distance of light ignore control temperature ignore use same pondweed	1	AO3
	use a gas syringe **or** use a (measuring) cylinder to measure / collect the oxygen / gas produced	do **not** accept carbon dioxide ignore references to counting bubbles	1	AO1
	measure time oxygen / gas is collected for using a timer / stopwatch / stopclock		1	AO1
	repeat the measurements **and** calculate a mean	allow repeat the measurements **and** discard anomalies	1	AO1 4.4.1.1 4.4.1.2 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4		ignore answers relating to the scale on the y-axis		AO2 4.4.1.2 RPA5
	independent variable in student's investigation is categoric / discrete	allow colour of light is a categoric / discrete variable ignore discontinuous	1	
	independent variable in scientist's investigation is continuous	allow wavelength is a continuous variable	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	492 to 577 (nm)	allow answers in ranges 475 to 525 **and** 575 to 650 (nm)	1	AO3 4.4.1.1 4.4.1.2 RPA5

Total Question 4		**9**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	any **four** from: **Similarities:** • result from changes in the cell / DNA / genes • uncontrolled cell growth / division • can form a lump of cells • made up of abnormal cells **Differences:** Malignant tumours: • are made of cancer cells, benign tumours are not **or** benign tumours are made up of cells that are more similar to normal cells • (usually) grow faster than benign tumours • invade neighbouring tissues, but benign tumours do not • can spread (to other parts of the body) but benign tumours stay in one place **or** cells can travel in the blood, but benign tumours do not • can form secondary tumours, benign tumours do not	max **three** marks if only similarities or differences given allow result from mutations allow benign tumours (often) have a layer of covering cells, malignant tumours (usually) do not ignore references to level of harm	4	AO1 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	little exposure to ionising radiation **or** little exposure to carcinogens	allow little exposure to UV (light) allow little exposure to sunlight ignore little exposure Sun unqualified allow use sunscreen allow do not use sunbeds allow named carcinogen e.g. smoking	1	AO3
	(so) less cell / DNA / gene damage	allow (so) fewer mutations allow older people's (skin) cells are more susceptible to DNA damage if no other marks awarded allow **1** mark for skin cancer takes a long time to develop	1	AO2 4.2.2.6 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	any **two** from: • more females than males diagnosed each year up to age 59 (years) • more new cases in males than in females from 60 (years) • greatest number of people / males / females diagnosed in age group 65-69 (years) • number of new cases increases in **males** up to age group 65−69 (years) after which they decrease / fall	ignore the number of cases of skin cancer increases with age	2	AO3 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	to account for the different group sizes	allow there are different numbers of people / males / females of different ages allow so the different group sizes can be compared allow so it can be compared to populations in other countries ignore to compare unqualified	1	AO3 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	any **two** from: • number (of males / female per 100 000 population) increases with age • in females the number (per 100 000 population) increases at a steady rate • number (per 100 000 population) in males increases at a similar **or** at a slightly lower rate as in females up to age 55 • number (per 100 000 population) increases at a much higher rate in males than females above age 59	do **not** accept if referring to number of new cases allow number (per 100 000 population) in males increases at a steady rate up to 55−59 (years) allow number (per 100 000 population) in males increases more rapidly above age 59	2	AO2 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	$\frac{116 \times 694\,000}{100\,000}$ = 805.04 = 805	allow values in the range 114 to 118 allow an incorrectly calculated number of males correctly rounded to 3 significant figures if no other marks awarded allow **1** mark only for an answer of 5270	1 1 1	AO2 4.2.2.7

Total Question 5		**14**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	it is made up of (different) tissues (that perform specific functions)		1	AO1 4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	some blood would flow back into the ventricle / heart	allow not all the blood would leave the ventricle / heart allow blood clot (may form in the heart) do **not** accept blood would flow back into the right ventricle	1	AO2 4.2.1 4.2.2.2 4.2.2.4 4.4.2.1
	(so) less oxygenated blood would be pumped to the body	ignore references to glucose	1	
	cells require oxygen for respiration **or** less aerobic respiration	allow more anaerobic respiration	1	
	(so) person would become out of breath **or** (so) less energy transferred **or** (so) person would be tired	(so) lactic acid will build up allow the idea of lacking energy do **not** accept less energy produced / made / created	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	any **four** from: (advantages of biological valve): • reduced risk of blood clots which could cause heart attack or stroke • reduced risk of blood clots during pregnancy / birth • reduced risk of bleeding during pregnancy / birth • do not need to take anti (blood) clotting drugs • no risk to foetus / baby from drugs • reduced risk of serious bleeds if in an accident • do not need to carry (anti-blood clotting) drugs when travelling • lower risk of rejection / immune reaction (disadvantages of biological valve): • may be rejected • may have to go through surgery more than once • may have to take immunosuppressant drugs • have to wait for (suitable) donor	max **three** marks if only advantages or disadvantages of biological valve given ignore do not need to take blood thinners allow do not need to take drugs for life allow problems related to losing / obtaining drugs when travelling do **not** credit reference to rejection twice allow no risk of side effects from drugs do **not** credit reference to rejection twice ignore risks from surgery unqualified allow an animal might be killed	4	AO3 4.2.2.2 4.2.2.3 4.2.2.4

Total Question 6		**9**