2024

Name_____

Combined Science

Higher

Biology: Paper 1

AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
COMBINED SCIENCE: TRILOGY
H

Higher Tier
Biology Paper 1H

Tuesday 14 May 2019 Afternoon 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.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- 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.

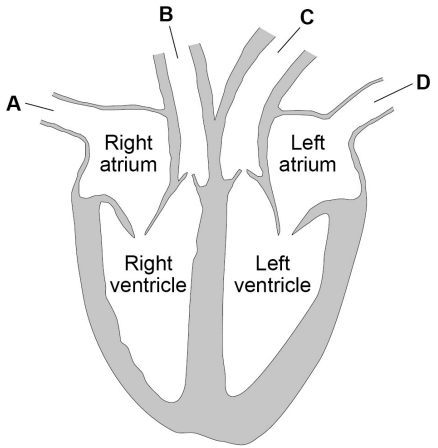
Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

Do not write outside the box

0 1 **Figure 1** shows a human heart.

Figure 1



0 1 . 1 Which blood vessel carries deoxygenated blood away from the heart to the lungs?
[1 mark]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

0 1 . 2 The natural resting heart rate is controlled by a group of cells that act as a pacemaker.

Where in the heart are 'pacemaker cells' found?
[1 mark]

Tick (✓) **one** box.

Left atrium ☐

Left ventricle ☐

Right atrium ☐

Right ventricle ☐

Do not write outside the box

Some people may be treated with a drug to slow their heart rate.

0 1 . 3 Digitalis is a drug that slows the heart rate.

Where does the drug digitalis originate from?

[1 mark]

Tick (✓) **one** box.

- Bacteria ☐
- Foxgloves ☐
- Mould ☐
- Willow ☐

Question 1 continues on the next page

Do not write outside the box

Beta blockers are another type of drug that slows the heart rate.

Table 1 shows information for people who do not take beta blockers and for people who do take beta blockers.

- Stroke volume is the volume of blood pumped out of the heart each time it beats.
- Cardiac output is the total volume of blood pumped out of the heart each minute.

Table 1

	No beta blockers taken		**Taking beta blockers**	
	At rest	**During exercise**	**At rest**	**During exercise**
Heart rate in beats per minute	68	150	52	88
Stroke volume in cm^3	80	120	**X**	98
Cardiac output in cm^3 per minute	5440	18 000	2800	8624

0 1 . 4 Calculate stroke volume **X** in **Table 1**.

Use the equation:

cardiac output = stroke volume × heart rate

Give your answer to 2 significant figures.

[3 marks]

Stroke volume **X** = _____ cm^3

Do not write outside the box

0 1 . 5 Some people who take beta blockers get out of breath when they exercise.

Explain why beta blockers can have this effect during exercise.

You should refer to information given in **Table 1**.

[6 marks]

12

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 2 This question is about digestion.

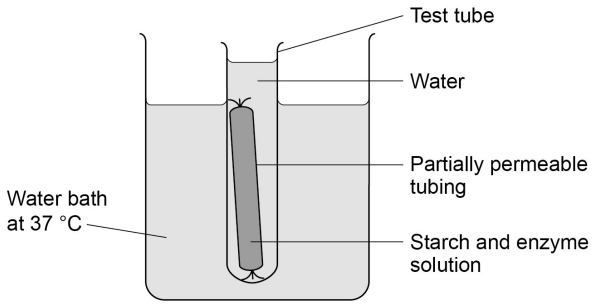
0 2 . 1 Name the enzyme that digests starch in the human digestive system.

[1 mark]

A student set up a model to represent the digestion and absorption of food molecules in the digestive system.

Figure 2 shows the student's model.

Figure 2



This is the method used.

1. Fill a test tube with water at 37 °C
2. Test the water for starch and for sugar.
3. Mix together starch and enzyme solution and immediately test it for starch and for sugar.
4. Fill some partially permeable tubing with the starch and enzyme mixture.
5. Seal the tubing and place it in the test tube of water.
6. Place the test tube in a water bath at 37 °C
7. After 30 minutes, test the mixture inside the partially permeable tubing and test the water in the test tube for starch and for sugar.

0 2 . 2 Suggest which parts of the body the partially permeable tubing and the water in the test tube represent.

[2 marks]

Partially permeable tubing _____

Water in the test tube _____

Turn over ►

Do not write outside the box

Table 2 shows the results.

Table 2

Test	Description of liquid	Result of starch test	Result of sugar test
1	Mixture inside tubing at start	✓	✗
2	Water in the test tube at start	✗	✗
3	Mixture inside tubing after 30 minutes	✓	✓
4	Water in the test tube after 30 minutes	✗	✓

Key
✓ = Present
✗ = Not present

0 2 . 3 Name the reagents used to test for starch and for sugar.

[2 marks]

Starch _____

Sugar _____

0 2 . 4 Why was there no sugar present in test **1**?

[1 mark]

_____

_____

0 2 . 5 Explain the results for test **3**.

[2 marks]

_____

_____

_____

_____

_____

Do not write outside the box

0 2 . 6 Explain the results for test **4**.

[2 marks]

10

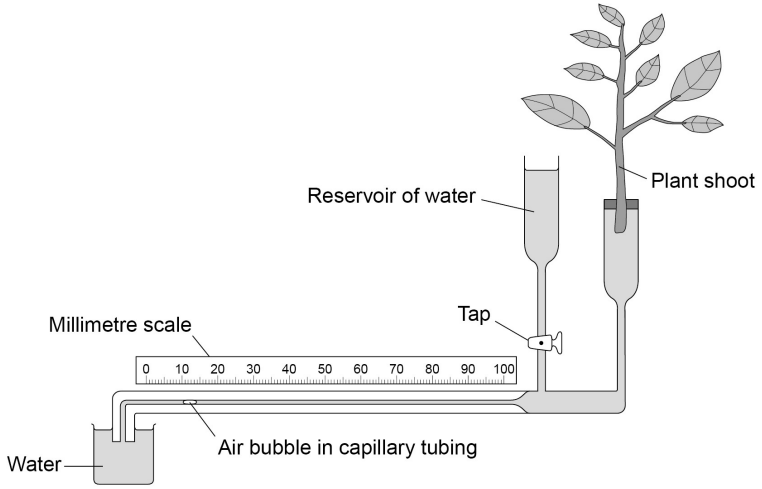
Turn over for the next question

Do not write outside the box

0 3 A student used a potometer to investigate the rate of water uptake in a plant shoot.

Figure 3 shows a potometer.

Figure 3



As the shoot takes in water the air bubble moves.

The rate of water uptake is the distance the air bubble moves in a given time.

This is the method used.

1. Place the potometer in moist air at 25 °C
2. Position the air bubble at 0 mm in the capillary tube.
3. Record the position of the air bubble in the capillary tube every minute for 5 minutes.
4. Repeat steps 2 and 3 with the potometer in different conditions.

Table 3 shows the conditions used.

Table 3

Investigation	Conditions
A	Moist air at 25 °C
B	Dry air at 15 °C
C	Dry air at 25 °C

0 3 . 1 After investigation **A** the air bubble had moved part way along the capillary tube.

Suggest how the student moved the air bubble back to 0 mm for the start of investigation **B**.

[1 mark]

0 3 . 2 Capillary tubing is very narrow.

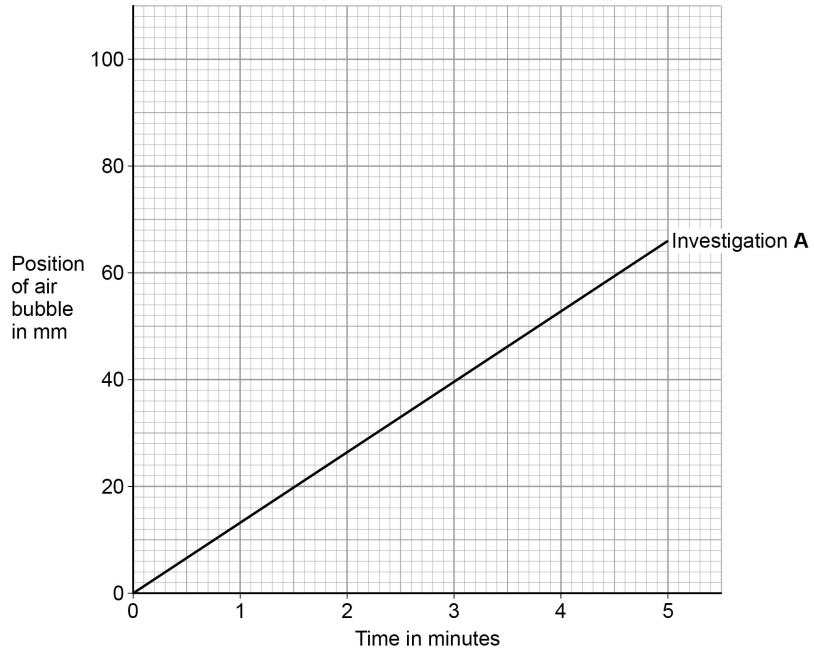
Explain why narrow tubing was used.

