



GCSE
COMBINED SCIENCE: TRILOGY
8464/B/1F

Biology Paper 1F

Mark scheme

June 2020

Version: 1.0 Final Mark Scheme

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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 his or her judgement
- the Assessment Objectives, level of demand 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.

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**. Different terms in the mark scheme are shown by a / ; 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 error / 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 planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, 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. Full marks can, however, be given for a correct numerical answer, without any working shown.

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

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **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 **not** 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.

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 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.

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	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	eat less fatty food		1	AO2 4.2.2.5 4.2.2.6
01.2	any two from: <ul style="list-style-type: none"> • strengthens muscles • strengthens heart (muscle) • reduces risk of Can younCan(coronary) heart disease / CHD / cardiovascular disease • reduces blood pressure • reduces risk of (Type 2) diabetes • improves mental health / mood • improves mobility 	ignore references to losing weight / mass ignore references to immediate effects of exercise on body eg increases heart rate ignore makes you healthier allow makes you stronger allow improves stamina allow keeps your heart healthy allow reduces (blood) cholesterol allow improves circulation allow strengthens bones allow boosts immunity allow reduces risk of (some) cancers allow makes you fitter ignore improves a person's appearance	2	AO2 4.2.2.4 4.2.2.6

01.3	glucose + oxygen → carbon dioxide + water		1	AO1 4.4.2.1
01.4	C		1	AO2 4.2.1 4.2.2.2
01.5	any two from: <ul style="list-style-type: none"> • lowest / lower resting breathing rate • lowest / lower breathing rate after exercise • lowest / lower increase in breathing rate • least amount of time for breathing rate to return to resting rate 	statements must be comparative allow less time for breathing rate to return to resting rate allow shortest recovery time	2	AO3 4.2.2.2 4.4.2.2
01.6	any two from: <ul style="list-style-type: none"> • only based on one measurement • person B may have done less intense exercise • other factors (besides breathing rate) indicate fitness 	allow person B may have done a different type of exercise eg stamina / strength / speed allow age / sex / body mass may not have been controlled ignore references to medical conditions	2	AO3 4.4.2.2

01.7	deeper breathing	allow heavier breathing ignore breathing rate increases	1	AO1 4.4.2.2
	increased heart rate	allow blood flows <u>faster</u> ignore more blood flows around body allow increased (body) temperature allow (increased) sweating allow increased blood flow to skin do not accept lactic acid is produced	1	
01.8	oxygen	word takes precedence allow O ₂ ignore O / O ²	1	AO1 4.4.2.1 4.4.2.2
	lactic acid		1	
Total			13	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	any one from: <ul style="list-style-type: none"> • (live) cells • (live) tissues • (live) animals 	allow examples , eg mice / rats	1	AO1 4.3.1.9
02.2	7 / seven (years)		1	AO2 4.3.1.9
02.3	to see if the drug is safe to use		1	AO2 4.3.1.9
02.4	tablet that does not contain the drug / active ingredient	allow a sugar pill allow a fake drug	1	AO1 4.3.1.9
02.5	not the patients or the doctors		1	AO1 4.3.1.9
02.6	any two from: <ul style="list-style-type: none"> • age • gender • body mass • number of children (in group) or 100 in group • time (after taking medicine) when temperature was measured 	allow all (children had a) high body temperature (at the start) allow dose of drug / medicine ignore temperature unqualified	2	AO2 4.3.1.9

02.7	any one from: <ul style="list-style-type: none"> • unethical not to treat ill children • children were ill so had to be treated • children may become more ill if no drug given 		1	AO3 4.3.1.9
02.8	37.4 (°C)		1	AO2 4.3.1.9
02.9	any two from: <ul style="list-style-type: none"> • reduced (body) temperature faster • decreased (body) temperature more • reduced (body) temperature to normal / 37 °C • maintained normal (body) temperature / 37 °C for longer or for several hours 	allow converse arguments allow paracetamol did not reduce (body) temperature to normal	2	AO3 4.3.1.9
Total			11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	transpiration		1	AO1 4.2.3.2
03.2	guard cells		1	AO1 4.2.3.1 4.2.3.2
03.3	0.04 (g)		1	AO2 4.2.3.1 4.2.3.2
03.4	$\frac{0.15}{24}$ = 0.0062(5) (g) or = 6.2(5) × 10 ⁻³ (g)	allow $\frac{1}{160}$ allow 0.006 / 0.0063 / 6 × 10 ⁻³ / 6.3 × 10 ⁻³ (g)	1 1	AO2 4.2.3.1 4.2.3.2

03.5	any one from: <ul style="list-style-type: none"> • leaf B lost more mass / water than leaf C or leaf C lost less mass / water than leaf B • when lower surface covered less mass / water was lost (than when upper surface covered) • when upper surface covered more mass / water was lost (than when lower surface covered) 	allow B lost 0.13 g of mass / water and C lost 0.05 g of mass / water allow lower surface lost 0.13 g of mass / water and upper surface lost 0.05 g of mass / water	1	AO3 4.2.3.1 4.2.3.2
03.6	there are more stomata on the lower surface		1	AO3 4.2.3.1 4.2.3.2
03.7	more (mass / water) lost (because) evaporation / transpiration would be faster	'it' refers to the mass of water lost	1 1	AO3 4.2.3.2 AO2 4.2.3.2
Total			9	

Question	Answers	Mark	AO / Spec. Ref.
04.3	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4-6	AO1 4.2.2.3 4.3.1.1 4.3.1.6
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1-3	
	No relevant content	0	
	Indicative content <ul style="list-style-type: none"> • white blood cells • detect / identify foreign antigens / cells / pathogens / bacteria • destroy / kill invading cells • phagocytes • engulf invading cells • digest / kill invading cells • produce antibodies • (antibodies) attach to invading cells • (antibodies) destroy / kill invading cells • (antibodies) make invading cells clump together • (so) phagocytes can engulf more cells / pathogens / bacteria • produce antitoxins • to destroy toxins • (so) less tissue damage • (therefore) don't feel as ill • produce memory cells • (so) immune response (to later exposure) is faster <p>A description of the ways that white blood cells act is needed for Level 2.</p>		

04.4	any one from: <ul style="list-style-type: none"> • HIV is a virus • antibiotics do not kill viruses • antibiotics (are used to) kill bacteria 	allow HIV is not a bacterium	1	AO1 4.3.1.2 4.3.1.8
04.5	any two from: <ul style="list-style-type: none"> • avoid sexual intercourse • use a condom • do not share needles • use antiretroviral drugs • screen blood used for transfusions 	ignore handwashing ignore social distancing allow practise safe sex ignore use protection unqualified ignore use contraception unqualified ignore use medication unqualified allow have regular checks / tests to see if you have HIV if no other marks awarded allow 1 mark for do not exchange body fluids	2	AO1 4.3.1.1 4.3.1.2
04.6	HIV damages the immune system		1	AO1 4.3.1.2
Total			14	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	concentration of the sugar solution		1	AO1 4.1.3.2 RPA 2
05.2	gained <u>water</u> (water moves) by osmosis or (because) concentration of water outside the potato is greater than inside the cells / potato	allow converse statements (because) concentration (of sugar solution) inside the potato is greater than outside the potato / cells	1 1	AO2 AO1 4.1.3.2 RPA 2
05.3	all points correctly plotted line of best fit drawn as a curve through all the points	allow $\pm \frac{1}{2}$ a square ignore extrapolation of curve	1 1	AO2 4.1.3.2 RPA 2
05.4	correct reading from their graph	allow $\pm \frac{1}{2}$ a square allow answer in range 0.23 to 0.24 (mol/dm ³) if no line drawn	1	AO3 4.1.3.2 RPA 2

<p>05.5</p>	$\frac{0.25 \times 100}{7.96}$ <p>= 3.14(070352)</p> <p>3.14 (%)</p>	<p>allow $\frac{(8.21-7.96) \times 100}{7.96}$</p> <p>allow correct rounding to 3 sig figs of an incorrectly calculated percentage change</p>	<p>1</p> <p>1</p> <p>1</p>	<p>AO2 4.1.3.2 RPA 2</p>
<p>Total</p>			<p>9</p>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	amylase	allow phonetic spelling allow carbohydrase do not accept amylose	1	AO1 4.2.2.1
06.2	small intestine		1	AO1 4.2.1 4.2.2.1
06.3	any one from: <ul style="list-style-type: none"> greater magnification higher resolving power 	allow can see (smaller) sub-cellular structures / parts allow can see more detail (inside cells) allow reference to 3-D images	1	AO1 4.1.1.5
06.4	capillary		1	AO2 4.2.2.1 4.2.2.2
06.5	$20 = \frac{\text{image length}}{0.8}$ image length = 0.8 x 20 image length = 16 (mm)		1 1 1	AO2 4.1.1.5 RPA 1
06.6	diffusion		1	AO3 4.1.3.1
06.7	active transport	allow active uptake	1	AO3 4.1.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.8	any one from: <ul style="list-style-type: none"> • respiration • to form glycogen • to make amino acids / proteins 	allow as an energy source do not accept to make / use / create / produce energy allow to make lipid / fat	1	AO1 4.4.2.1 4.4.2.3
06.9	Level 2: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.		3–4	AO2 4.1.1.3 4.1.3.1 4.1.3.3 4.2.2.1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.		1–2	
	No relevant content		0	
	Indicative content <ul style="list-style-type: none"> • have (many) microvilli • (to) increase surface area • wall of villus only one cell thick or is thin • capillaries are close to surface • (so) short pathway • good blood supply • (to) transport food molecules away or to the body • (and) maintain a diffusion gradient • cells have many mitochondria • (where) respiration takes place • (where) energy is transferred • (as) active transport requires energy • energy is needed to absorb sugar / food / molecules For Level 2 must make links between structure and it's function			
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4. Level of response marking instructions

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- The descriptor for the level shows the average performance for the level.
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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.

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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

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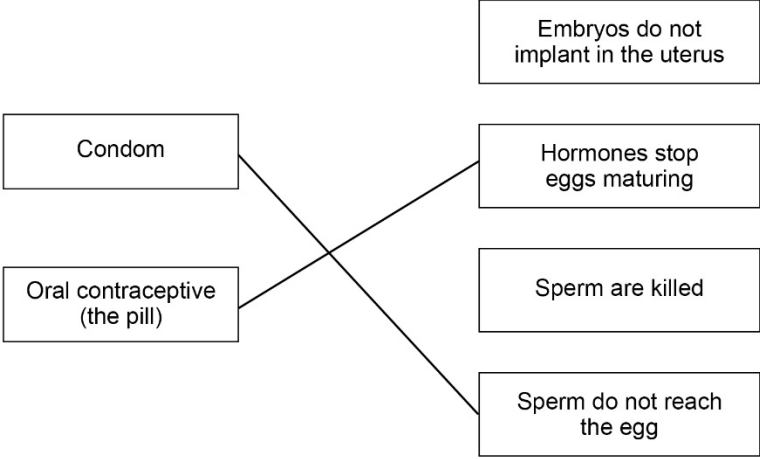
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Question	Answers	Extra information	Mark	AO / Spec. Ref.															
01.1	gametes are formed sperm and egg fuse		1 1	AO1 4.6.1.1															
01.2	<p>Y gamete for father</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td colspan="2"></td> <th colspan="2">Mother</th> </tr> <tr> <td colspan="2"></td> <td>X</td> <td>X</td> </tr> <tr> <th rowspan="2">Father</th> <td>X</td> <td>XX</td> <td>XX</td> </tr> <tr> <td>Y</td> <td>XY</td> <td>XY</td> </tr> </table>			Mother				X	X	Father	X	XX	XX	Y	XY	XY	<p>all derivations correct = 2 marks 1 or 2 correct = 1 mark</p> <p>allow correct derivations from incorrect gamete</p>	1 2	AO2 4.6.1.6
		Mother																	
		X	X																
Father	X	XX	XX																
	Y	XY	XY																
01.3	rings drawn around all XY	<p>allow one ring drawn around both XY ignore ring drawn around father's genotype</p> <p>ecf any letter for Y, except X</p>	1	AO2 4.6.1.6															
01.4	<table border="0" style="width: 100%;"> <tr> <th style="text-align: left;">Hormone</th> <th style="text-align: left;">Change that hormone causes at puberty</th> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">Oestrogen</td> <td style="border: 1px solid black; padding: 5px;">Breasts develop</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">Testosterone</td> <td style="border: 1px solid black; padding: 5px;">Skin turns lighter</td> </tr> <tr> <td></td> <td style="border: 1px solid black; padding: 5px;">Voice becomes deeper</td> </tr> <tr> <td></td> <td style="border: 1px solid black; padding: 5px;">Wisdom teeth appear</td> </tr> </table> <p>If more than one line from a hormone no mark for that hormone</p>	Hormone	Change that hormone causes at puberty	Oestrogen	Breasts develop	Testosterone	Skin turns lighter		Voice becomes deeper		Wisdom teeth appear		1 1	AO2 4.5.3.3					
Hormone	Change that hormone causes at puberty																		
Oestrogen	Breasts develop																		
Testosterone	Skin turns lighter																		
	Voice becomes deeper																		
	Wisdom teeth appear																		

<p>01.5</p>	<p>Method of contraception</p>  <p>If more than one line from a method of contraception no mark for that method</p>	<p>How the method prevents pregnancy</p> <p>Embryos do not implant in the uterus</p> <p>Hormones stop eggs maturing</p> <p>Sperm are killed</p> <p>Sperm do not reach the egg</p>	<p>1 1</p>	<p>AO1 4.5.3.4</p>
<p>01.6</p>	<p>advantage – any one from:</p> <ul style="list-style-type: none"> • very reliable • easy to take • do not have to rely on partner • helps to treat acne or period pain <p>disadvantage – any one from:</p> <ul style="list-style-type: none"> • may cause side effects • may affect her fertility later • have to remember to take it (every day) • does not protect against STIs 	<p>ignore you do not get pregnant</p> <p>allow described eg headaches, nausea, putting on weight</p> <p>allow you have to take it every day</p>	<p>1 1</p>	<p>AO3 4.5.3.4</p>
<p>Total</p>			<p>12</p>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	the ammonite shell was replaced by minerals		1	AO2 4.6.3.2
02.2	any one from: <ul style="list-style-type: none"> • no living ones around now or during human times • all the soft parts have decayed • the soft parts did not mineralise / fossilise. 	allow there were no humans living then	1	AO3 4.6.3.2
02.3	60 (million years)		1	AO2 4.6.3.3
02.4	(ammonites) $420 - 60 = 360$ $360 - 270 = 90$ (million years)	allow ecf from question 02.3	1 1	AO2 4.6.3.3
02.5	any two from: <ul style="list-style-type: none"> • drought • ice age / global warming • volcanic activity • asteroid / meteor collision • (new) predators • (new) diseases / pathogens • competition for food • competition for mates • lack of habitat or habitat change 	ignore pollution ignore temperature change unqualified allow earthquake / tsunami allow hunted / eaten by other animals allow lack of food allow isolation or lack of mates if no other mark awarded allow natural disaster or climate change or catastrophic event for 1 mark	2	AO1 4.6.3.3
02.6	Charles Darwin		1 (1-3)	AO1 4.6.3.1