[2 marks]

Question 3 continues on the next page

Figure 4 shows the results for investigation **A**.

Figure 4



0 3 . 3 The cross-sectional area of the capillary tube was 0.8 mm^2

Calculate the rate of water uptake for investigation **A** in mm^3/min

[3 marks]

Rate = _____ mm^3/min

Do not write outside the box

0 3 . 4 **Table 4** shows the results from investigation **B**.

Table 4

Time in minutes	Position of air bubble in mm
0	0
1	6
2	16
3	22
4	30
5	42

Plot the data from **Table 4** on **Figure 4**.

You should:

- draw a line of best fit
- label the line **B**.

[3 marks]

0 3 . 5 Investigation **C** was carried out in dry air at 25 °C

Draw a line on **Figure 4** to show the results you would expect for investigation **C**.

Label the line **C**.

[1 mark]

0 3 . 6 The investigations were carried out in daylight.

The air bubble would **not** move if the investigations were done in the dark.

Explain why.

[3 marks]

13

Turn over ►

Do not write outside the box

0 4 Pathogens are microorganisms that cause infectious diseases.

0 4 . 1 What type of pathogen causes malaria?

[1 mark]

Tick (✓) **one** box.

Bacterium ☐

Fungus ☐

Protist ☐

Virus ☐

0 4 . 2 Give **two** methods used to prevent people catching malaria.

Give a reason why each method works.

[4 marks]

Method 1 _____

_____

Reason _____

_____

_____

Method 2 _____

_____

Reason _____

_____

_____

Do not write outside the box

0 4 . 3 Describe **two** differences between a bacterial cell and a eukaryotic cell.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

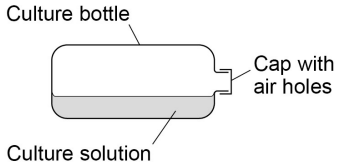
A scientist investigated the population growth of bacteria in a culture solution.

At the start of the investigation the culture solution contained all the nutrients the bacteria needed.

The scientist determined the number of living bacterial cells in the solution every hour over two days.

Figure 5 shows the apparatus used.

Figure 5



0 4 . 4 Describe why there are air holes in the cap of the culture bottle.

[1 mark]

_____

_____

Question 4 continues on the next page

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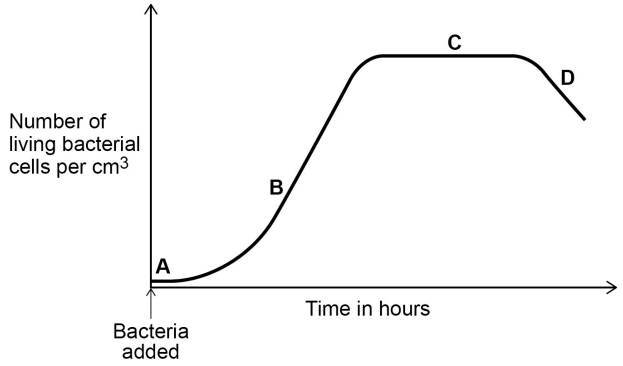
Figure 6 shows the scientist's results.

Figure 6



0 4 . 5 Give **one** reason for what is happening to the number of bacteria at each of the stages.

[4 marks]

Stage **A** _____

_____

_____

Stage **B** _____

_____

_____

Stage **C** _____

_____

_____

Stage **D** _____

_____

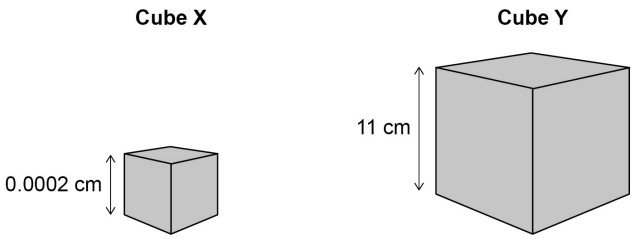
_____

0 4 . 6 **Figure 7** shows two cubes.

Cube **X** represents a bacterial cell.

Cube **Y** represents a small multicellular organism.

Figure 7



A bacterial cell can absorb all the nutrients it needs by diffusion through its outer surface.

Explain why a multicellular organism **cannot** absorb all the nutrients it needs by diffusion through its outer surface.

You **must** include calculations in your answer.

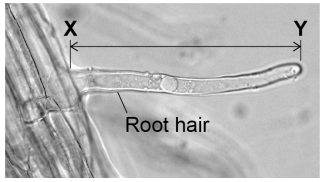
Use **Figure 7**.

[5 marks]

17

0 5 **Figure 8** shows a root hair viewed using a microscope.

Figure 8



0 5 . 1 The root hair was viewed at a magnification of ×50

The image length of the root hair **X–Y** is 43 mm

Calculate the real length of the root hair in micrometres (μm).

[4 marks]

Real length = _____ μm

Do not write outside the box

0 5 . 2 A microscope has a ×5 eyepiece lens.

Describe how to use this microscope to observe a prepared slide of root hair cells at a magnification of ×50

[4 marks]

Question 5 continues on the next page

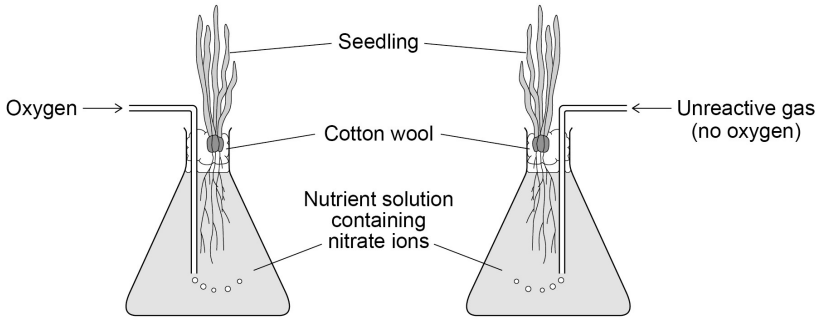
Do not write outside the box

Root hair cells absorb water and mineral ions from the soil.

A scientist investigated the rate of nitrate ion uptake by two seedlings.

Figure 9 shows how the investigation was set up.

Figure 9



The scientist determined the mass of nitrate ions absorbed by each seedling every 30 minutes for 4 hours.

Table 5 shows the results.

Table 5

Time in hours	Total mass of nitrate ions absorbed by seedling in arbitrary units	
	With oxygen added	With no oxygen added
0	0	0
0.5	100	60
1.0	145	95
1.5	170	105
2.0	195	115
2.5	215	120
3.0	235	125
3.5	250	130
4.0	265	130

Do not write outside the box

0 5 . 3 Describe the changes in the rate of absorption of nitrate ions for the seedling with **no** oxygen added.

Use information from **Table 5**.

[3 marks]

0 5 . 4 Explain what the results in **Table 5** show about how nitrate ions are absorbed.

[4 marks]

Question 5 continues on the next page

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0 5 . 5 Nitrate ions are essential for plants to grow.

Describe how nitrate ions are used in a plant to help the plant grow.