02.7	older fossils are more simple		1	AO3 4.6.3.2
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	root (hairs)		1	AO1 4.7.2.2 4.2.3.2
03.2	carbon water	in either order allow carbon dioxide if no other mark awarded allow oxygen for 1 mark	1 1	AO1 4.7.2.2
03.3	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.		4–6	AO1 4.7.2.2 4.4.1.1 4.4.2.1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.		1–3	
	No relevant content		0	
	Indicative content <ul style="list-style-type: none"> • microorganisms decay (the dead plant) • microorganisms respire • using carbon compounds / glucose • releasing carbon dioxide • into the atmosphere • new plants take in carbon dioxide • (carbon dioxide) for photosynthesis • making glucose • converted into correctly named cell materials (when plants are decayed) Nitrate / mineral ions <ul style="list-style-type: none"> • are released into soil • to be taken up by new growing plants Water <ul style="list-style-type: none"> • plants dehydrate or water evaporates when they die • recycled as rain needed by growing plants 			
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	controlling water output in urine		1	AO2 4.5.1
	keeping cool on a hot day		1	
04.2	pituitary		1	AO1 4.5.3.1
04.3	(8.4 – 5.2 =) 3.2 (mmol/dm ³)		1	AO2 4.5.3.2
04.4	diabetes	ignore type of diabetes	1	AO3 4.5.3.2
04.5	the pancreas is not releasing insulin		1	AO3 4.5.3.2
04.6	change diet	allow description of suitable diet change e.g. use sweetener in hot chocolate, eat less sugary / starchy food or stop eating sugar-coated cereal	1	AO3 4.5.3.2
	take more exercise	allow description e.g. go to gym instead of reading and TV, walk / cycle to work allow change to an active job if no other marks awarded allow 1 mark for lose weight.	1	
Total			8	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	plant hedgerows around his fields		1	AO3 4.7.3.6
	plant many different crops in his fields		1	
05.2	any one from: <ul style="list-style-type: none"> • repeat in each area • do more quadrats (to take more readings) • count the number of individuals of each species • remove leaf litter and search in tray • do a timed search of the leaf litter • do on the same day or time of day 		1	AO3 4.7.2.1 RPA 7
05.3	the trees provide habitat(s) or shelter	allow described	1	AO2 4.7.2.1 RPA 7
	so (more) food / camouflage / shade available	allow places to hide or cooler or wetter environment	1	
05.4	ring drawn around 20		1	AO3 4.7.2.1 RPA 7
05.5	(removing trees) decreases the number of invertebrate species		1	AO3 4.7.2.1 RPA 7

05.6	(less trees means) more light		1	AO2 4.7.1.2 4.4.1.1 4.4.1.3
	(and) more water / minerals in soil		1	
	(so) reduced competition		1	
	OR			
	(less trees means) more light (1)			
	(so) (more) photosynthesis (1)			
	(so) (more) glucose (for growth) (1)			
Total			10	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1			1	AO2 4.6.1.3
06.2	any one from: <ul style="list-style-type: none"> • 2 strands / chains that are twisted / coiled / spiralled • double helix • (long) polymer 	allow cross links between 2 strands / chains allow reference to nucleotides or sugars, phosphates and bases	1	AO1 4.6.1.3
06.3	amino acids protein	in this order only allow polypeptide	1 1	AO1 4.6.1.3
06.4	all the genetic material (of an organism)	allow DNA / genes for genetic material ignore chromosomes	1	AO1 4.6.1.3
06.5	tracing how aboriginal people spread across Australia		1	AO2 4.6.1.3
06.6	variation	ignore genetic/environmental	1	AO1 4.6.2.1

<p>06.7</p>	<p>stronger / larger (shell)</p> <p>(so) more likely to (survive and) breed</p> <p>or</p> <p>(so) more likely to (survive and) pass on genes</p> <p>OR</p> <p>(better) camouflaged (1)</p> <p>(so) less likely to be eaten and will breed more (1)</p>		<p>1</p> <p>1</p>	<p>AO2 4.6.2.2</p>
<p>Total</p>			<p>9</p>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	any four from: <ul style="list-style-type: none"> • (stimulus is) detected by the receptor • (initiates) an electrical impulse • (impulse) travels via the neurones • sensory, relay and motor • crosses synapses • (crosses synapses) as a chemical 	allow in this order only	4	AO1 AO2 4.5.2
07.2	Level 2: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		3–4	AO2
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.		1–2	AO1
	No relevant content		0	4.5.2 RPA 6
	Indicative content <ul style="list-style-type: none"> • select at least 3 people • do reaction time test at least 3 times using right hand • details on how to do test in valid manner • find a mean • remove anomalous readings • repeat for each person for left hand • select people of same age • select people of same gender • same time of day • other control such as amount of coffee, sleep. <p>To access level 2 the right hand and left hand of each person must be compared</p>			
07.3	$\frac{(0.2 + 0.4 + 0.3 + 0.4 + 0.2 + 0.3)}{6}$		1	AO2 4.5.2 RPA 6
	or $\frac{1.8}{6}$ 0.3		1	

07.4	reaction time	allow time	1	AO2 4.5.2 RPA 6
07.5	students who play tennis (regularly) had shorter / faster (mean) reaction time(s)		1	AO3 4.5.2 RPA 6
07.6	any one from: <ul style="list-style-type: none"> • overlap in times between two groups • small difference in (mean) times • small sample used 	allow correctly described as comparative data allow students who did not play tennis may have played other (ball) games	1	AO3 4.5.2 RPA 6
Total			13	

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Biology Paper 1F

Tuesday 12 May 2020

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.
- 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.



J U N 2 0 8 4 6 4 B 1 F 0 1

0 1

Being overweight can affect the health and life expectancy of a person.

0 1 . 1What is **one** lifestyle change a person could make to help them lose body mass?**[1 mark]**Tick (✓) **one** box.

Drink more alcohol

Eat less fatty food

Stop smoking

0 1 . 2

Exercise has many health benefits.

Give **two** health benefits of regular exercise.Do **not** refer to losing body mass in your answer.**[2 marks]**

1

2



During exercise, breathing rate increases to provide more oxygen for aerobic respiration.

0 1 . 3 What is the equation for aerobic respiration?

[1 mark]

Tick (✓) **one** box.

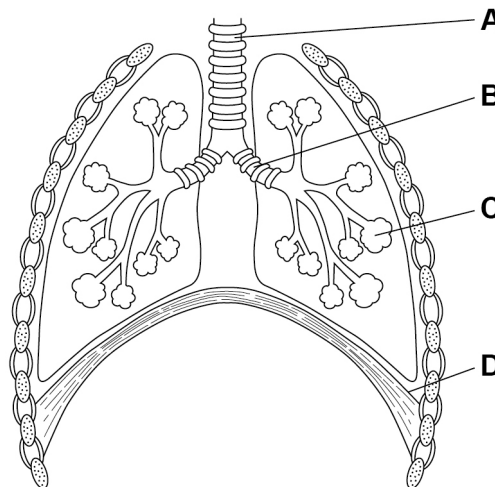
carbon dioxide + water → glucose + oxygen

glucose + oxygen → carbon dioxide + water

oxygen + water → glucose + carbon dioxide

0 1 . 4 **Figure 1** shows the human breathing system.

Figure 1



Where does gas exchange take place?

[1 mark]

Tick (✓) **one** box.

A

B

C

D

Turn over ►



A scientist investigated the effect of exercise on the breathing rate of four people.

This is the method used.

1. Measure the resting breathing rate.
2. Exercise for 10 minutes.
3. Measure the breathing rate as soon as exercise stops.
4. Record the time taken for the breathing rate to return to the resting rate.

Table 1 shows the results.

Table 1

Person	Resting breathing rate in breaths per minute	Breathing rate after exercise in breaths per minute	Increase in breathing rate in breaths per minute	Time for breathing rate to return to resting rate in minutes
A	12	45	33	5.5
B	10	28	18	4.0
C	11	35	24	6.5
D	13	52	39	10.0

0 1 . 5 The scientist concluded that person **B** was the fittest.

Give **two** reasons that support the scientist's conclusion.

Use **Table 1**.

[2 marks]

1 _____

2 _____



0 1 . 6 Suggest **two** reasons why the scientist's conclusion may **not** be valid.

[2 marks]

1 _____

2 _____

0 1 . 7 Give **two** changes that happen in the body during aerobic exercise.

Do **not** refer to increased breathing rate in your answer.

[2 marks]

1 _____

2 _____

0 1 . 8 Muscles respire anaerobically during vigorous exercise.

Complete the sentences.

Choose answers from the box.

[2 marks]

amino acids

carbon dioxide

glucose

lactic acid

oxygen

Muscles respire anaerobically if they do not have

enough _____.

Anaerobic respiration of glucose produces _____.

13

Turn over ►

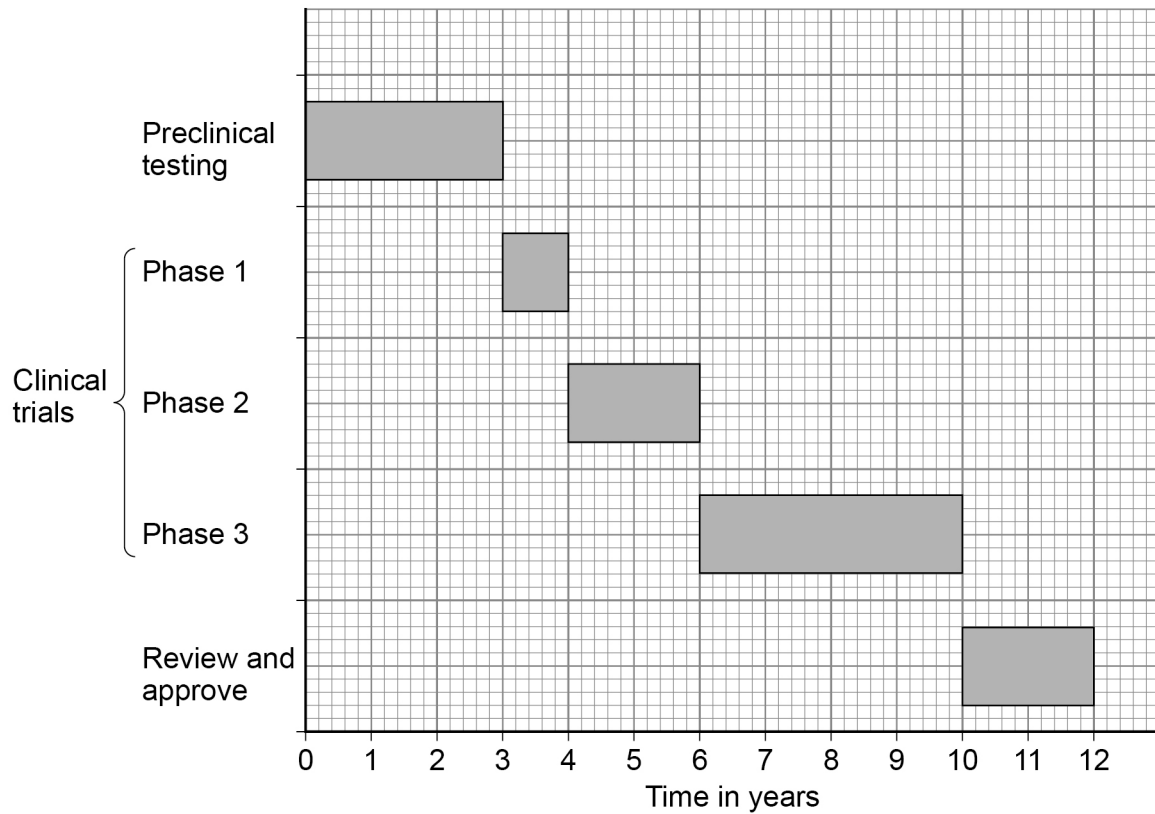


0 2

New drugs are tested before they can be licensed for use with patients.

Figure 2 shows how much time the different stages of testing took for one new drug.

Figure 2



0 2 . 1

Preclinical testing is done in a laboratory.

What is the drug tested on in a laboratory?

Give **one** example.

[1 mark]

0 2 . 2

How many years did the clinical trials take for the drug in **Figure 2**?

[1 mark]

Time for clinical trials = _____ years



0 2 . 3

During Phase 1 clinical trials, the drug is tested on **healthy** volunteers using **low** doses.

What is the main purpose of Phase 1 testing?

[1 mark]

Tick (✓) **one** box.

To find the best dose to use.

To see if the drug is safe to use.

To see if the drug works.

During clinical trials, half of the patients are given a placebo in a double blind trial.

0 2 . 4

What is a placebo?

[1 mark]

0 2 . 5

Who knows which patients are given the placebo and which patients are given the drug in a double blind trial?

[1 mark]

Tick (✓) **one** box.

Not the patients or the doctors

The patients and the doctors

The patients but not the doctors

Turn over ►



Paracetamol and ibuprofen are two medicines used to reduce a high body temperature.

Doctors investigated which medicine was more effective at reducing high body temperature in 200 children who were ill.

The children were put into two groups, which were matched for:

- age
- gender
- body mass.

Each group had 100 children.

This is the method used.

1. Measure the body temperature of each child before any medicine is given.
2. Give children in Group 1 paracetamol.
3. Give children in Group 2 ibuprofen.
4. Measure the body temperature of each child every hour after the medicine is given.

0 2 . 6 Give **two** control variables in this investigation.

[2 marks]

1 _____

2 _____



0 2 . 7 None of the children was given a placebo.

Suggest **one** reason why.

[1 mark]

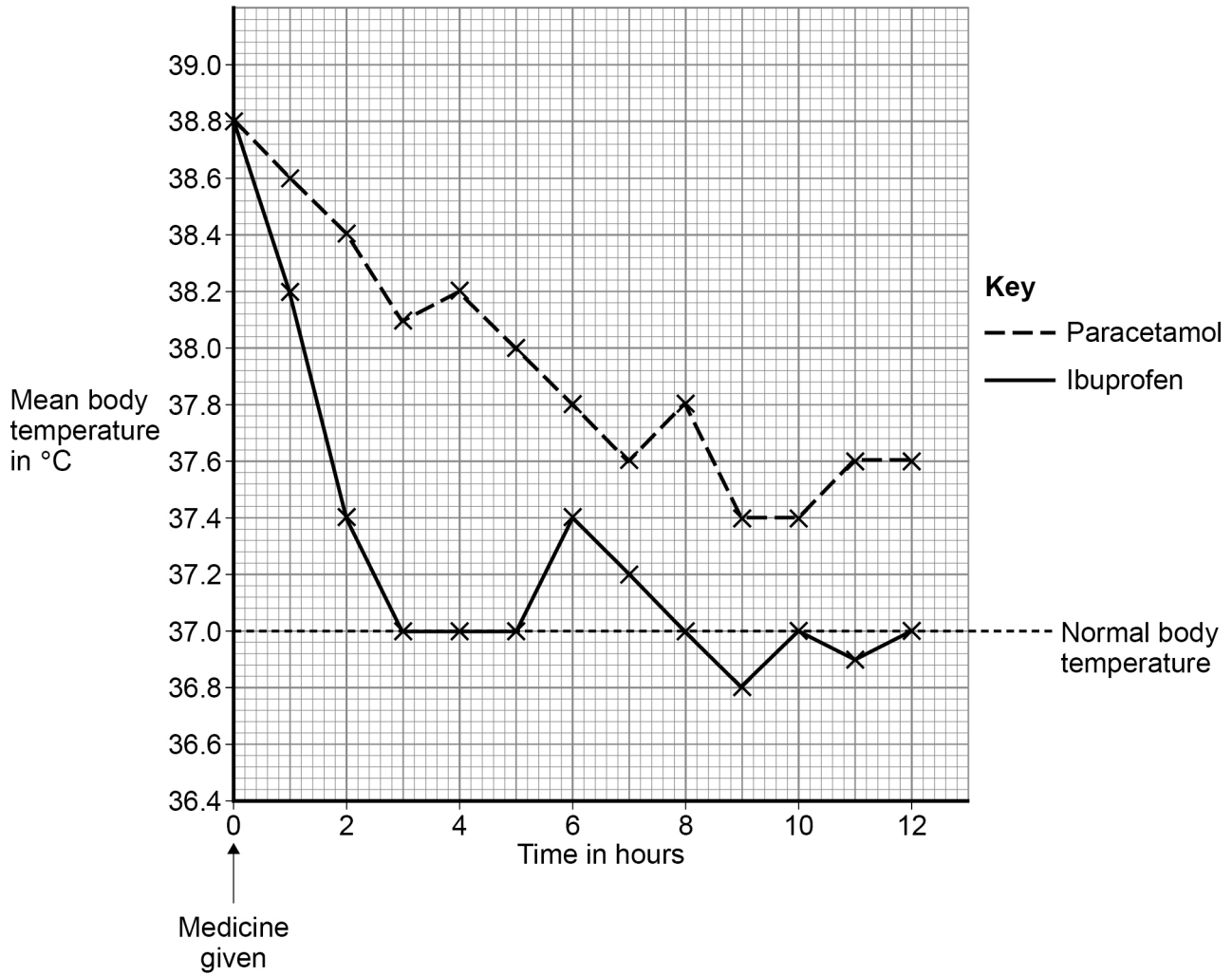
Question 2 continues on the next page

Turn over ►



Figure 3 shows the results.

Figure 3



0 2 . 8

What was the mean body temperature after 6 hours for the children given ibuprofen?

[1 mark]

Mean body temperature = _____ °C



0 2 . 9

The doctors concluded that children with a high body temperature should be given ibuprofen and not paracetamol.

Give **two** reasons for the doctors' conclusion.

Use **Figure 3**.

[2 marks]

1 _____

2 _____

11

Turn over for the next question

Turn over ►



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ANSWER IN THE SPACES PROVIDED**



0 3

Water is lost from the leaves of plants through pores called stomata.

0 3 . 1

What is the loss of water from a leaf called?

[1 mark]Tick (✓) **one** box.

Osmosis

Respiration

Transpiration

0 3 . 2

Which cells control the size of stomata?

[1 mark]Tick (✓) **one** box.

Guard cells

Phloem cells

Xylem cells

Question 3 continues on the next page**Turn over ►**

A student investigated the water loss when different surfaces of leaves were covered in grease.

The grease blocks the stomata.

This is the method used.

1. Remove four similar leaves from one plant.
2. Put grease on different surfaces of the leaves as shown in **Figure 4**.
3. Record the mass of each leaf and attach the four leaves to a string.
4. After 24 hours record the mass of each leaf again.

Figure 4

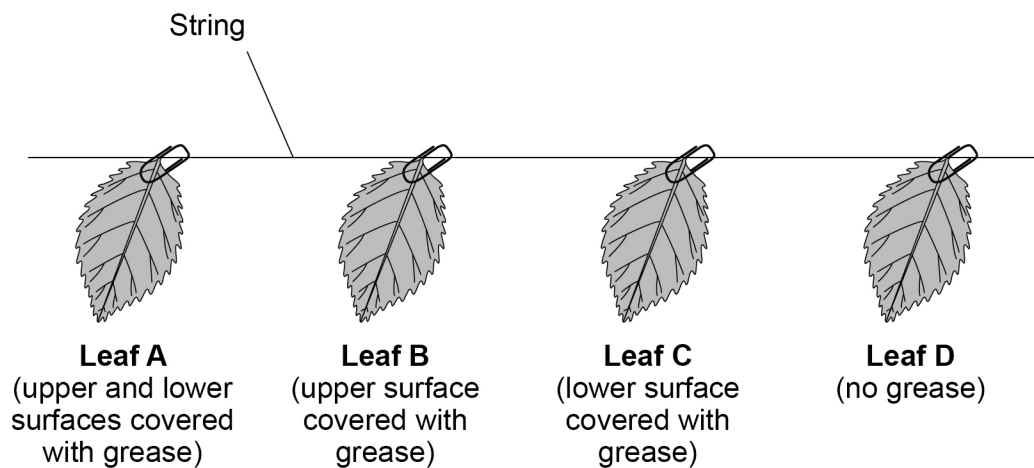


Table 2 shows the results.

Table 2

Leaf	Surfaces covered with grease	Mass of leaf at start in grams	Mass of leaf after 24 hours in grams	Loss in mass after 24 hours in grams
A	Upper and lower	2.01	1.97	X
B	Only upper	2.00	1.87	0.13
C	Only lower	2.01	1.96	0.05
D	None	1.98	1.83	0.15



0 3 . 3 Calculate value **X** in **Table 2**.

[1 mark]

Value **X** = _____ g

0 3 . 4 The loss in mass of water was measured after 24 hours.

Calculate the mass of water lost in grams per hour for leaf **D**.

[2 marks]

Mass of water lost per hour = _____ g

The student concluded:

'More water is lost from the lower surface of a leaf than from the upper surface.'

0 3 . 5 What evidence is there in **Table 2** to support the student's conclusion?

[1 mark]

0 3 . 6 What do the results in **Table 2** show about the number of stomata on the surfaces of a leaf?

[1 mark]

Tick (✓) **one** box.

There are more stomata on the lower surface.

There are more stomata on the upper surface.

There are the same number of stomata on both surfaces.

Turn over ►



0 3 . 7 The investigation was done at 20 °C

How would the mass of water lost be different if the investigation was done at 25 °C?

Give a reason for your answer.

[2 marks]

Difference _____

Reason _____

9



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

Turn over ►



0 4

Pathogens cause infectious diseases.

0 4 . 1

Draw **one** line from each disease to the type of pathogen that causes the disease.**[2 marks]**

Disease	Type of pathogen
Gonorrhoea	Bacterium
Measles	Fungus
	Protist
	Virus

The body defends itself against pathogens in different ways.

0 4 . 2

Give **two** ways that the body prevents pathogens entering the body.**[2 marks]**

1 _____

2 _____



0 4 . 3

If pathogens do enter the body the immune system tries to destroy the pathogens.

Describe how the immune system defends the body against disease.

[6 marks]

Question 4 continues on the next page

Turn over ►



0 4 . 4

Give **one** reason why antibiotics cannot be used to treat HIV infections.

[1 mark]

0 4 . 5

Give **two** ways to prevent the spread of HIV.

[2 marks]

1

2

0 4 . 6

Some people with a HIV infection develop AIDS.

Some people with AIDS may die from a different type of infection, such as a chest infection.

Why do people with AIDS die from a different type of infection?

[1 mark]

Tick (✓) **one** box.

HIV damages the immune system.

Pathogens enter the body more easily.

People with AIDS are immune to HIV.

14



0 5

A student investigated the effect of different concentrations of sugar solution on pieces of potato.

This is the method used.

1. Cut five pieces of potato.
2. Record the starting mass of each piece of potato.
3. Place each piece of potato in a different concentration of sugar solution.
4. After 24 hours remove the pieces of potato from the solutions.
5. Record the final mass of each piece of potato.
6. Calculate the change in mass for each piece of potato.

0 5 . 1

What is the independent variable?

[1 mark]

Tick (✓) **one** box.

Change in mass of the pieces of potato

Concentration of the sugar solution

Length of time the pieces of potato are in the solution

Starting mass of the pieces of potato

Question 5 continues on the next page

Turn over ►

Table 3 shows the results.

Table 3

Concentration of sugar solution in mol/dm ³	Mass of potato at start in grams	Mass of potato after 24 hours in grams	Change in mass in grams
0.0	7.94	10.14	2.20
0.1	7.95	9.10	1.15
0.2	7.96	8.21	0.25
0.3	7.93	7.53	-0.40
0.4	7.93	7.18	-0.75
0.5	7.95	7.00	-0.95

0 5 . 2

Explain why the potato in 0.0 mol/dm³ sugar solution increased in mass.

[2 marks]



0 5 . 3 Complete **Figure 5**.

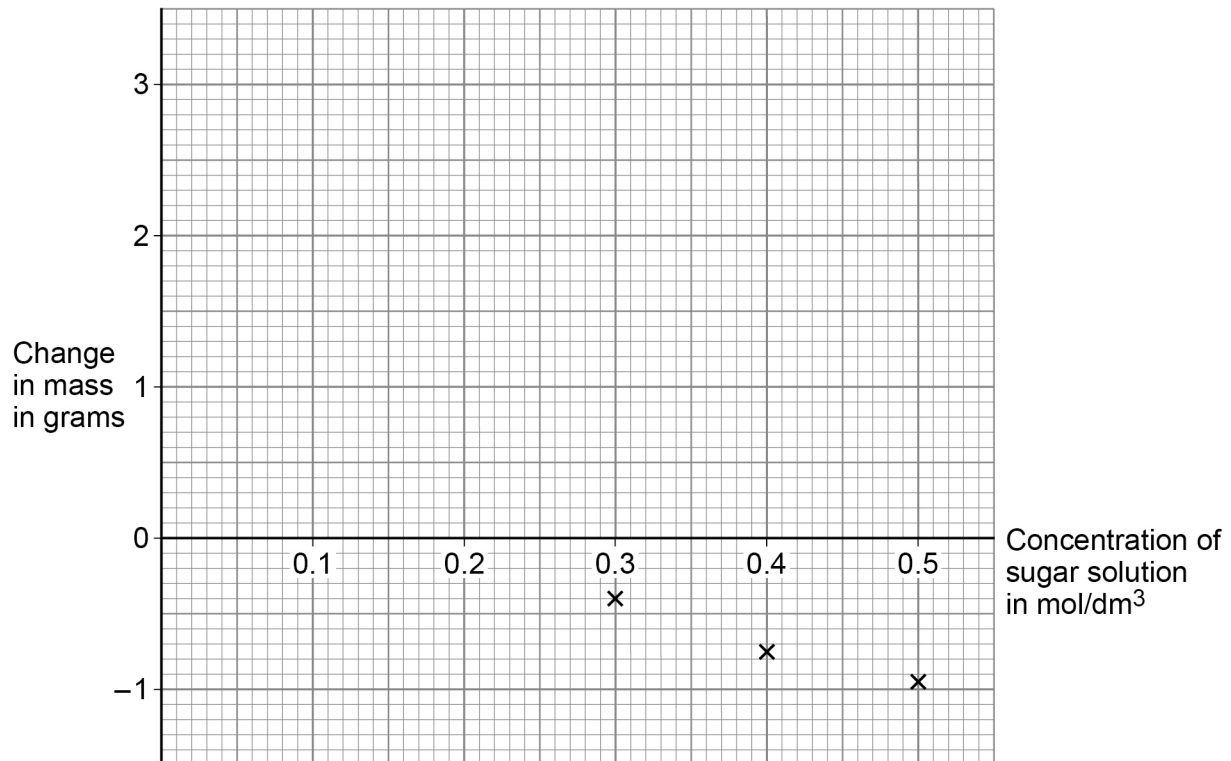
Some of the results have been plotted for you.

You should:

- plot the data from **Table 3**
- draw a line of best fit through all the points.

[2 marks]

Figure 5



0 5 . 4 The mass of a piece of potato does **not** change when:

concentration of solution inside cells = concentration of solution outside cells

Determine the concentration of sugar solution inside the potato cells.

Use **Figure 5**.

[1 mark]

Concentration = _____ mol/dm³

Turn over ►



Table 3 is repeated below.