[3 marks]

18

END OF QUESTIONS

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AQA

GCSE
COMBINED SCIENCE: TRILOGY
8464/B/1H

Biology Paper 1H

Mark scheme

June 2019

Version: 1.0 Final

196G8464B1H/MS

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	**B**		1	AO2 4.2.2.2
01.2	right atrium		1	AO1 4.2.2.2
01.3	foxgloves		1	AO1 4.3.1.9
01.4		an answer of 54 (cm^3) scores 3 marks		AO2 4.2.2.2
	X = 2800 / 52		1	
	53.846153		1	
	54 (cm^3)	allow correct rounding of an incorrectly calculated value of stroke volume	1	

Question	Answers	Mark	AO / Spec. Ref.
01.5	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO3 4.2.2.2 4.2.2.4 4.4.2.1 4.4.2.2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO2 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 effect of exercise • during exercise body needs to transfer (more) energy • energy transferred during respiration • rate of respiration increases during exercise • (so) more oxygen is needed effect of beta blockers • beta blockers reduce (the increase in) heart rate (during exercise) • beta blockers reduce stroke volume (or described) • beta blockers reduce cardiac output • (so) heart cannot supply oxygen fast enough / in sufficient quantity to muscle cells effect on breathing rate • breathing rate increases to increase rate / amount of oxygen absorbed • breathing rate increases to increase rate / amount of carbon dioxide removed from body • (but) increased breathing rate cannot fully compensate for changes in heart function A level 3 response should make links between all three sections of indicative content A level 2 response should attempt to link effect of exercise with oxygen / energy requirement **and** beta blockers to effect on heart function. .		
Total		**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	amylase	allow phonetic spelling allow carbohydrase ignore references to source of enzyme e.g. salivary / pancreatic do **not** accept amylose	1	AO1 4.2.2.1
02.2	(partially permeable tubing) small intestine (water in test tube) blood	allow stomach ignore intestine unqualified do **not** accept large intestine allow plasma	1 1	AO3 4.2.2.1
02.3	(Starch): Iodine (solution) (Sugar): Benedict's (solution)	allow phonetic spelling ignore iodide unqualified	1 1	AO1 4.2.2.1
02.4	enzyme had not started to work **or** none of the starch had been digested / broken down	allow idea of not enough time (for digestion)	1	AO2 4.2.2.1
02.5	(enzyme) digested / broke down starch to form sugar (however) not all the starch was digested / broken down		1 1	AO2 AO3 4.2.2.1
02.6	sugar molecules formed are small enough to pass through tubing (but) starch molecules too large (to pass through tubing)		1 1	AO3 4.2.2.1 AO2 4.2.2.1
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	opened and closed the tap (so water enters from reservoir)	allow opened the tap (carefully / gently)	1	AO3 4.2.3.2
03.2	air bubble moves further (in a given time)	allow air bubble moves faster	1	AO3 4.2.3.2
	(so) resolution is improved	allow it is easier to see a small change (in volume) ignore is easier to measure unqualified allow measurements are more accurate ignore to make test more accurate ignore references to precision or validity	1	
03.3		an answer of 10.56 (mm^3/min) scores 3 marks		AO2 4.2.3.2
	$\frac{66}{5}$ **or** 13.2 (mm/min)	allow tolerance of ± ½ square allow full marks from calculation from other **correct** pairs of readings allow value in range 13 to 13.4 for $\frac{66}{5}$ only ignore $\frac{63}{5}$ or 12.6	1	
	13.2 × 0.8	allow their calculated value in the range from 12 to 14 x 0.8	1	
	10.56 (mm^3/min)	allow 10.6 or 11	1	

03.4	points plotted correctly suitable line of best fit	allow +/- ½ a square allow 1 mark for 4/5 correct plots	2 1	AO2 4.2.3.2
03.5	straight line starting at 0,0 with a steeper gradient than A		1	AO3 4.2.3.2
03.6	no photosynthesis (so) stomata closed (as no carbon dioxide needed) (so) no transpiration	allow plants need light for photosynthesis allow very little transpiration **or** little water lost	1 1 1	AO1 AO2 AO2 4.2.3.2 4.4.1.2
Total			**13**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	protist		1	AO1 4.3.1.5
04.2	any **two** methods with reason from: • Method: insecticides Reason: to kill mosquitos / vector • Method: (mosquito) nets Reason: to avoid being bitten • Method: insect repellents Reason: less likely to be bitten • Method: vaccination Reason: so people are immune (to malaria) • Method: anti-malaria tablets Reason: kills the pathogen / protist	1 mark for method and 1 mark for a correctly linked reason ignore kill insects unqualified allow long clothing ignore acts as a physical barrier allow DEET or named insect repellent allow named anti-malarial e.g. Larium / Malarone allow antibiotics allow ecf from 04.1 ignore kills malaria allow Method: drain swampy ground **or** remove pots of water **or** put oil on water / pond Reason: fewer breeding grounds for mosquitos allow Method: release GM / sterile mosquitos Reason: prevent / reduce reproduction if no other marks awarded allow **1** mark for kill mosquitos	4	AO1 4.3.1.1 4.3.1.5 4.3.1.7

04.3	any **two** from: (bacterial cell): does not have a nucleus has plasmids is smaller	 allow DNA is free in cytoplasm allow has a single loop of DNA allow has a single strand of DNA allow description, e.g. (small) ring(s) of DNA allow bacterial cells do not have mitochondria **or** do not have membrane bound organelles allow bacteria have smaller ribosomes ignore bacterial cells do not have chloroplasts	2	AO1 4.1.1.1
04.4	to allow air / oxygen in for bacteria to respire **or** so bacteria can respire aerobically	allow to allow carbon dioxide produced in respiration to escape	1	AO3 4.4.2.1

04.5	(A) (no change in population size) because no / limited cell division / reproduction	allow (no change in population size) because bacteria / cells adjusting to environment / culture conditions ignore reference to growth unqualified	1	AO2 4.1.2.2 4.3.1.1 4.4.2.1 4.4.2.3
	(B) (rapid increase in population size) as cells dividing rapidly as (plentiful) supply of nutrients / food	allow rapid binary fission as (plentiful) supply of nutrients / food	1	
	(C) (population size stays the same) as rate of cell death equals rate of cell division		1	
	(D) (population size decreasing) as cells dying due to nutrients running out **or** (population size decreasing) as cells dying due to toxins / carbon dioxide / cell wastes building up (in solution)		1	

04.6		a ratio of 30 000:1 for **X and** 0.55:1 for **Y** scores 3 marks		4.1.3.1
	(SA: vol ratio of **X** =) $2.4 \times 10^{-7} : 8 \times 10^{-12}$ **or** 0.000 000 24 : 0.000 000 000 008	if no other calculation marks awarded allow 1 mark for calculation of SA for **X and Y** **or** calculation of volume for **X and Y** **or** calculation of SA **and** volume for one **or** both cubes if not given as a ratio	1	AO2
	(SA: vol ratio of **Y** =) 726:1331		1	AO2
	conversion to same scale: 30 000:1 **and** 0.55:1		1	AO2
	(so) diffusion distance is longer in multicellular organism **or** (so) volume supplied by each unit of surface area is greater in multicellular organism	allow converse allow converse allow idea that some cells will have no surfaces exposed to outside in multicellular organism	1	AO1
	(so) diffusion rate per unit volume is slower in a multicellular organism	allow converse	1	AO2
Total			**17**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	$50=\frac{43}{\text{size of real object}}$	an answer of 860 (μm) scores 4 marks	1	AO1 3×AO2 4.1.1.5
	(size of real object =) $\frac{43}{50}$		1	
	(size of real object =) 0.86 (mm)		1	
	(size of real object =) 860 (μm)	allow correct conversion of their calculated value if no other marks awarded allow 1 mark for magnification= size of image / size of real object	1	

Question	Answers	Mark	AO / Spec. Ref.
05.2	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4	AO1 4.1.1.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	AO1
	No relevant content	0	
	Indicative content • place slide on stage • use lowest power / ×4 objective lens (initially) • adjust mirror **or** switch light on so light passes through slide • move stage as close to lens as possible • slide must not touch lens • turn focussing knob so slide moves away from lens • turn focussing knob until image comes into focus • use fine focus to get clear image • change objective lens to ×10 • ×5 eyepiece and ×10 objective lenses (gives total magnification of ×50) • refocus slide using focussing knob For Level 2 reference to how to focus the slide / cells **and** achieve magnification of ×50 is required		

05.3	any **three** from: • (rate) fastest in the first 0.5 hours • (rate gradually) decreases after first 0.5 hours **or** (rate gradually) decreases throughout the investigation • rate is constant between 1.0 and 2.0 hours **or** rate is constant between 2.0 and 3.5 hours • (rate) becomes zero between 3.0 and 3.5 hours	allow 'it' for rate allow fastest rate is 120 units per hour (at start) allow mean rate over 3.5 hours is 37.14 units per hour allow (rate) is zero after 3.5 hours	3	AO3 4.1.3.3 4.2.3.2

05.4	more nitrate ions are absorbed in the presence of oxygen	allow nitrate ions absorbed faster in the presence of oxygen	1	AO3
	(which suggests) they are absorbed by active transport / uptake		1	AO2
	which requires energy from respiration	do **not** accept energy produced / created / made	1	AO1
	some nitrate ions absorbed by diffusion **or** some nitrate ions absorbed (by active transport / uptake) requiring energy from anaerobic respiration **or** some nitrate ions absorbed by active transport / uptake using oxygen already dissolved in the solution		1	AO2 4.1.3.3 4.2.3.2

05.5	nitrate ions are used with glucose to form amino acids (which are) used to synthesise proteins (needed for growth)		1 1 1	AO1 4.4.1.3 4.4.2.3
Total			**18**	

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	
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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.