Table 3

Concentration of sugar solution in mol/dm ³	Mass of potato at start in grams	Mass of potato after 24 hours in grams	Change in mass in grams
0.0	7.94	10.14	2.20
0.1	7.95	9.10	1.15
0.2	7.96	8.21	0.25
0.3	7.93	7.53	-0.40
0.4	7.93	7.18	-0.75
0.5	7.95	7.00	-0.95

0 5 . 5

Calculate the percentage change in mass for the potato in 0.2 mol/dm³ sugar solution.

Use **Table 3**.

Use the equation:

$$\text{percentage change in mass} = \frac{\text{change in mass}}{\text{mass of potato at start}} \times 100$$

Give your answer to 3 significant figures.

[3 marks]

Percentage change in mass (3 significant figures) = _____ %

9



0 6

Starch is digested to form sugar molecules in the digestive system.

0 6 . 1

What is the name of the enzyme that digests starch?

[1 mark]

0 6 . 2

Where are most food molecules absorbed?

[1 mark]Tick (✓) **one** box.

Large intestine

Liver

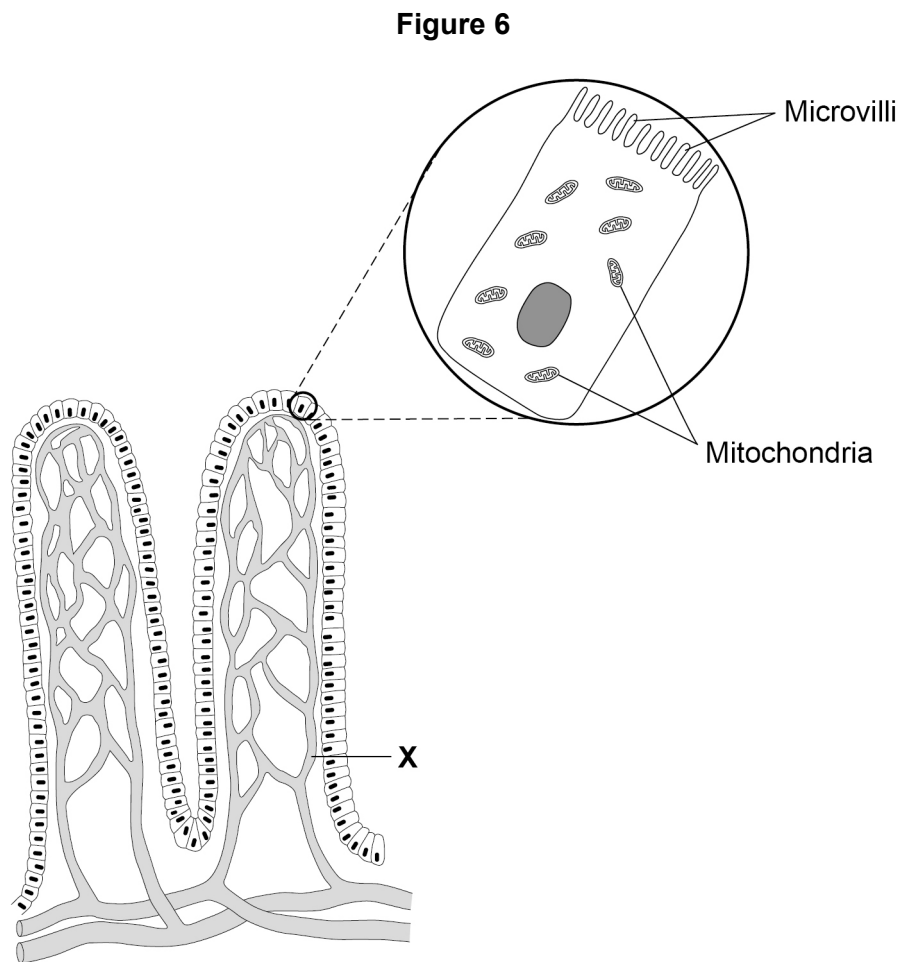
Small intestine

Stomach

Question 6 continues on the next page**Turn over ►**

Figure 6 shows two villi.

Figure 6 also shows one cell on the surface of a villus as seen using an electron microscope.



0 6 . 3

Give **one** advantage of using an electron microscope compared with using a light microscope.

[1 mark]



0 6 . 4 What type of blood vessel is labelled **X**?

[1 mark]

Tick (✓) **one** box.

Artery

Capillary

Vein

0 6 . 5 The real length of one villus is 0.8 mm

Calculate the image length if the villus is viewed at a magnification of $\times 20$

Use the equation:

$$\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$$

[3 marks]

Image length = _____ mm

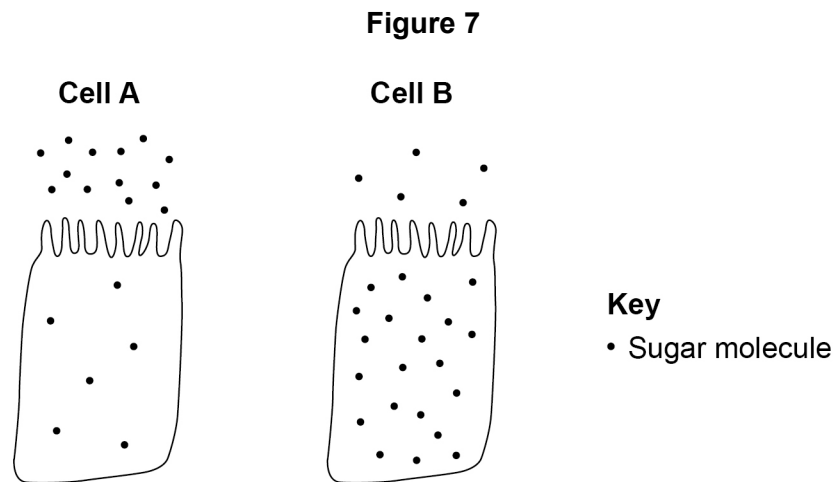
Question 6 continues on the next page

Turn over ►



Figure 7 shows two cells from the surface of a villus.

There are sugar molecules inside and next to each cell.



0 6 . 6 Name the process by which sugar moves into cell **A**.

[1 mark]

0 6 . 7 Name the process by which sugar moves into cell **B**.

[1 mark]

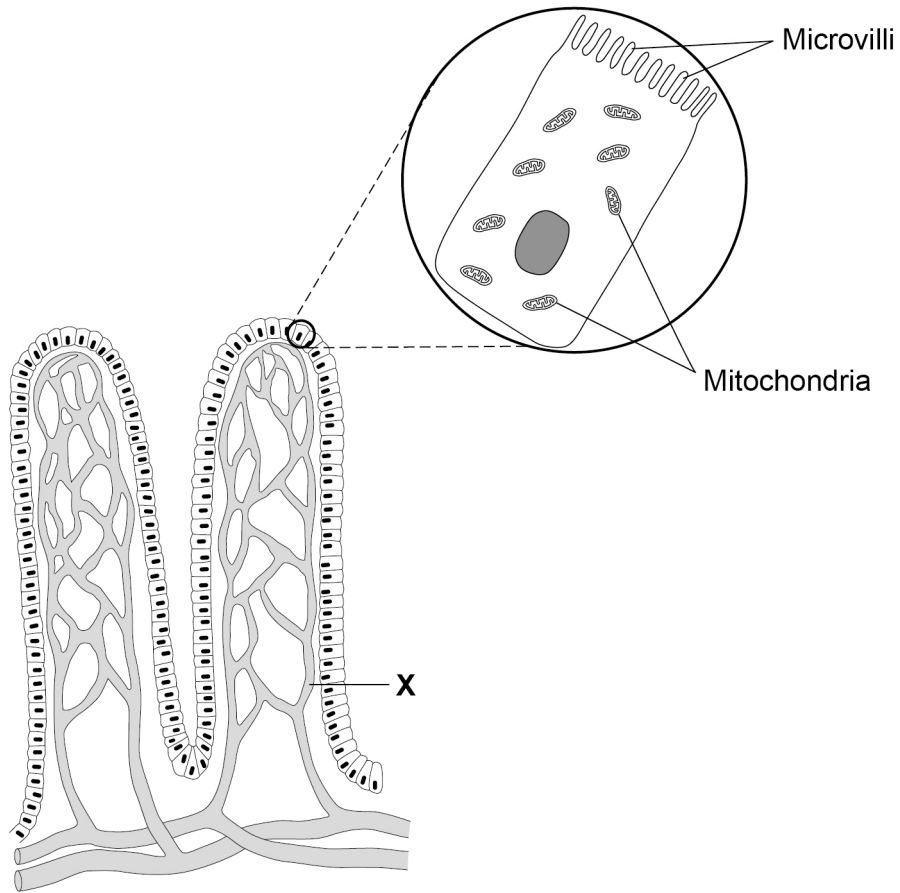
0 6 . 8 Give **one** use of sugar in the body.

[1 mark]



0 6 . 9 Figure 6 is repeated below.

Figure 6



Explain how villi are adapted for efficient absorption of sugar molecules.

[4 marks]

14

END OF QUESTIONS



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Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Biology Paper 2F

Monday 1 June 2020

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.
- 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.

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	
6	
7	
TOTAL	



0 1

This question is about reproduction.

0 1 . 1

Which **two** statements are true for sexual reproduction in humans?**[2 marks]**Tick (✓) **two** boxes.

Gametes are formed.

Offspring are clones.

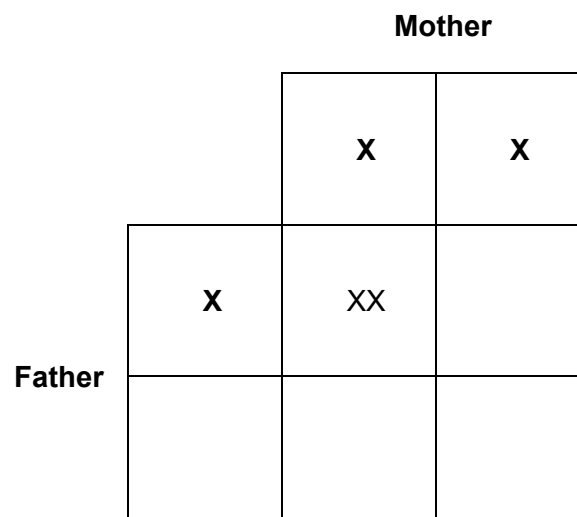
Offspring are genetically identical to parents.

Only one parent is involved.

Sperm and egg fuse.

0 1 . 2

Humans reproduce by sexual reproduction.

Complete **Figure 1** to show the inheritance of sex.**[3 marks]****Figure 1**

0 1 . 3 Draw a ring around the genotype of all male children in **Figure 1**.

[1 mark]

0 1 . 4 When children reach puberty, reproductive hormones cause changes in their bodies.

Draw **one** line from each hormone to the change the hormone causes at puberty.

[2 marks]

Hormone

**Change the hormone
causes at puberty**

Oestrogen

Breasts develop

Skin turns lighter

Testosterone

Voice becomes deeper

Wisdom teeth appear

Question 1 continues on the next page

Turn over ►



A woman does **not** want to become pregnant.

She considers two methods of contraception.

0 1 . 5

Draw **one** line from each method of contraception to how the method prevents pregnancy.

[2 marks]

Method of contraception

How the method prevents pregnancy

Condom

Embryos do not
implant in the uterus

Hormones stop
eggs maturing

Oral contraceptive
(the pill)

Sperm are killed

Sperm do not reach
the egg



0 1 . 6

Give **one** advantage and **one** disadvantage of taking oral contraceptives to prevent pregnancy.

[2 marks]

Advantage _____

Disadvantage _____

12

Turn over for the next question**Turn over ►**

0 2

Ammonites became extinct millions of years ago.

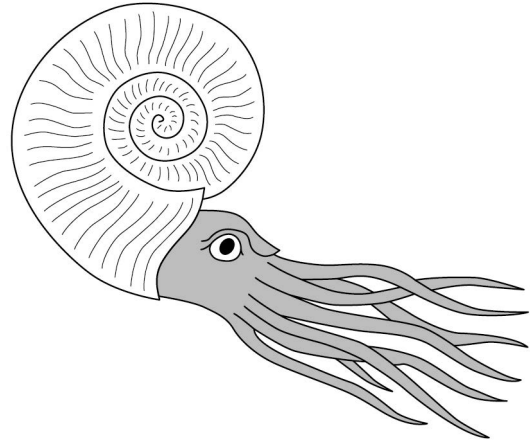
Figure 2 is a photograph of a fossil ammonite.

Figure 3 is a drawing of what scientists think a living ammonite looked like.

Figure 2



Figure 3



0 2 . 1

How was the fossil in **Figure 2** formed?

[1 mark]

Tick (✓) **one** box.

The ammonite left traces where it moved.

The ammonite shell was replaced by minerals.

The ammonite was frozen in ice.

0 2 . 2

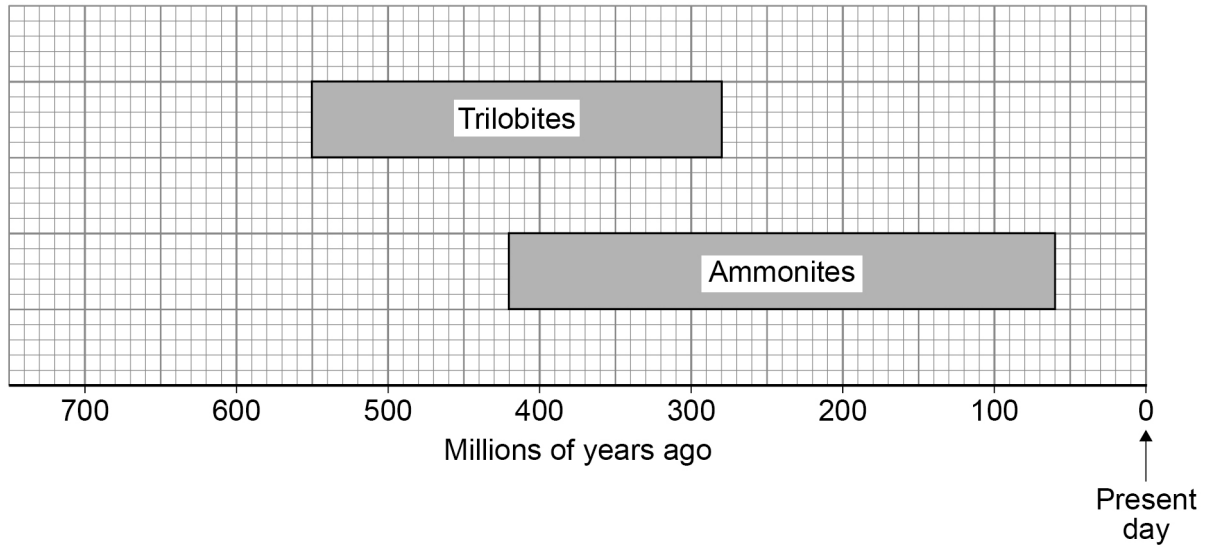
Suggest why scientists are **not** certain what living ammonites looked like.

[1 mark]



Figure 4 shows when two different types of organism were alive on Earth.

Figure 4



0 2 . 3 How many millions of years ago did ammonites become extinct?

Use Figure 4.

[1 mark]

_____ million years

0 2 . 4 Trilobites lived on Earth for 270 million years.

Calculate how much longer ammonites lived on Earth than trilobites.

Use Figure 4.

[2 marks]

 _____ million years

Turn over ►



0 2 . 5 Suggest **two** factors which may have caused ammonites to become extinct.

[2 marks]

1 _____

2 _____

The fossil record provides evidence for the theory of evolution by natural selection.

0 2 . 6 Which scientist proposed the theory of evolution by natural selection?

[1 mark]

Tick (✓) **one** box.

Carl Linnaeus

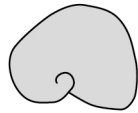
Carl Woese

Charles Darwin

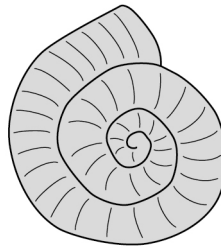


0 2 . 7 **Figure 5** shows ammonite fossils from three different time periods.

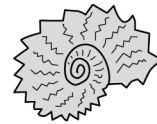
Figure 5



400 million years ago



300 million years ago



200 million years ago

How do the fossils in **Figure 5** give evidence for the theory of evolution by natural selection?

[1 mark]

Tick (✓) **one** box.

All fossils have coiled shells.

More recent fossils are bigger.

Older fossils are more simple.

9

Turn over for the next question

Turn over ►



0 3

Mineral ions are important chemicals in an ecosystem.

0 3 . 1

Plants take in nitrate ions dissolved in water.

Which part of a plant takes in nitrate ions?

[1 mark]

0 3 . 2

Name **two** chemicals that are cycled between plants, the soil and the air.

Do **not** refer to nitrogen or nitrates in your answer.

[2 marks]

1 _____

2 _____



0 3 . **3**

All the chemicals in a plant are recycled when the plant dies.

Describe how:

- microorganisms recycle chemicals
- the chemicals are used again by new plants.

[6 marks]

9

Turn over for the next question

Turn over ►



0 4

Homeostasis regulates the internal conditions of the human body.

0 4 . 1Which **two** processes are regulated by homeostasis?**[2 marks]**Tick (✓) **two** boxes.

Controlling water output in urine

Defending the body against pathogens

How quickly you walk

Keeping cool on a hot day

Waking up in the morning

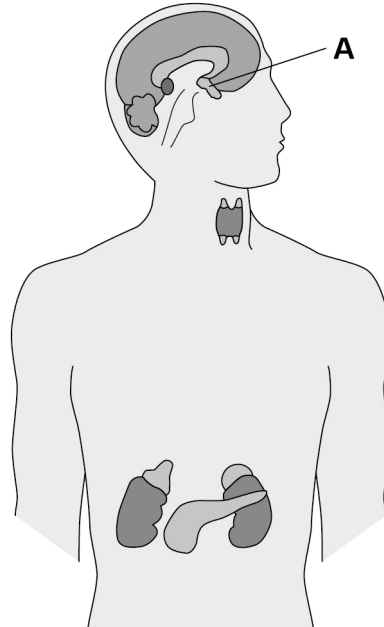


Hormones are produced by glands in the endocrine system.

Each hormone has an effect on a target organ.

Figure 6 shows glands of the endocrine system.

Figure 6



0 4 . 2 What is the name of gland **A**?

[1 mark]

Tick (✓) **one** box.

Pancreas

Pituitary

Thyroid

Question 4 continues on the next page

Turn over ►



Before eating a sugar-coated cereal a person had a blood glucose concentration of 5.2 mmol/dm^3

Soon after eating the cereal the person had a blood glucose concentration of 8.4 mmol/dm^3

0 4 . 3 Calculate the increase in the blood glucose concentration.

[1 mark]

Increase = _____ mmol/dm^3

0 4 . 4 The person needed medication to decrease their blood glucose concentration.

Suggest what disorder the person has.

[1 mark]

0 4 . 5 There is a problem with the hormone control of the person.

What is the problem?

[1 mark]

Tick (✓) **one** box.

The blood is not taking hormones to target organs.

The pancreas is not releasing insulin.

The pituitary gland is not being stimulated.



0 4 . 6

The person:

- works in an office
- drives to work
- is overweight
- watches the television and reads every night
- drinks a hot chocolate every night.

Suggest **two** lifestyle changes the person could make to help treat their disorder.**[2 marks]**

1 _____

2 _____

8

Turn over for the next question**Turn over ►**

0 5

This question is about biodiversity.

A farmer:

- grows only wheat crops
- has used all his small fields to make a few large fields
- cuts down trees in his woodlands to burn as fuel.

0 5**. 1**

What are **two** ways the farmer could increase biodiversity on his farm?

[2 marks]

Tick (✓) **two** boxes.

Cut down trees to grow wheat

Plant hedgerows around his fields

Plant many different crops in his fields

Put fences around his fields

Put fertiliser on his wheat crop



Students investigated the effect of cutting down trees in the woodland.

This is the method used.

1. Mark out a 10 m by 10 m area where trees have been removed.
2. Place a 1 m × 1 m quadrat at six random positions in the area.
3. Record the number of plant species present.
4. Record the number of invertebrate species seen among dead leaves on the ground.
5. Repeat steps 1 to 4 in an area where there are trees.

0 5 . 2

Suggest **one** improvement the students could make to their method.

[1 mark]

0 5 . 3

The students made this prediction:

‘There will be more invertebrate species living in the area where there are trees.’

Explain why the students’ prediction may be correct.

[2 marks]

Question 5 continues on the next page

Turn over ►



Table 1 shows the students' results.

Table 1

Quadrat	Number of plant species		Number of invertebrate species	
	Area with no trees	Area with trees	Area with no trees	Area with trees
1	8	2	4	10
2	6	2	3	6
3	7	0	4	8
4	6	3	5	14
5	20	4	2	9
6	8	1	6	13
Mean	7	2	4	10

0 5 . 4 The students decided that one result was anomalous.

Draw a ring around the anomalous result in **Table 1**.

[1 mark]

0 5 . 5 How does removing trees affect the number of invertebrate species living among the dead leaves on the ground?

Use **Table 1**.

[1 mark]



0 5 . 6

There were more plant species growing in the area where there were no trees.

Explain why.

[3 marks]

10

Turn over for the next question

Turn over ►

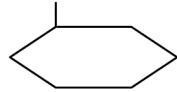


0 6 This question is about DNA and genes.

0 6 . 1 Which diagram represents a DNA molecule?

[1 mark]

Tick (✓) **one** box.







0 6 . 2 Describe the structure of a DNA molecule.

[1 mark]

0 6 . 3 A gene is a small section of DNA on a chromosome.

Complete the sentences.

[2 marks]

A gene codes for a particular sequence of _____.

This sequence makes a specific _____.



0 6 . 4 What is meant by the term genome?

[1 mark]

0 6 . 5 The complete human genome is now known.

Which important scientific advance was made using knowledge of the human genome?

[1 mark]

Tick (✓) **one** box.

Discovering antibiotic resistant bacteria

Finding more foods to eat from tropical forests

Tracing how aboriginal people spread across Australia

Working out when the last ice age ended

Question 6 continues on the next page

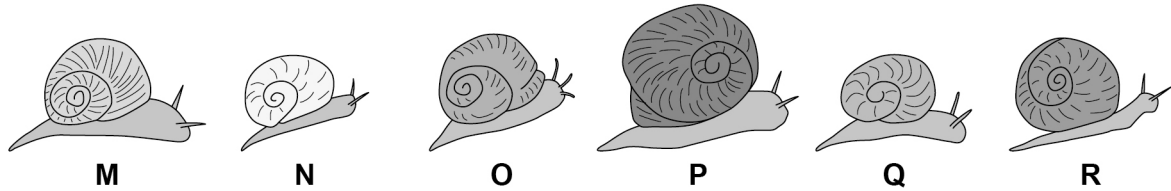
Turn over ►



A student found six different snails of one species in his garden.

Figure 7 shows the snails.

Figure 7



0 6 . 6 All the snails are different.

What scientific term describes differences in characteristics between individuals of a species?

[1 mark]

0 6 . 7 A change in DNA has caused snail **P** to be very different from the other five snails.

Suggest why there might be an increasing number of snails similar to snail **P** in each future generation.

[2 marks]



Turn over for the next question

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Turn over ►



0 7

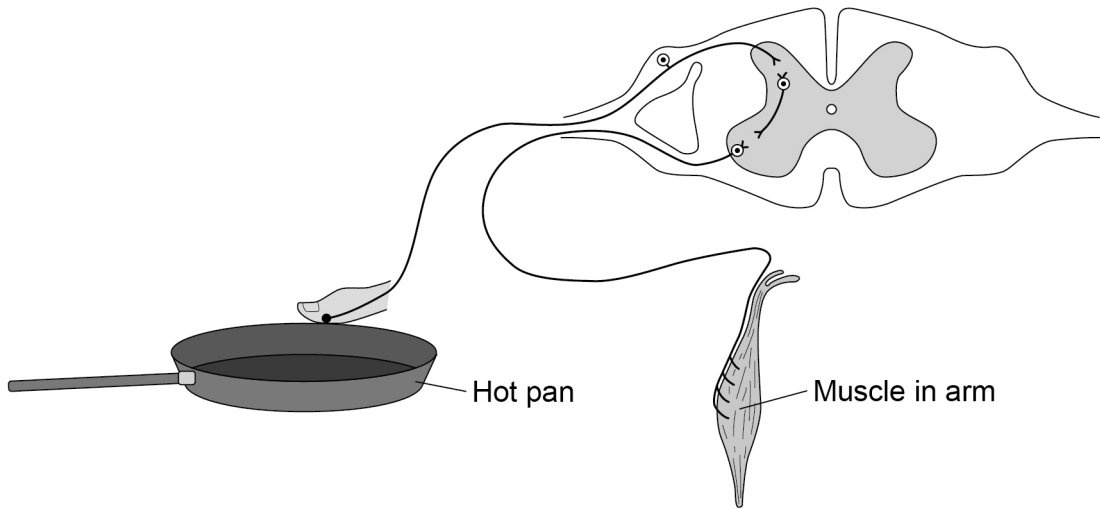
Human reactions are a response to an external change.

0 7 . 1

Reflex actions help to protect the body against damage.

Figure 8 shows the nervous pathway for a reflex action.

Figure 8



A stimulus from the hot pan will cause the muscle in the arm to contract and move the finger away.

Describe how the stimulus from the hot pan reaches the muscle in the arm.

[4 marks]



07.2

A student investigated whether using the right hand or the left hand had an effect on reaction time.

The student only tested right-handed people.

Describe a method for the student's investigation.

Include details of the test you would use for reaction time.

[4 marks]

Question 7 continues on the next page

Turn over ►



A different student carried out an investigation to see if playing tennis improved reaction time.

The student used two groups of six people.

Table 2 shows the results.

Table 2

Person	Reaction time in seconds	
	People who play tennis	People who do not play tennis
1	0.2	0.3
2	0.4	0.4
3	0.3	0.6
4	0.4	0.5
5	0.2	0.3
6	0.3	0.2
Mean	X	0.4

0 7 . 3 Calculate mean value **X** in **Table 2**.

[2 marks]

X = _____ seconds

0 7 . 4 What is the dependent variable in the student's investigation?

[1 mark]



The student concluded:

'Playing tennis improves reaction time.'

0 7 . 5

Give **one** piece of evidence which supports the conclusion.

[1 mark]

0 7 . 6

Give **one** piece of evidence which does **not** support the conclusion.