Do not write outside the box

0 1 Plants absorb light for photosynthesis.

0 1 . 1 Which is the equation for photosynthesis?

[1 mark]

Tick (✓) **one** box.

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

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

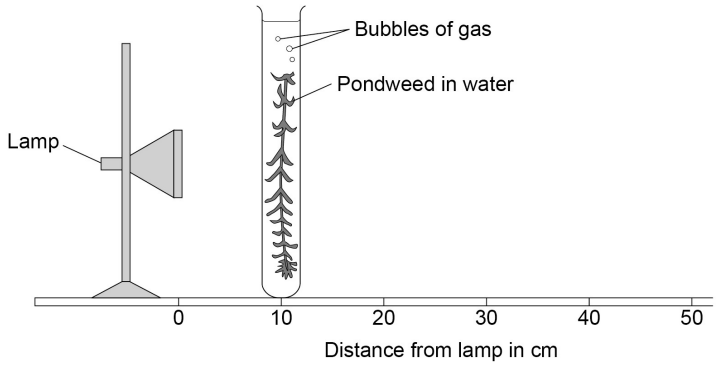
$6H_2O + 6O_2 \rightarrow C_6H_{12}O_6 + 6CO_2$ ☐

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

A student investigated the effect of light intensity on the rate of photosynthesis.

Figure 1 shows the apparatus.

Figure 1



Do not write outside the box

This is the method used.

1. Set up the apparatus as shown in **Figure 1**.
2. Place the pondweed 10 cm away from the lamp.
3. Switch on the lamp.
4. Record the number of bubbles of gas produced in 5 minutes.
5. Repeat steps 2 to 4 with the pondweed at different distances from the lamp.

0 1 . 2 What was the independent variable in this investigation?

[1 mark]

Tick (✓) **one** box.

- Distance of the pondweed from the lamp ☐
- Length of the piece of pondweed ☐
- Number of bubbles of gas produced ☐
- Time taken to collect the gas ☐

Question 1 continues on the next page

Do not write outside the box

The lamp gets warm when it is on. This causes the temperature of the water to increase.

0 1 . 3 Explain how an increase in temperature would affect the results of this investigation.

[2 marks]

0 1 . 4 Suggest **one** way the investigation could be improved so the temperature of the water does **not** increase.

[1 mark]

0 1 . 5 Suggest **two** improvements to the investigation so the results would be more valid.

Do **not** refer to controlling the temperature of the water.

[2 marks]

1

2

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Question 1 continues on the next page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

Table 1 shows the results.

Table 1

Distance of pondweed from the lamp in cm	Number of bubbles of gas produced in 5 minutes
10	120
20	56
30	31
40	16
50	10

0 1 . 6 Calculate the rate of photosynthesis when the pondweed was 40 cm from the lamp.

Give the rate of photosynthesis as the number of bubbles of gas produced per minute.
[1 mark]

Rate = _____ bubbles of gas produced per minute

0 1 . 7 Give **one** conclusion that can be made from **Table 1.**
[1 mark]

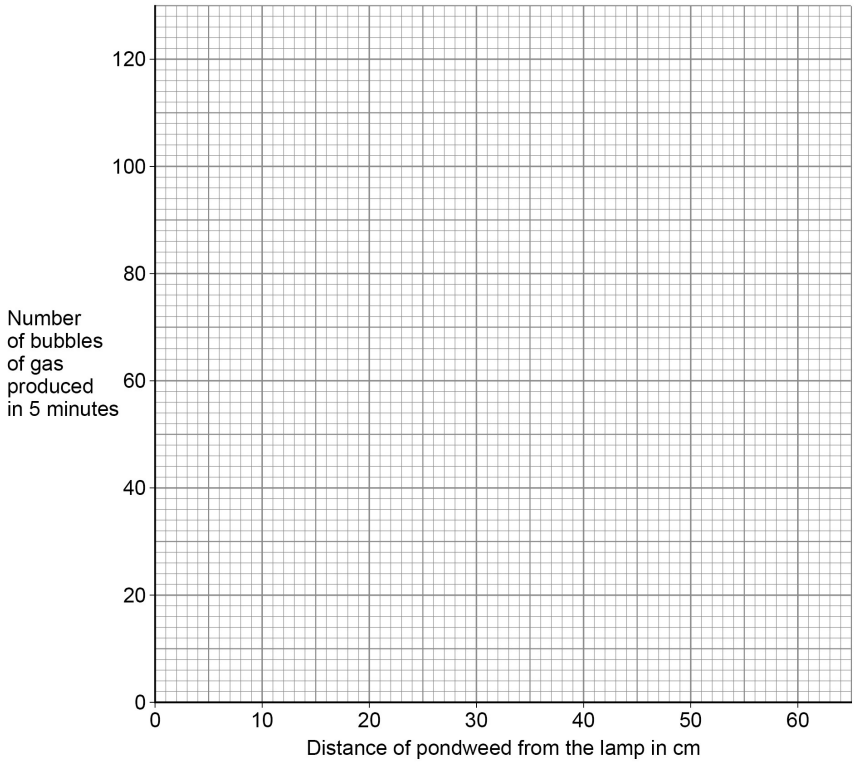
Do not write outside the box

0 1 . 8 Plot the data from **Table 1** on **Figure 2.**

Draw a line of best fit.

[3 marks]

Figure 2



0 1 . 9 Predict the number of bubbles that would be produced in 5 minutes if the pondweed was 60 cm from the lamp.

Use **Figure 2.**

[1 mark]

Number of bubbles produced in 5 minutes = _____

13

Turn over ►

Do not write outside the box

0 2 Describe how to test a sample of food for protein, starch and sugar.

Give the colours that would be seen if the food sample contained protein, starch and sugar.

[6 marks]

6

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 3 Fermentation in yeast is used in the manufacture of bread and alcoholic drinks.

The equation for fermentation is:

glucose → ethanol + carbon dioxide

0 3 . 1 Fermentation is an exothermic reaction.

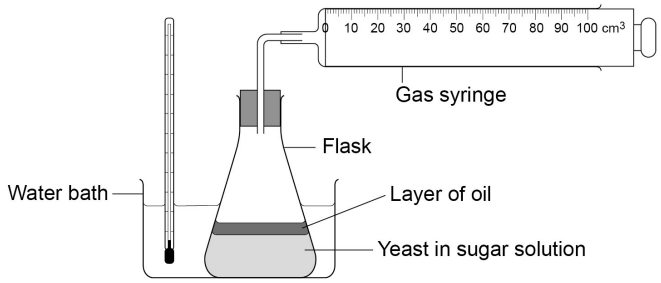
What does exothermic mean?

[1 mark]

A student investigated the effect of temperature on fermentation in yeast.

Figure 3 shows the apparatus.

Figure 3



This is the method used.

1. Mix yeast with sugar solution in a flask.
2. Pour a layer of oil over the surface of the mixture.
3. Put the flask in a water bath at 2 °C and leave for 20 minutes.
4. Attach a gas syringe.
5. Record the volume of gas collected every 5 minutes for 30 minutes.
6. After 30 minutes move the flask to a water bath at 35 °C.
7. Continue to record the volume of gas collected every 5 minutes.

0 3 . 2 Suggest why a layer of oil was needed on the surface of the mixture.

[1 mark]

0 3 . 3 Suggest why the mixture was left for 20 minutes before the gas syringe was attached.

[1 mark]

Question 3 continues on the next page

Steps 1 to 4 of the method were repeated at 35 °C.

The volume of gas collected was recorded every 5 minutes for 45 minutes.

Table 2 shows the results for both flasks for the first 30 minutes.

Table 3 shows the results for the last 15 minutes, when both flasks were at 35 °C.

Table 2

Time in minutes	Volume of gas collected in cm^3	
	Flask at 2 °C	Flask at 35 °C
0	0	0
5	0	26
10	0	52
15	0	78
20	0	98
25	0	108
30	0	115

Table 3

Time in minutes	Volume of gas collected in cm^3	
	Flask at 2 °C moved to 35 °C	Flask kept at 35 °C
35	2	120
40	7	123
45	22	124

Do not write outside the box

0 3 . 4 Explain the results from 0 minutes to 45 minutes for the flask that was at 2 °C and was then moved to 35 °C.