[1 mark]

13

END OF QUESTIONS



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3 2



2 0 6 G 8 4 6 4 / B / 2 F

IB/M/Jun20/8464/B/2F

**GCSE
COMBINED SCIENCE: TRILOGY
8464/B/1F**

Biology Paper 1F

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme



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

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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 **not** 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	C		1	AO1 4.2.1 4.2.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2 Mark with 01.3	protease		1	AO1 4.2.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3 Mark with 01.2	acidic		1	AO1
	reason: any one from: <ul style="list-style-type: none"> • produces (hydrochloric) acid • optimum / best condition for enzyme / protease to act 	allow contains (hydrochloric) acid allow optimum / best condition to digest food / protein allow ecf from question 01.2 allow to kill microorganisms / bacteria / pathogens	1	AO2 4.2.2.1 4.3.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	liver		1	AO1 4.2.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	it increases the surface area of fats		1	AO1 4.2.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	<p>all three correct for 2 marks one or two correct for 1 mark extra line from a box negates that box</p>		2	AO1 4.2.2.1 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	any one from: <ul style="list-style-type: none"> • wear goggles • use a water bath to heat the solution / mixture • wash spills from bench / skin 	allow wash hands allow wear gloves ignore examples such as tie hair back or move bags under bench	1	AO1 4.2.2.1 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	Benedict's and iodine tests only		1	AO3 4.2.2.1 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	any one from: <ul style="list-style-type: none"> • starch (molecule) is (too) large • starch (molecule) is insoluble 	allow idea that starch needs to be broken down into small / soluble molecules	1	AO1 4.2.2.1

Total Question 1		11
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Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	cells contain (many) chloroplasts	allow positioned nearest to the light or at the top of the leaf allow cells are closely packed or no gaps between cells allow chlorophyll for chloroplast	1	AO1 4.1.1.3 4.2.1 4.2.3.1 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	stomata		1	AO1 4.2.3.1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$(\text{real length}) = \frac{28}{400}$	allow answer given for length in mm correctly multiplied by 1000	1	AO2 4.1.1.1 4.1.1.2 4.1.1.5 RPA1
	(real length in mm =) 0.07		1	
	(real length in μm =) 70		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	diffusion		1	AO1 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	A	no marks if wrong cell chosen	1	AO3
	Reason any one from: <ul style="list-style-type: none"> • steeper (diffusion) gradient • bigger difference in concentration of carbon dioxide inside and outside the cell 	allow higher concentration of carbon dioxide outside the cell than inside the cell allow particles / molecules for carbon dioxide	1	AO2 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	(number / amount of) bubbles	allow volume of gas / oxygen	1	AO1 4.4.1.2 RPA5
	time	allow suitable time eg 1 / 5 / 10 minutes	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	any two from: <ul style="list-style-type: none"> • temperature (of water) • light intensity or <ul style="list-style-type: none"> distance of light (from pondweed) • concentration of carbon dioxide (in water) 	do not accept colour of light ignore time allow amount of light ignore light unqualified allow amount / mass of sodium hydrogen carbonate (in water) allow type / size of plant ignore volume of water / solution	2	AO3 4.4.1.2 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	y-axis labelled: rate of photosynthesis in arbitrary units		1	AO2 4.4.1.2 RPA5
	suitable scale		1	
	all bars plotted correctly	allow $\pm \frac{1}{2}$ a small square the bars can be in any order	1	
	all bars labelled correctly		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	blue		1	AO3 4.4.1.2 RPA5

Total Question 2		17
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Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	fungus		1	AO1 4.3.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	less / no chlorophyll or chlorophyll has been broken down	allow reference to chloroplasts for chlorophyll	1	AO2 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	less photosynthesis or less light absorbed (so) less glucose / sugar formed		1	AO2 4.3.1.4 4.4.1.1 4.4.1.2
	or less light absorbed (1) (so) less photosynthesis (1)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	drain water from swamps		1	AO2 4.3.1.5

Total Question 3		9
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Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	nucleus		1	AO2 4.1.1.1 4.1.1.2 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	cells never stop dividing		1	AO1 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	any one from: <ul style="list-style-type: none"> chemicals enter the lungs (first) chemicals are inhaled chemicals are more concentrated in the lungs 	allow smoke / tar / carcinogens for chemicals ignore nicotine unqualified	1	AO2 4.2.2.6 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	(cancer cells transported) in the blood		1	AO2 4.2.2.2 4.2.2.3 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	any one from: <ul style="list-style-type: none"> • (smoking) will damage the new lung • (NHS has) limited financial resources • the lung could be used for someone else (who does not smoke) • illness is self-inflicted or person is not attempting to help themselves 	allow poor chance of success allow (smoking) will increase the risk of cancer developing in the new lung allow wastes a healthy lung allow there is a shortage of lungs	1	AO3 4.2.2.6 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	300	answer line takes precedence	1	AO2 4.2.2.6 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	<p>any one from:</p> <ul style="list-style-type: none"> • little exposure to ionising radiation • little exposure to the sunlight / UV (light) • more use of sunscreen • little exposure to carcinogens <ul style="list-style-type: none"> • little cell / DNA / gene damage 	<p>ignore references to smoking</p> <p>allow do not use sunbeds</p> <p>allow better sunscreen</p> <p>allow named carcinogen</p> <p>allow skin cancer takes a long time to develop</p>	1	AO2 4.2.2.6 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	<p>any one from:</p> <ul style="list-style-type: none"> • most new cases each year are in males / people aged 65–69 (years) • new cases per year increases (from age 15) up to 69 (years) • new cases per year decreases from age 69 to 90 (+ years) 	<p>allow any upper age of 65-69</p>	1	AO3 4.2.2.6 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
<p>04.9</p>	<p>any two from:</p> <ul style="list-style-type: none"> • improved treatment / drugs • earlier diagnosis • improved cancer screening • improved patient / doctor knowledge (of dangers / treatments) 	<p>allow improved technology / machinery</p> <p>allow improved patient diet / lifestyle</p>	<p>2</p>	<p>AO3 4.2.2.6 4.2.2.7</p>

<p>Total Question 4</p>		<p>10</p>
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Question 5

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	any one from: <ul style="list-style-type: none"> • 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.
05.3	penicillin	allow phonetic spelling	1	AO2 4.3.1.9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	any one from: <ul style="list-style-type: none"> 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.
05.5	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.
05.6	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.
05.7	B		1	AO2 4.2.2.3 4.3.1.7

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

Total Question 5		9
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Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	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.
06.2	differentiation	ignore specialisation	1	AO1 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	4	allow 15	1	AO2 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	46	allow 23 pairs (of chromosomes)	1	AO2 4.1.2.1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	<p>Stage 1 any one from:</p> <ul style="list-style-type: none"> • (cell) growth • increase in number of sub-cellular structures • DNA replicates • chromosomes double / duplicate / replicate <p>Stage 2 any one from:</p> <ul style="list-style-type: none"> • (one set of) chromosomes pulled to each end of cell • two nuclei form <p>Stage 3 any one from:</p> <ul style="list-style-type: none"> • cytoplasm / membrane divides • two identical cells formed 	<p>allow increase in number of organelles / ribosomes / mitochondria</p> <p>allow genetic material for DNA</p> <p>allow DNA doubles / duplicates</p> <p>ignore mitosis occurs</p> <p>allow chromosomes line up across the centre of the cell</p> <p>allow chromosomes move to opposite ends of the cell</p> <p>allow nucleus divides / splits (into two)</p> <p>allow cytokinesis</p>	<p>1</p> <p>1</p> <p>1</p>	<p>AO1 4.1.2.2</p>

Question	Answers	Mark	AO / Spec. Ref.
06.6	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	

	<p>Indicative content</p> <p>General comparisons:</p> <ul style="list-style-type: none"> • 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 <p>Rate comparisons:</p> <ul style="list-style-type: none"> • 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 <p>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.</p>		<p>4.1.2.2</p>
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	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 6		14
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GCSE
COMBINED SCIENCE: TRILOGY
8464/B/2F

Biology Paper 2F

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme



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

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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 not 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	larger yields		1	AO1 4.6.2.4

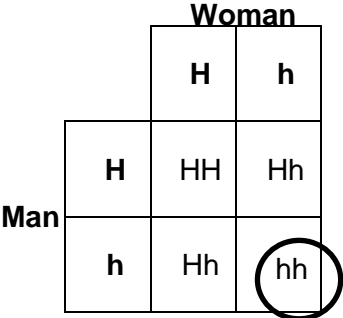
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	GM crops will harm wildlife		1	AO1 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	gene(s)	allow allele(s)	1	AO1 4.6.1.3 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	protein		1	AO1 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	an allele that is only expressed if two copies are present		1	AO1 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	heterozygous		1	AO2 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7 mark with 1.8	offspring genotypes correctly derived hh circled 	allow 1 mark for 1 or 2 correct genotypes	2 1	AO2 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8 mark with 01.7	25%	probability must match derivations (hh) in question 01.7	1	AO3 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	any one from: <ul style="list-style-type: none"> • it might harm the embryo / baby / mother • it might cause a miscarriage • they do not want to make a choice about having an abortion • it is against their religious beliefs 	ignore cost ignore harmful / dangerous unqualified allow against their religion	1	AO3 4.6.1.4 4.6.1.5

Total Question 1		11
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Question 2

Question	Answers	Mark	AO / Spec. Ref.
02.1	Level 2: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4	AO1 4.7.2.1 RPA 7
	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 <ul style="list-style-type: none"> • place quadrat randomly / systematically • description of how randomness is achieved or • description of how systematic placement is achieved • count number of buttercups in quadrat • record number • repeat quadrat (in another location in the same wet soil area) • (repeat) at least 5 times • calculate a mean number of buttercups per quadrat • the area of the wet soil area is 100 m² • estimate the buttercup population using the area of the quadrat 		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	an abiotic factor		1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	any two from: <ul style="list-style-type: none"> • light (intensity) • temperature • competition • herbivores / grazing • pollinators • trampling / mowing • wind (direction / strength) • soil pH or soil type • ions / minerals / nutrients in the soil • pathogens • herbicides 	ignore rain / water / weather allow shade ignore sun allow other plants growing there allow pests or named pest allow insects or named pollinator allow named mineral allow infection ignore disease unqualified allow pesticides	2	AO2 4.7.1.2 4.7.1.3 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(the) dependent		1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5 mark with 02.6	0.25 (m ²)		1	AO2 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6 mark with 02.5	8 ÷ 0.25	allow ecf from question 02.5	1	AO2 4.7.1.2 RPA7
	32 (buttercups per m ²)	allow 8 × 4	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	any two from: <ul style="list-style-type: none"> • repeat • same volume of water • same mass / volume of soil • more acidity / pH levels • same number of bean seeds • same spacing / depth of seeds • same species / variety / type of bean seeds • same size boxes • same light (intensity) • same temperature 	allow same amount of water allow same amount of soil } if neither marking point awarded, allow put them in the same place eg greenhouse	2	AO3 4.7.1.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	$\frac{11+12+11+17+19}{5}$		1	AO2 4.7.1.2 RPA7
	or $\frac{70}{5}$ 14 (cm)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	bean plants grow less well (in acid soil) or bean plants are shorter (in acid soil)	allow converse	1	AO3 4.7.1.2 RPA7

Total Question 2		16
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Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	knowledge of how DNA controls inheritance		1	AO1 4.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	there was no oxygen in the amber		1	AO2 4.6.3.1 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	silverfish	ignore A	1	AO3 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	C		1	AO2 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	dragonflies	ignore A / B	1	AO3 4.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6		all correct for 3 marks allow 2 marks for 2 or 3 correct allow 1 mark for 1 correct allow animals allow insects ignore italics and upper / lower case letters	3	AO2 4.6.4
	animalia			
	insecta			
	Musca domestica			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	eukaryota		1	AO2 4.6.4

Total Question 3		9
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Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	D		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	B		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(in / through / via) blood(stream)	allow (in / through / via) plasma allow (in / through / via) blood vessels allow (in / through / via) arteries / veins / capillaries	1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	insulin		1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	glucose is converted to glycogen		1	AO1 4.5.3.2
	glucose moves from the blood into the cells		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	8:30 (am)	allow 8:15 – 8:35 (am) allow time written in words	1	AO3 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	any value in the range ≥ 6.5 to ≤ 20 (mmol/dm ³)		1	AO3 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	any two from: <ul style="list-style-type: none"> • low carbohydrate diet • exercise (regime) • lose body mass 	allow low calorie / fat / sugar diet allow eat fewer (sugary) snacks allow description of exercise allow lose weight allow (metformin) tablets to reduce blood glucose	2	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.9	(less) respiration		1	AO1 4.5.3.2
	(so) less energy released / transferred or less muscle contraction	do not accept energy produced / made / created	1	AO2 4.4.2.1

Total Question 4		12
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Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	aerobic respiration		1	AO1 4.4.2.1 4.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	1. evaporation	allow evaporate(s) / evaporating	1	AO1 4.7.2.2
	2. condensation	allow condense(s) / condensing	1	
	3. precipitation	allow rain(ing) / rainfall allow named precipitation ignore precipitates	1	
	4. draining / drainage	allow run-off / percolation / infiltration allow groundwater / underground flow	1	
	5. transpiration		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	$6\,000\,000\,000 \times \frac{4.5}{100}$	allow $6\,000\,000\,000 \times 0.045$	1	AO2 4.7.2.2
	270 000 000		1	
	2.7×10^8	allow an incorrectly calculated number of people given in correct standard form	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	climate change has increased the area of deserts		1	AO3 4.7.2.2
	more water is used to grow crops		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	decay / decomposition of leaves	allow leaves are broken down	1	AO2
	respiration (by microorganisms / decomposers)	ignore aerobic / anaerobic ignore respiration by worms / detritivores / insects / leaves	1	AO1
	respiration releases carbon dioxide or microorganisms release carbon dioxide		1	AO1
	carbon dioxide is used in photosynthesis (for new plant growth)	do not accept carbon dioxide absorbed in the roots	1	AO1 4.7.2.2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	nitrates are released into the soil		1	AO2 4.7.2.2 4.4.1.3

Total Question 5		16
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Question 6

Question	Answers	Mark	AO / Spec. Ref.
06	Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO3
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO3 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	

<p>06 cont.</p>	<p>Indicative content</p> <p>Increase in world population</p> <ul style="list-style-type: none"> • sewage (released into rivers / lakes / seas) <ul style="list-style-type: none"> ○ causes algae to grow ○ algae block light ○ causing plants to die and decompose ○ leading to lack of oxygen in the water ○ (sewage) could contain pathogens <p>Need to produce more food for world's population</p> <ul style="list-style-type: none"> • fertilisers (used on farms to increase crop yield, leach into rivers / lakes / seas) <ul style="list-style-type: none"> ○ causes algae to grow ○ leading to lack of oxygen in the water • herbicides / pesticides (used on farms to increase crop yield, run into rivers / lakes / seas) <ul style="list-style-type: none"> ○ build-up in food chains <p>Increasing demand for products / energy</p> <ul style="list-style-type: none"> • toxic chemicals or named toxic chemicals (run into rivers / lakes / seas) <ul style="list-style-type: none"> ○ from factories / industry or power stations ○ build-up in food chains ○ chemicals may cause mutations or chemicals may act as hormones ○ radiation leaks from nuclear (power stations) ○ (oil) spills from extraction / rigs / tankers in oceans ○ acid rain formation ○ acidification of lakes ○ increased carbon dioxide emissions causes acidification of oceans <p>Buildup of waste products</p> <ul style="list-style-type: none"> • litter / plastics (thrown in rivers / lakes / seas) <ul style="list-style-type: none"> ○ example of effect on living organisms, such as plastics consumed or plastics build up in stomach or plastics get stuck around beaks ○ (most) plastics are not biodegradable ○ build-up of microplastics in water animals <p>Consequence of the above is that organisms living in rivers / lakes / seas are harmed / die</p> <p>For Level 3 students need to consider different types of pollution</p>		<p>4.7.3.2 4.7.2.1</p>
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<p>Total Question 6</p>		<p>6</p>
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Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Biology Paper 1F

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.

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	
6	
TOTAL	

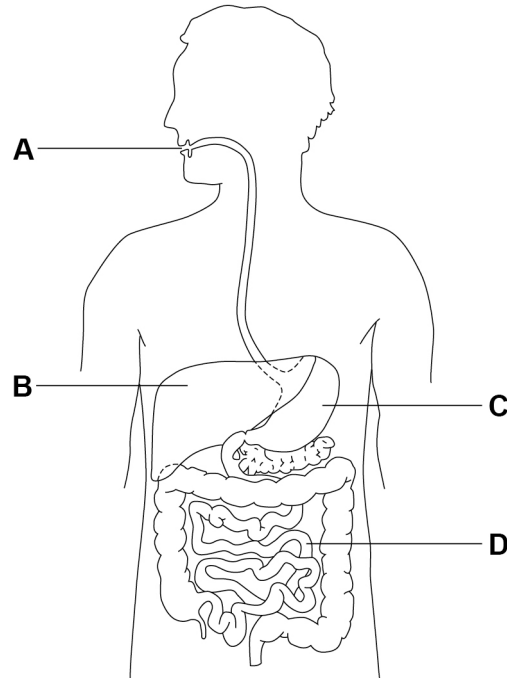


0 1

Foods are digested before they are absorbed into the blood.

Figure 1 shows organs in the human digestive system.

Figure 1



0 1 . 1

Which organ is the stomach?

[1 mark]

Tick (✓) **one** box.

A B C D

0 1 . 2

What type of enzyme is produced in the stomach?

[1 mark]

Tick (✓) **one** box.

Carbohydrase

Lipase

Protease



0 1 . 3 Which term describes the pH in the stomach?

Give **one** reason why the stomach is this pH.

[2 marks]

Tick (✓) **one** box.

Acidic

Alkaline

Neutral

Reason _____

0 1 . 4 Which organ produces bile?

[1 mark]

Tick (✓) **one** box.

Large intestine

Liver

Mouth

Pancreas

Question 1 continues on the next page

Turn over ►



0 1 . 5 How does bile help in the digestion of foods?

[1 mark]

Tick (✓) **one** box.

It increases the surface area of fats.

It is an enzyme that digests protein.

It makes the pH in the small intestine acidic.

A student tested different foods for the presence of protein, starch and sugar.

0 1 . 6 Draw **one** line from each food molecule to the reagent used to test for the food molecule.

[2 marks]

Food molecule

Reagent

Protein

Benedict's solution

Starch

Biuret reagent

Sugar

Iodine solution



0 1 . 7

Give **one** safety precaution a student should take when using Benedict's solution.

[1 mark]

0 1 . 8

Table 1 shows the results for one food sample.

Table 1

Test	Benedict's test	Biuret test	Iodine test
Colour after test	Red	Blue	Black

Which of the tests show positive results?

[1 mark]

Tick (✓) **one** box.

All three tests

Benedict's and Biuret tests only

Benedict's and iodine tests only

Biuret and iodine tests only

0 1 . 9

Starch molecules are **not** absorbed into the blood from the digestive system.Give **one** reason why.

[1 mark]

11

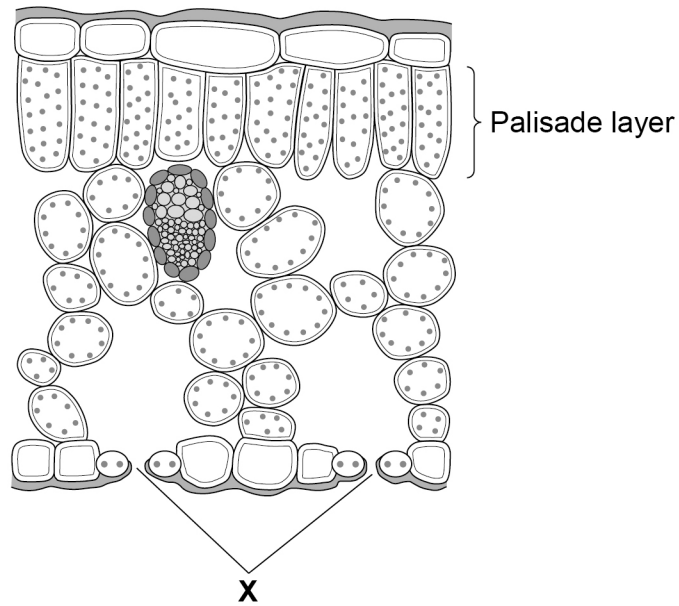
Turn over ►



0 2

Figure 2 shows a section through a leaf.

Figure 2



0 2 . 1

Give **one** way that the palisade layer is adapted for photosynthesis.

[1 mark]

0 2 . 2

Gases pass into and out of the leaf through small pores in the surface of the leaf.

What are the small pores labelled **X** called?

[1 mark]

Tick (✓) **one** box.

Guard cells

Stomata

Xylem vessels



0 2 . 3

A student viewed a section of a leaf using a microscope.

The student measured the length of one of the palisade cells.

The cell image measured 28 mm in length when viewed at a magnification of $\times 400$

Calculate the real length of the palisade cell in millimetres (mm).

Use the equation:

$$\text{real length} = \frac{\text{image length}}{\text{magnification}}$$

[3 marks]

Real length = _____ mm

Convert the real length of the cell from millimetres to micrometres (μm).

1 mm = 1000 μm

Real length = _____ μm

0 2 . 4

Carbon dioxide can move into and out of cells.

What is the process by which carbon dioxide can move into and out of cells?

[1 mark]

Tick (\checkmark) **one** box.

Active transport

Diffusion

Osmosis

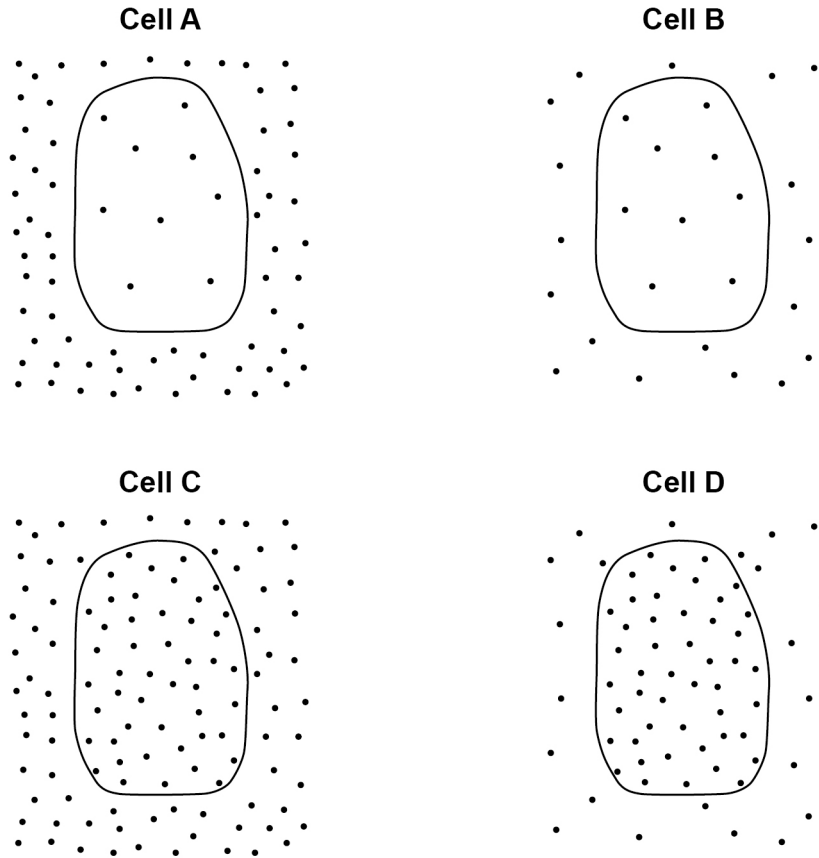
Turn over ►



Figure 3 shows a diagram of four cells.

Each cell is surrounded by carbon dioxide molecules.

Figure 3



Key

• Carbon dioxide molecule

0 2 . 5 Which cell will carbon dioxide move into at the fastest rate?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

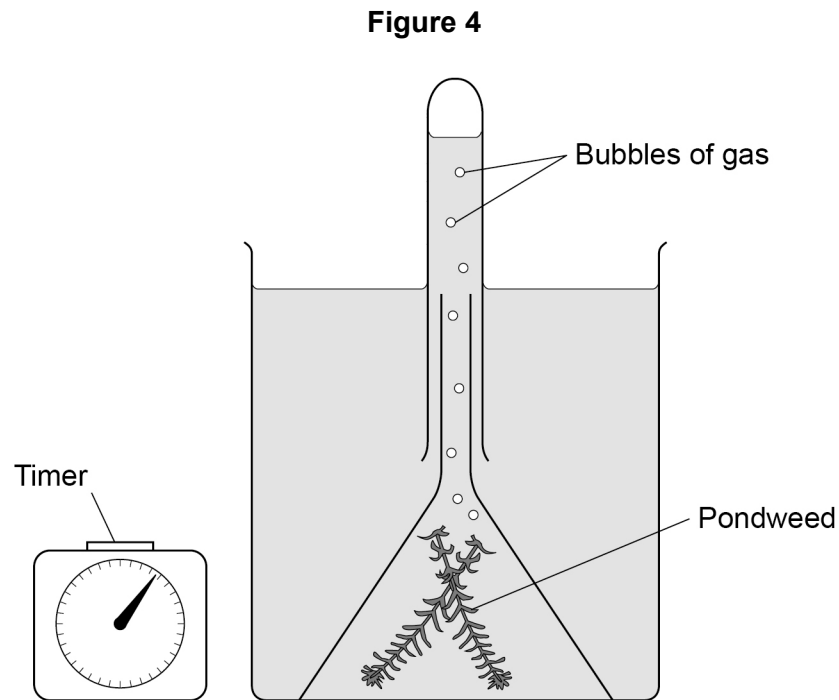
A B C D

Reason _____



A student investigated the effect of different colours of light on the rate of photosynthesis.

Figure 4 shows some of the apparatus the student used.



The student placed the apparatus in blue light, then in green light and then in red light.

The student measured the rate of photosynthesis in each colour of light.

0 2 . 6

What **two** measurements should the student make to calculate the **rate** of photosynthesis?

[2 marks]

- 1 _____
- 2 _____

Question 2 continues on the next page

Turn over ►



0 2 . 7

Give **two** variables the student should keep the same in this investigation.**[2 marks]**

1 _____

2 _____

Table 2 shows the results.**Table 2**

Colour of light	Rate of photosynthesis in arbitrary units
Blue	9
Green	1
Red	8



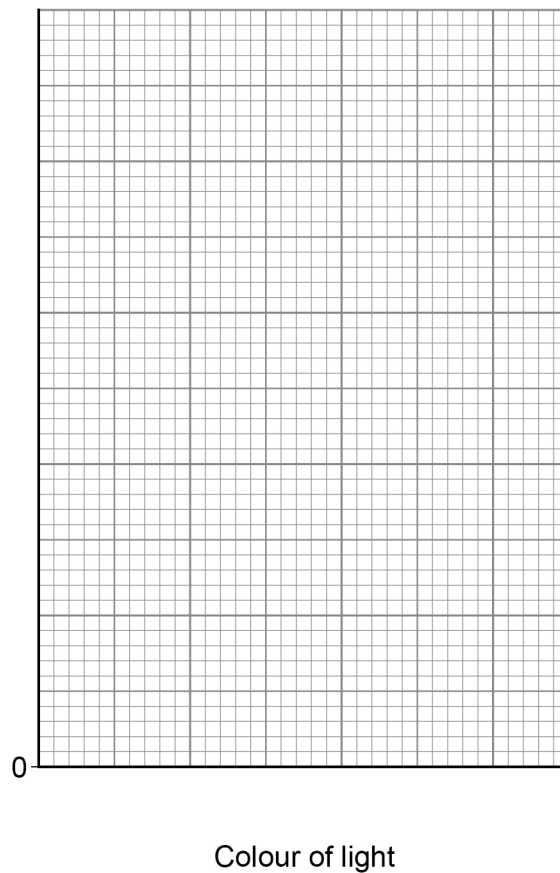
0 2 . 8 Complete **Figure 5**.

You should:

- label the y-axis
- use a suitable scale
- plot the data from **Table 2** as a bar chart
- label each bar.

[4 marks]

Figure 5



0 2 . 9 Look at **Table 2**.

What colour of light should be used to grow plants in a greenhouse?

[1 mark]

Tick (✓) **one** box.

Blue

Green

Red

17

Turn over ►



0 3

This question is about disease.

Rose black spot is a disease where black spots develop on the leaves of rose plants.

0 3**1**

What type of pathogen causes rose black spot disease?

[1 mark]Tick (✓) **one** box.

Bacterium

Fungus

Protist

Virus

0 3**2**

Plants with rose black spot disease often have yellow leaves.

Suggest **one** reason why the leaves are yellow instead of green.**[1 mark]**

0 3**3**

Explain why plants with yellow leaves grow slowly.

[2 marks]



0 3 . 4

The spread of rose black spot can be controlled using different methods.

Draw **one** line from each method of control to the explanation of how it works.

[2 marks]

Method of control

Explanation

Remove and burn
infected leaves

Creates a barrier to the
movement of pathogens

Pathogens are killed

Water the roots of
the plant only, **not** the
leaves

Reduces the chance of
pathogens being spread
by water droplets

Reduces the temperature
so pathogens reproduce
less

Question 3 continues on the next page

Turn over ►



0 3 . 5 Tobacco plants may become infected with a pathogen called TMV.

What type of pathogen is TMV?

[1 mark]

Tick (✓) **one** box.

Bacterium

Fungus

Protist

Virus

Malaria is a disease caused by a protist.

0 3 . 6 How is the malaria pathogen transferred to humans?