Use **Table 2** and **Table 3.**

[3 marks]

0 3 . 5 Explain the results from 0 minutes to 45 minutes for the flask kept at 35 °C.

Use **Table 2** and **Table 3.**

[4 marks]

10

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 4 Pathogens are microorganisms that cause diseases.

Gonorrhoea, malaria and measles are three diseases in humans.

0 4 . 1 Draw **one** line from each disease to the pathogen that causes the disease.

[3 marks]

Disease	Pathogen
Gonorrhoea	Bacterium
Malaria	Fungus
Measles	Protist
	Virus

Question 4 continues on the next page

Do not write outside the box

0 4 . 2 Malaria is transmitted by mosquitos.

Male mosquitos can be sterilised so they are infertile.

The spread of malaria is reduced by releasing sterile mosquitos into the environment.

Explain how releasing sterile mosquitos reduces the spread of malaria.

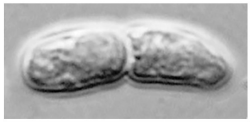
[2 marks]

Pathogens also cause diseases in plants.

Figure 4 shows a rose black spot fungal spore and a tobacco mosaic virus.

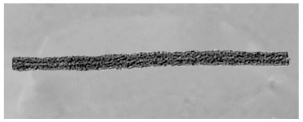
Figure 4

Rose black spot fungal spore



16 µm

Tobacco mosaic virus



2.5×10^{-7} m

Images are **not** to the same scale

0 4 . 3 Name the piece of equipment used to view the virus.

[1 mark]

Do not write outside the box

0 4 . 4 How many times longer is the fungal spore than the virus?

Use **Figure 4.**

[3 marks]

Number of times longer = _____

0 4 . 5 Explain why plants infected with tobacco mosaic virus grow slowly.

[3 marks]

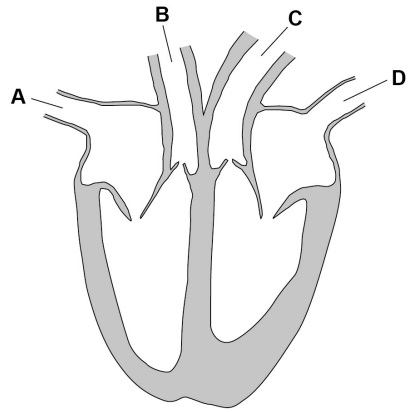
12

Turn over for the next question

Do not write outside the box

0 5 **Figure 5** shows the human heart.

Figure 5



0 5 . 1 Which blood vessel transports blood with the highest oxygen concentration **into** the heart?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 5 . 2 Blood pressure is a measure of the force of the blood against the walls of the blood vessels.

Which blood vessel transports blood at the highest pressure?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

Do not write outside the box

0 5 . 3 What is the correct order for blood flowing through the heart to the lungs?

[1 mark]

Tick (✓) **one** box.

left atrium → left ventricle → pulmonary artery ☐

left atrium → left ventricle → pulmonary vein ☐

right atrium → right ventricle → pulmonary artery ☐

right atrium → right ventricle → pulmonary vein ☐

Question 5 continues on the next page

Do not write outside the box

Every year thousands of people in the UK have heart attacks.

A heart attack is caused when the heart muscle cells do **not** get enough oxygen, causing the cells to die.

0 5 . 4 Statins and stents are two treatments used to reduce the risk of someone having a heart attack.

Evaluate the use of statins compared with the use of a stent to reduce the risk of a heart attack.

[6 marks]

Do not write outside the box

0 5 . 5 Many people who survive a heart attack get out of breath easily when they exercise gently.

Explain why heart attack survivors get out of breath easily.

[4 marks]

Question 5 continues on the next page

Do not write outside the box

Scientists have developed patches of beating heart cells to repair damaged heart tissue.

The patches are placed onto areas of the heart where cells have died. New cells grow to replace the dead cells.

The patches are made using a person's own cells that are converted into stem cells.

0 5 . 6 Explain why stem cells are used to make the patches.

[2 marks]

0 5 . 7 The scientists could have used human embryonic stem cells to make the patches.

Give **two** advantages of using stem cells made from the person's own cells, rather than using embryonic stem cells.

[2 marks]

1

2

17

Do not write outside the box

0 6 This question is about plant transport systems.

0 6 . 1 Describe how water is transported from the soil to the atmosphere through a plant.

[4 marks]

0 6 . 2 Dissolved sugars are moved through a plant in phloem tissue.

What is the name of the process that moves dissolved sugars through phloem tissue?

[1 mark]

Question 6 continues on the next page

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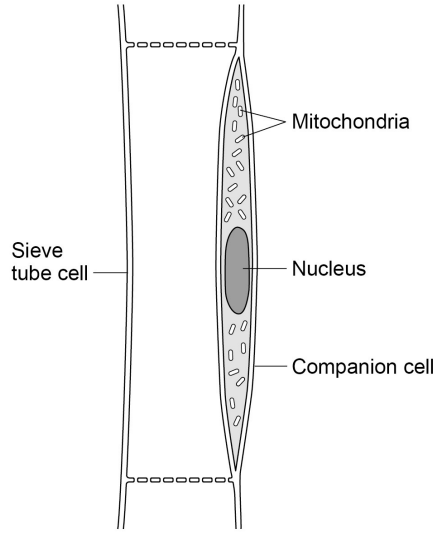
Phloem tissue is made of sieve tube cells and companion cells.

Figure 6 shows a section of phloem tissue.

Figure 6



0 6 . 3 Explain **one** way **sieve tube cells** are specialised for their function.

Use **Figure 6**.

[2 marks]

Do not write outside the box

0 6 . 4 What does the structure of the companion cells suggest about the process that moves dissolved sugars through the phloem tissue?

Give a reason for your answer.

Use **Figure 6.**

[2 marks]

0 6 . 5 Describe why it is important that dissolved sugars are moved both upwards **and** downwards in a plant.

[3 marks]

END OF QUESTIONS

12

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

AQA

GCSE
COMBINED SCIENCE: TRILOGY
8464/B/1H

Biology Paper 1H

Mark scheme

June 2021

Version: 1.0 Final Mark Scheme

216G8464B1H/MS

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	$6\,CO_2 + 6\,H_2O \rightarrow C_6H_{12}O_6 + 6\,O_2$		1	AO1 4.4.1.1
01.2	distance of the pondweed from the lamp		1	AO1 4.4.1.2 RPA5
01.3	bubbles (of gas) would be produced faster	allow more / bigger bubbles of gas would be produced (in a given time)	1	AO3 4.4.1.2 RPA5
	(because) enzymes work faster	allow (because) photosynthesis is controlled by enzymes allow (because) photosynthesis would be faster	1	AO2 4.2.2.1 4.4.1.2
01.4	any **one** from: • use an LED (lamp) • place a tank / beaker of water between the lamp and tube / pondweed • put the tube in a beaker of water • put the tube in a (thermostatically controlled) water bath • place a piece of glass between the lamp and tube / pondweed	 allow use a light that does not emit (a lot of) infrared / thermal radiation allow place a heat shield between the lamp and tube / pondweed	1	AO3 4.4.1.2 RPA5

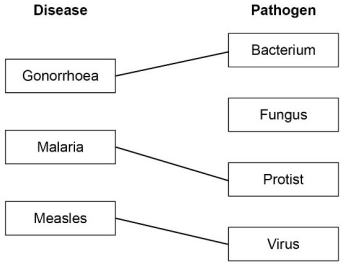
01.5	any **two** from: • measure the volume of gas produced • allow the pondweed time to equilibrate • repeat **and** calculate a mean **or** repeat **and** remove anomalies • control the concentration of carbon dioxide (in the water) • use the same bulb / lamp	allow amount for volume allow use a cylinder / gas syringe to collect the gas allow a description of this ignore repeat unqualified allow put the pondweed in sodium hydrogen carbonate (solution) **or** sodium bicarbonate (solution) allow use the same type / size / age / piece of pondweed allow record the number of bubbles of gas produced in a longer period of time	2	AO3 4.4.1.2 RPA5
01.6	3 (bubbles of gas produced per minute)	allow 3.2 (bubbles of gas produced per minute) do **not** accept 3.0 (bubbles of gas produced per minute)	1	AO2 4.4.1.2 RPA5
01.7	as light intensity decreases the rate of photosynthesis decreases	allow as distance from lamp increases rate of photosynthesis decreases allow as distance from lamp increases number of bubbles produced decreases	1	AO3 4.4.1.2 RPA5

01.8	all points plotted correctly line of best fit through their points	allow tolerance of ± ½ a small square allow **1** mark for four points plotted correctly do **not** accept line extended to 0, 0 ignore extrapolations of line	2 1	AO2 4.4.1.2 RPA5
01.9	8	allow correct value from their line ± ½ a small square allow value in range 6 to 9 if a curved line of best fit is not drawn	1	AO3 4.4.1.2 RPA5
Total			**13**	

Question	Answers	Mark	AO / Spec. Ref.
02	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.2.2.1 RPA3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content **Protein** • grind up food • add Biuret (reagent / solution) **or** add copper sulfate (solution) **and** sodium hydroxide (solution) **or** add Biuret 1 and Biuret 2 • turns purple / lilac **Starch** • add iodine (solution) • turns black / blue-black / dark blue - ignore blue / purple **Sugar** • grind up food • mix with water • add Benedict's (reagent / solution) • heat mixture (≥ 65 °C) • in a water bath • turns (brick) red / orange / brown / green / yellow For Level 3 correct references to all three tests are needed.		
Total		**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	releases energy (to the surroundings)	allow transfers (thermal) energy to the surroundings ignore transfers energy unqualified	1	AO1 4.4.2.1
03.2	to keep oxygen out	allow to keep air out allow (because) fermentation is an anaerobic reaction allow to prevent aerobic respiration	1	AO3 4.4.2.1
03.3	to allow the mixture / yeast / cells to reach the temperature	allow to reach 2 °C allow so yeast can equilibrate allow idea that contraction of gas (on cooling) would hinder results collection	1	AO3 4.4.2.1
03.4	(2 °C is) too cold for enzymes / yeast to work	allow (at 2 °C) few / no collisions (between sugar and enzymes)	1	AO2 4.2.2.1 4.4.2.1
	(so) no carbon dioxide / gas produced **or** (so) fermentation did not occur **or** fermentation was very slow	do **not** accept an incorrect gas	1	
	enzymes become active at 35 °C so carbon dioxide / gas was produced	allow at 35 °C the enzymes started to work so carbon dioxide / gas was produced	1	

03.5	ideal / suitable temperature for enzymes / yeast to work		1	AO1
	(so) carbon dioxide / gas produced (rapidly)	do **not** accept an incorrect gas	1	AO2
	(after time / ≥ 15 minutes) rate / fermentation slowed	allow (after time / ≥ 15 minutes) less gas produced per minute	1	AO2
	(because) sugar / glucose / food began to run out **or** (because) increased concentration of ethanol / alcohol started to kill the cells		1	AO2 4.2.2.1 4.4.2.1
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	 do **not** accept more than one line from a box on the left		1 1 1	AO1 4.3.1.1 4.3.1.2 4.3.1.3 4.3.1.5
04.2	reduces breeding / reproduction (in mosquitos)	allow fewer (mosquito) eggs fertilised allow no offspring produced (by sterile mosquitos)	1	AO2 4.3.1.1 4.3.1.5
	(so) fewer mosquitos to bite people **or** (so) fewer mosquitos to pass on pathogen / protist	allow (so) less likely to be bitten by mosquitos ignore fewer mosquitos to pass on malaria / disease	1	
04.3	electron microscope	ignore microscope unqualified ignore scanning / transmission do **not** accept light microscope	1	AO2 4.1.1.5 4.3.1.2

04.4	(fungal spore) (16 µm =) 1.6×10^{-5} m **or** (virus) (2.5×10^{-7} m =) 0.25 µm $\frac{1.6 \times 10^{-5}}{2.5 \times 10^{-7}}$ **or** $\frac{16}{0.25}$ (=) 64	 allow $\frac{0.000\,016}{0.000\,000\,25}$ allow incorrect attempt at conversion or not converted value for length correctly substituted allow a correctly calculated value using an incorrectly or not converted value for length allow **1** mark **only** for $\frac{16}{2.5} = 6.4$	1 1 1	AO2 4.1.1.1 4.1.1.5 4.3.1.2 4.3.1.4

04.5	 discolouration in leaves **or** less chlorophyll in leaves (so) reduced photosynthesis (so) less glucose produced so less amino acids / proteins / cellulose made	the idea of less is only needed once ignore mosaic pattern of leaves unqualified allow less light absorbed allow (so) less glucose so less energy for synthesis of chemicals **or** allow (so) less glucose for respiration (so) less energy transferred for growth	 1 1 1	 AO1 AO1 AO2 4.3.1.2 4.4.1.1 4.4.1.2 4.4.1.3 4.4.2.1
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	D		1	AO2 4.2.2.2
05.2	C		1	AO3 4.2.2.2
05.3	right atrium → right ventricle → pulmonary artery		1	AO1 4.2.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.		5–6	AO3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.		3–4	AO3
	Level 1: Relevant points are made. They are not logically linked.		1–2	AO1
	No relevant content		0	
	Indicative content Advantages of statins • easy to take **or** not invasive (procedure) • decrease blood cholesterol • slow down build-up of fatty materials in arteries • maintain blood flow to heart muscle cells • low cost (compared to stent operation) Disadvantages of statins • might be side effects of drug eg muscle pain • effects take time to happen • drug will need to be taken long term • might forget to take drug Advantages of stent • blocked artery is held open • blood flow to heart muscle cells is increased • stent will remain in place for a long time • effect of stent is immediate • rapid recovery from operation Disadvantages of stent • risk of infection from operation • risk of surgery eg heart attack **or** bleeding • risk of thrombosis **or** blood clot For Level 3, arguments for and against **both** treatments are needed.			4.2.2.4

05.5	heart (muscle) cannot contract / pump as effectively / powerfully (so) less blood pumped out of heart **or** to body (on each beat / contraction) (so) less oxygen (reaches cells / body) for (aerobic) respiration (so) breathing rate increases to supply more oxygen **or** (so) breathing rate increases to repay oxygen debt	allow heart (muscle) is not as strong ignore reference to rate of blood flow allow (so) more anaerobic respiration allow (so) breathing rate increases to break down lactic acid	1 1 1 1	AO2 4.2.2.2 4.2.2.4 4.4.2.1
05.6	stem cells are undifferentiated cells (therefore) can form heart (muscle) cells	allow stem cells can differentiate allow stem cells can develop into different types of cell ignore stem cells can become specialised ignore stem cells are not specialised allow (therefore) can form muscle cells	1 1	AO1 AO2 4.1.2.3 4.2.2.4
05.7	any **two** from: • cells will not be rejected • no risk of damage to embryo • adult can give consent	allow converse if clearly referring to embryonic stem cells allow no (potential) human life destroyed / damaged ignore unethical unqualified ignore religion unqualified	2	AO3 4.1.2.3
Total			**17**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(absorbed from soil) by osmosis through root hair (cells) travels through xylem (vessels) to the leaves lost through stomata (to atmosphere) idea of driven by evaporation / transpiration	allow (absorbed from soil) by diffusion through root hair (cells) ignore travels upwards in the xylem unqualified ignore evaporation / transpiration unqualified	1 1 1 1	AO1 4.1.3.2 4.2.1 4.2.3.1 4.2.3.2
06.2	translocation		1	AO1 4.2.3.2
06.3	have pores in the end walls (so) dissolved sugars / food / contents can move from cell to cell **or** no nucleus **or** few / no sub-cellular structures (1) to maximise space for movement of dissolved sugars / food / contents (1)	allow sap for dissolved sugars allow few / no organelles ignore cells are empty allow thick / rigid cell wall (1) to withstand pressure inside cell (1)	1 1	AO1 AO2 4.1.1.3 4.2.1 4.2.3.1 4.2.3.2

06.4	any **one** from: (the process): • requires energy • is an active process • uses active transport (reason) cells have many mitochondria	 allow flow of dissolved sugars / food in sieve tube cell is not impeded (1) (reason) companion cell is flattened (1)	1 1	AO3 AO2 4.1.1.2 4.1.1.3 4.1.3.3 4.2.3.1 4.2.3.2 4.4.2.1
06.5	 sugars are made in the leaves by photosynthesis all cells / tissues need sugar for respiration (sugars) transported to meristems for growth / cell division / mitosis **or** (sugars) transported for storage as starch / fat / oil	allow glucose for sugar allow sugars are not made in the root / meristems (by photosynthesis) allow every cell / tissue needs sugar for respiration allow whole plant needs sugar as an energy source	 1 1 1	 AO1 AO2 AO2 4.2.1 4.2.3.1 4.2.3.2 4.4.1.3 4.4.2.3
Total			**12**	

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.

Do not write outside the box

There are no questions printed on this page

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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

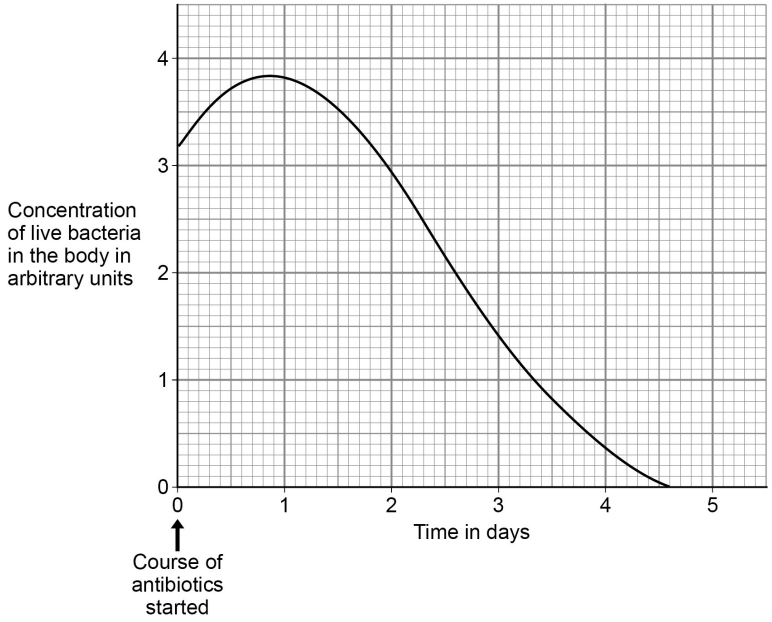
0 1 . 3 What is the name of the first antibiotic developed?

[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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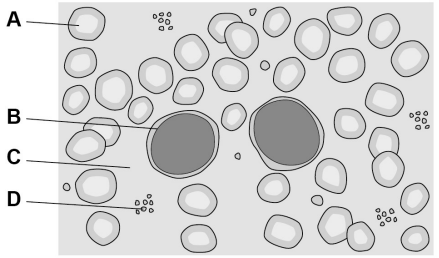
Figure 2 shows blood viewed using a microscope.

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

_____

_____

_____

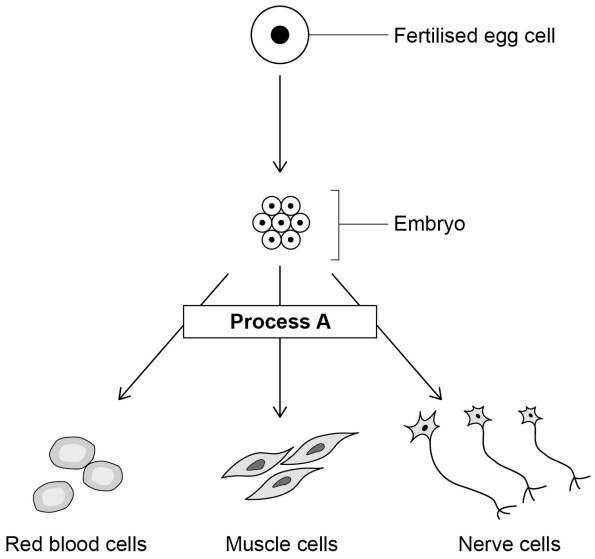
_____

Question 2 continues on the next page

Do not write outside the box

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

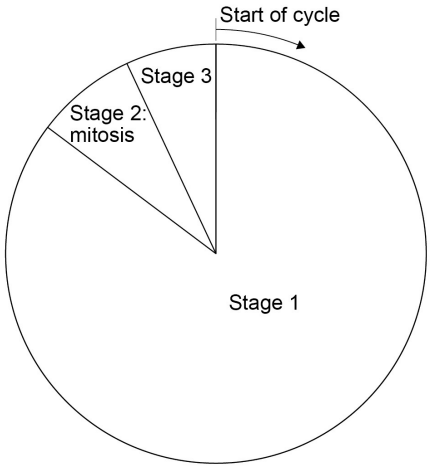
0 2 . 4 In humans a fertilised egg cell contains 23 pairs of chromosomes.

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

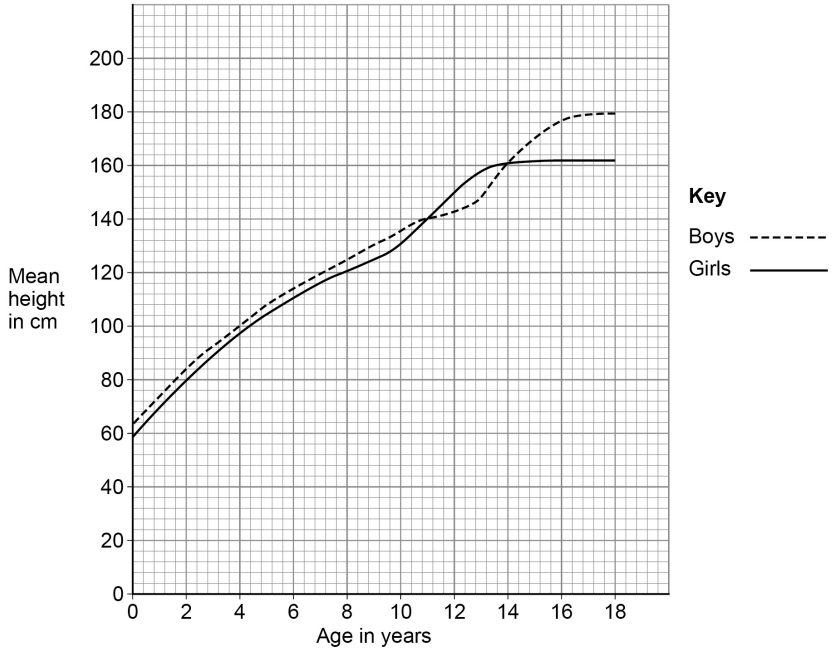
Stage 3

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]

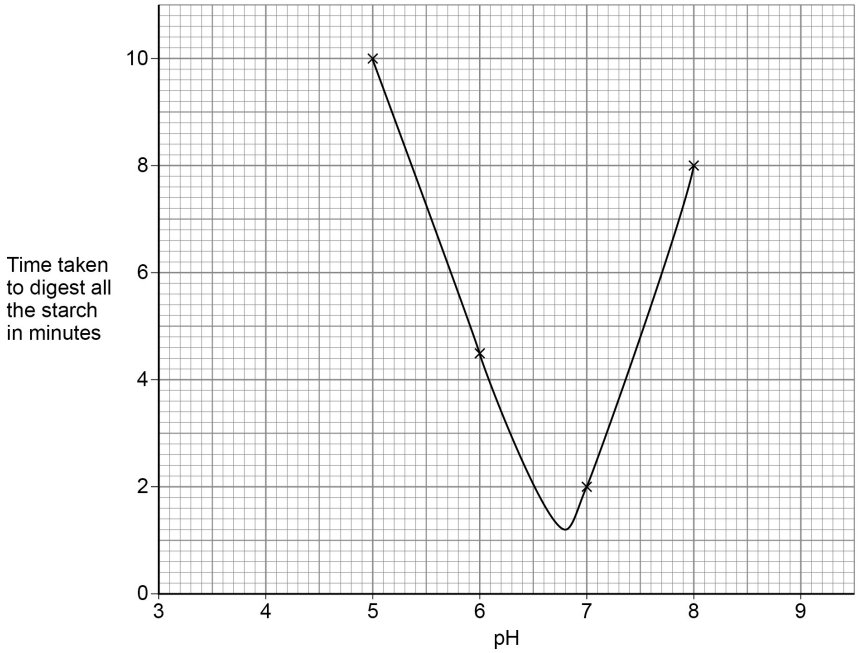
Do not write outside the box

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.

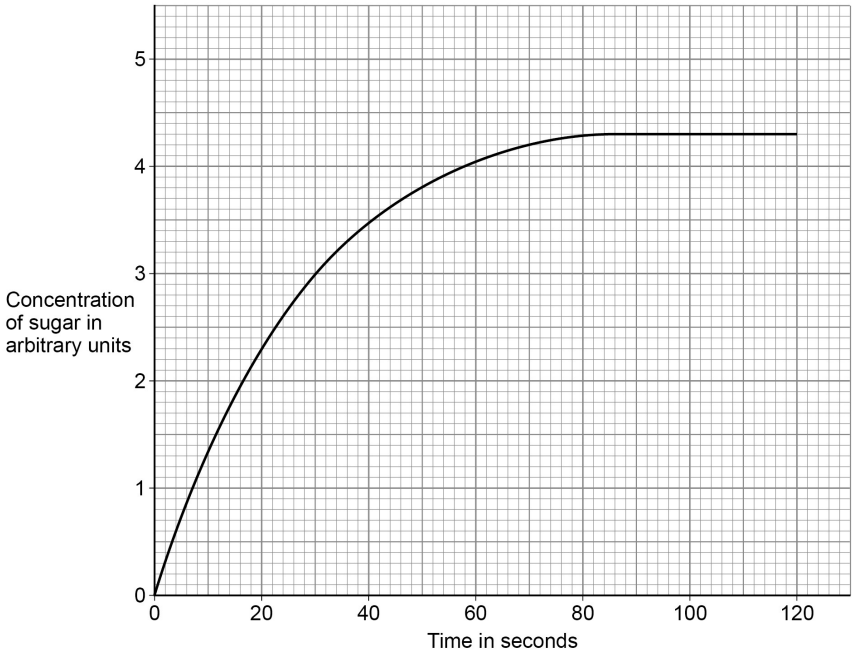
1. Prepare amylase solution at the optimum pH.

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

Do not write outside the box

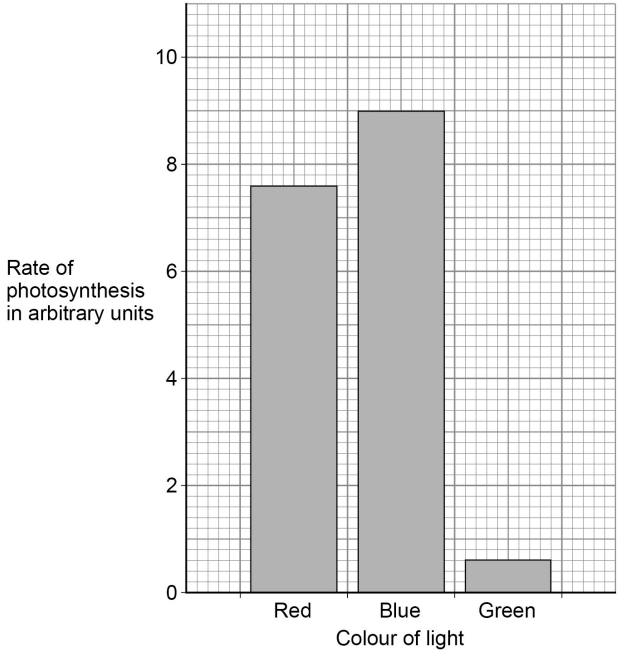
A scientist investigated the effect of different wavelengths of light on the rate of photosynthesis.

The wavelength of light determines the colour of the light.

Figure 8 shows the student's results.

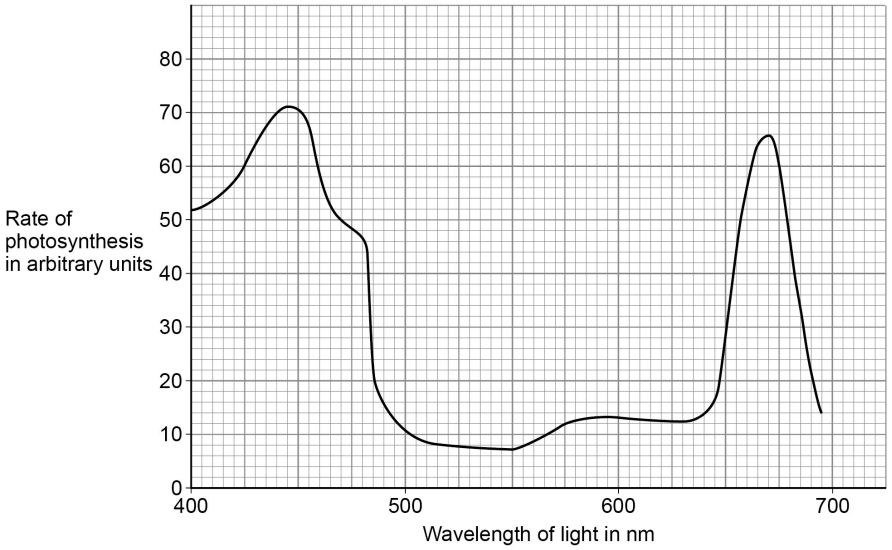
Figure 9 shows the scientist's results.

Figure 8



Do not write outside the box

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 ►

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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

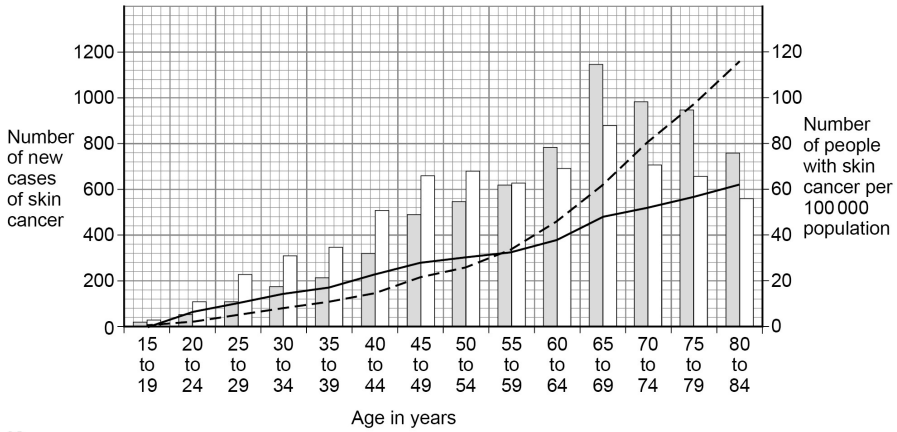
Do not write outside the box

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



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]

_____

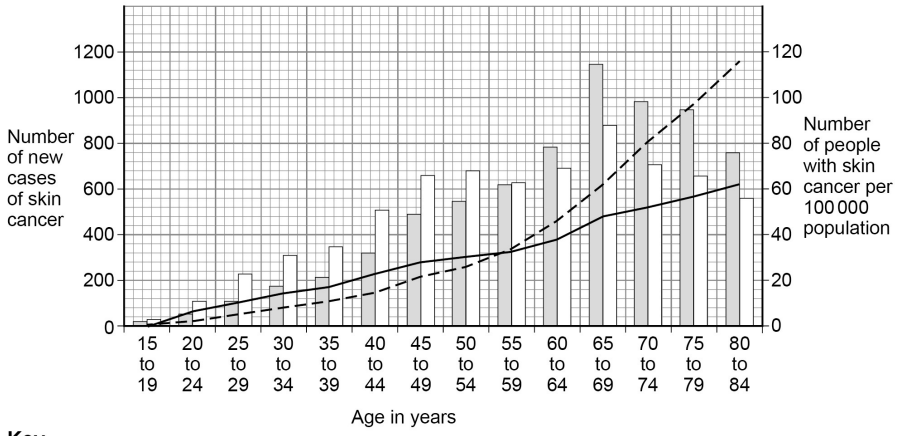
_____

Question 5 continues on the next page

Do not write outside the box

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.

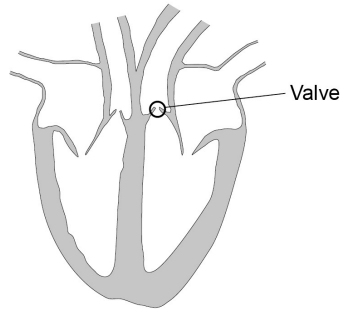
0 6 . 1 Why is the heart described as an organ?

[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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AQA

GCSE
COMBINED SCIENCE: TRILOGY
8464/B/1H

Biology Paper 1H

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme

2 2 6 G 8 4 6 4 B 1 H / M S

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 **Stage 2** any **one** from: • (one set of) chromosomes pulled to each end of cell • two nuclei form **Stage 3** any **one** from: • cytoplasm / membrane divides • two identical cells formed	 allow increase in number of organelles / ribosomes / mitochondria allow genetic material for DNA allow DNA doubles / duplicates 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) allow cytokinesis	1 1 1	AO1 4.1.2.2

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) 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	1	

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 (so) less cell / DNA / gene damage	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 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 1	AO3 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