[1 mark]

0 3 . 7 How can the spread of malaria pathogens be reduced?

[1 mark]

Tick (✓) **one** box.

Avoid sexual contact

Cook food thoroughly

Drain water from swamps

Use a tissue when sneezing

9



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

Turn over ►



0 4

Cigarette smoking is the main cause of cancer in the UK.

0 4 . 1

Mutations in cells cause cancer.

Where in a cell do mutations happen?

[1 mark]Tick (✓) **one** box.

Cell membrane

Cytoplasm

Nucleus

0 4 . 2

Why do some cancers develop into large tumours?

[1 mark]Tick (✓) **one** box.

Cells never stop dividing

Cell respiration is slowed down

Enzyme activity is stopped



Cigarette smoking has been linked to many different types of cancer.

0 4 . 3 Lung cancer is the most common type of cancer caused by smoking.

Suggest **one** reason why.

[1 mark]

0 4 . 4 A person with lung cancer can develop secondary cancers in other parts of the body.

Describe how this can happen.

[1 mark]

0 4 . 5 Sometimes a person may need a lung transplant.

The National Health Service (NHS) will **not** offer a lung transplant to a person who smokes.

Suggest **one** reason why.

[1 mark]

Question 4 continues on the next page

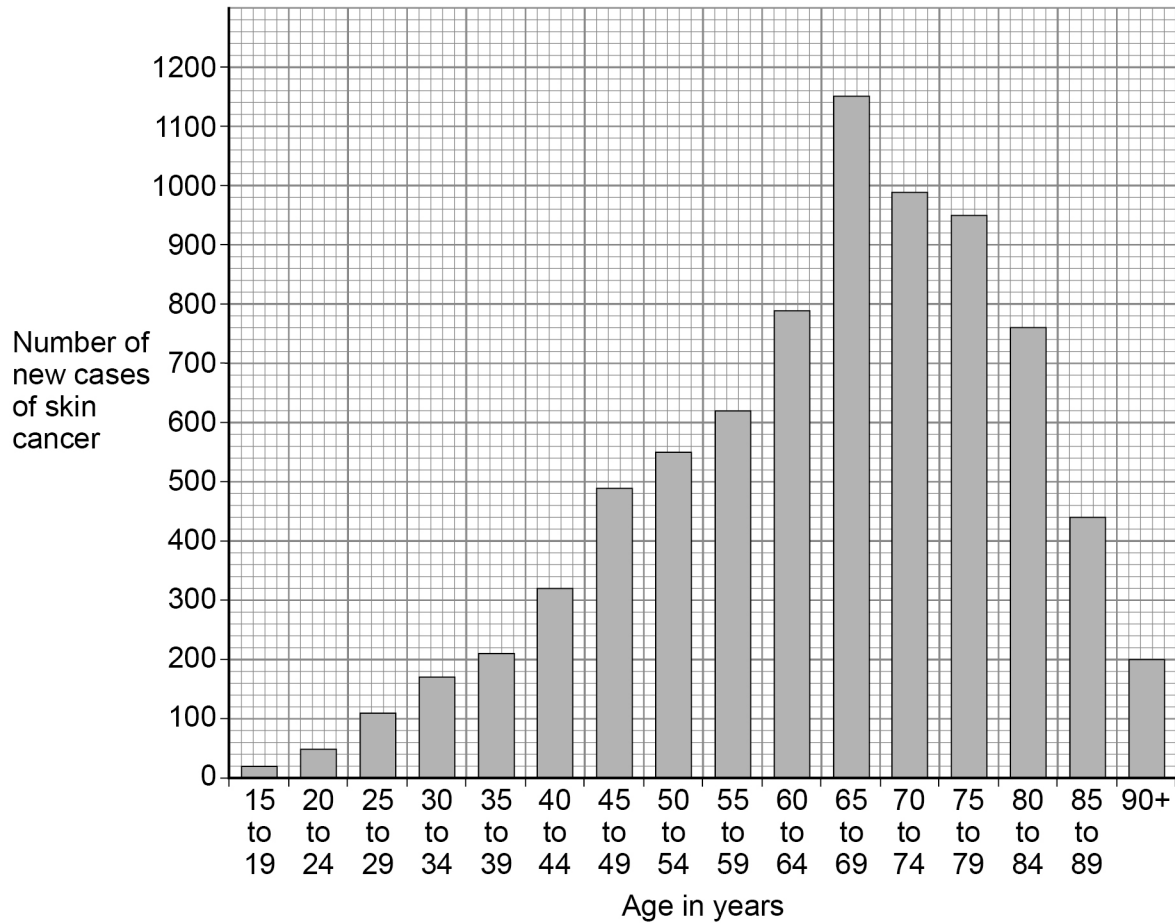
Turn over ►



Figure 6 shows data about skin cancer in males for different age groups in the UK.

The data shows the number of new cases of skin cancer in one year.

Figure 6



0 4 . 6

How many more new cases of skin cancer are there in males aged 40 to 44 than in males aged 15 to 19?

[1 mark]

Number of new cases = _____



0 4 . 7

There are no new cases of skin cancer diagnosed in males younger than 15 years of age.

Suggest **one** reason why.

[1 mark]

0 4 . 8

Give **one** conclusion from the data in **Figure 6**.

[1 mark]

0 4 . 9

Survival rates for all types of cancers have improved over the last 20 years.

Suggest **two** reasons why.

[2 marks]

1 _____

2 _____

10

Turn over for the next question

Turn over ►



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ANSWER IN THE SPACES PROVIDED**



0 5

Bacteria can cause a variety of diseases in humans.

0 5 . 1What 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 5 . 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 5 continues on the next page**Turn over ►**

0 5 . 3

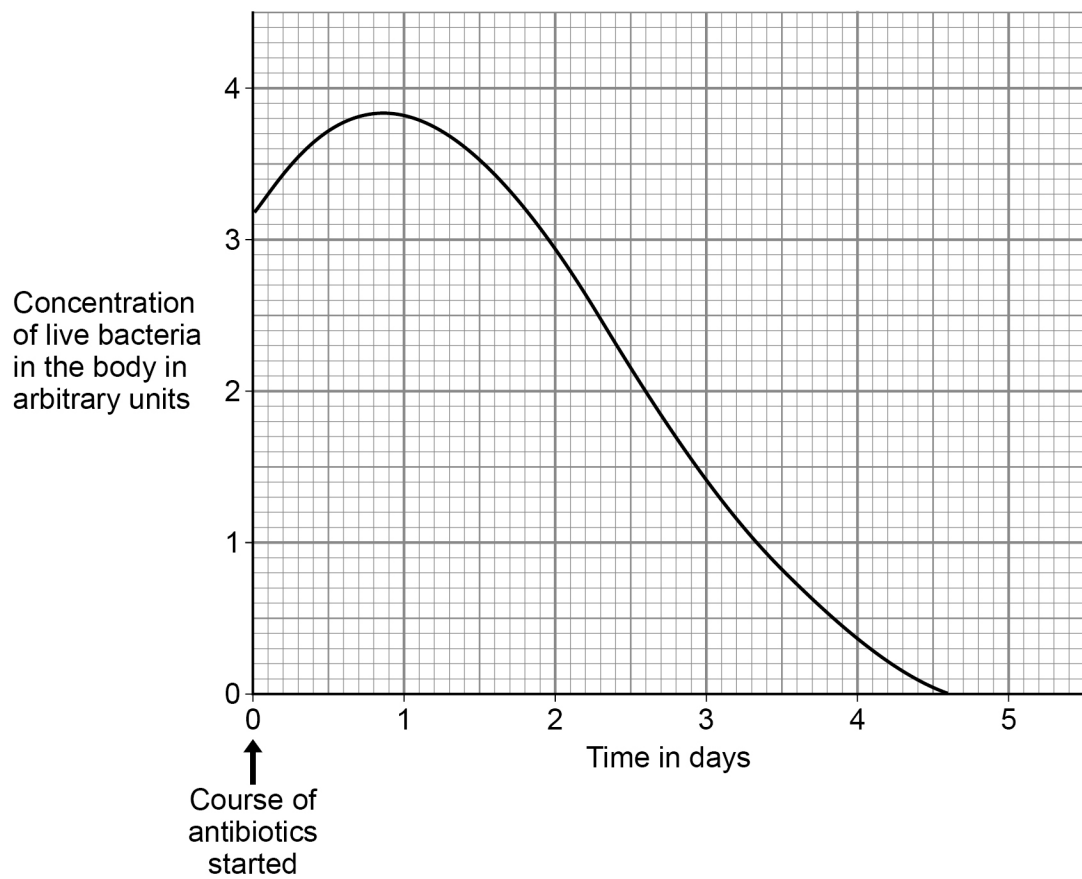
What is the name of the first antibiotic developed?

[1 mark]

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

Figure 7 shows how the concentration of live bacteria in the child's body changed when taking the course of antibiotics.

Figure 7



0 5 . 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 5 . 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 5 . 6

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

[1 mark]

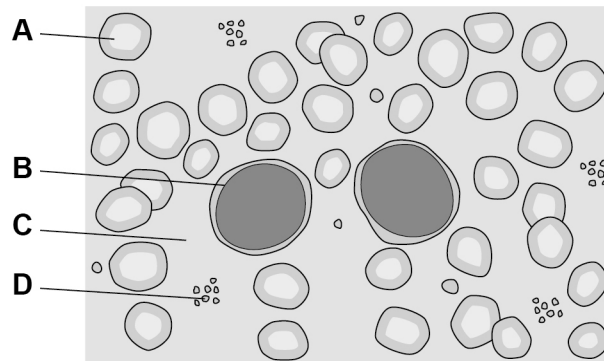
Question 5 continues on the next page

Turn over ►



Figure 8 shows blood viewed using a microscope.

Figure 8



0 5 . 7 A vaccine will stimulate the production of antibodies.

Which part of the blood in **Figure 8** produces antibodies?

[1 mark]

Tick (✓) **one** box.

A B C D

0 5 . 8 Which part of the blood in **Figure 8** starts the clotting process?

[1 mark]

Tick (✓) **one** box.

A B C D

9



0 6

This question is about cell division.

0 6 . 1

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

[1 mark]

cell	chromosome	gene	nucleus
------	------------	------	---------

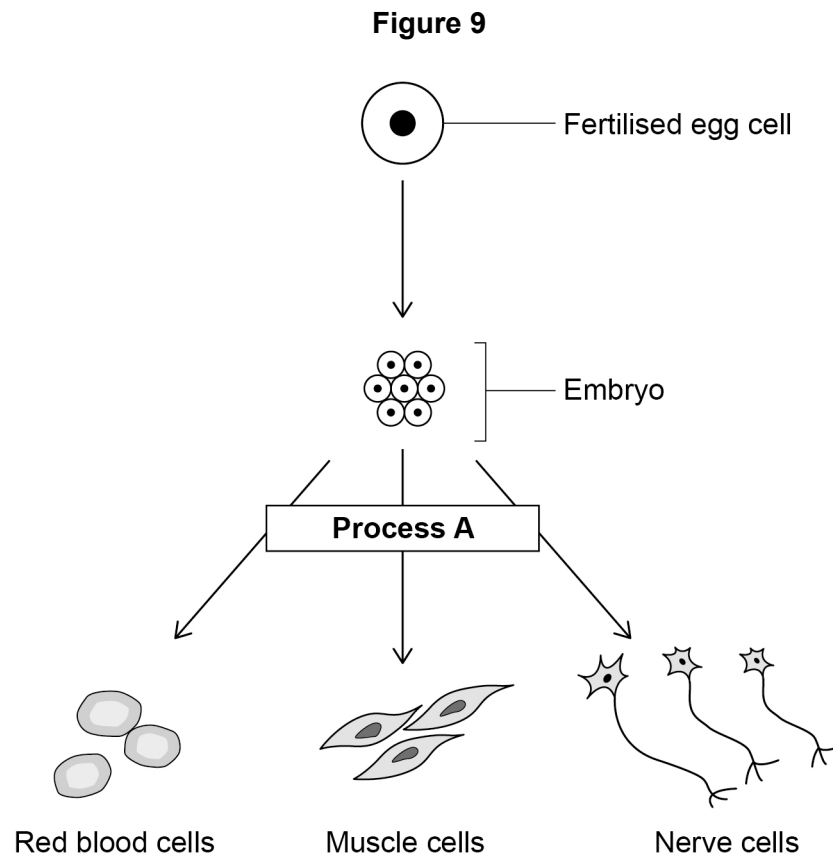
Smallest



Largest

Question 6 continues on the next page**Turn over ►**

Figure 9 shows how a fertilised egg cell can produce specialised cells.



0 6 . 2 Name **Process A**.

[1 mark]

0 6 . 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 = _____



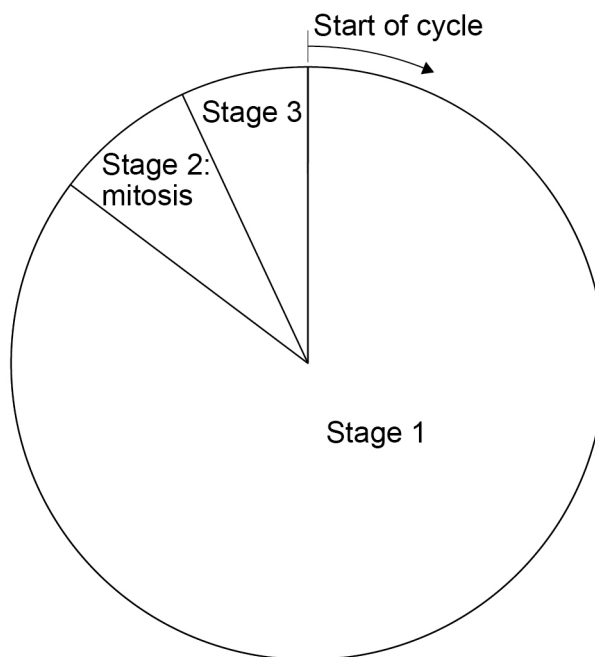
0 6 . 4 In humans a fertilised egg cell contains 23 pairs of chromosomes.

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

[1 mark]

0 6 . 5 **Figure 10** represents a cell cycle for a human embryonic cell.

Figure 10



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 _____

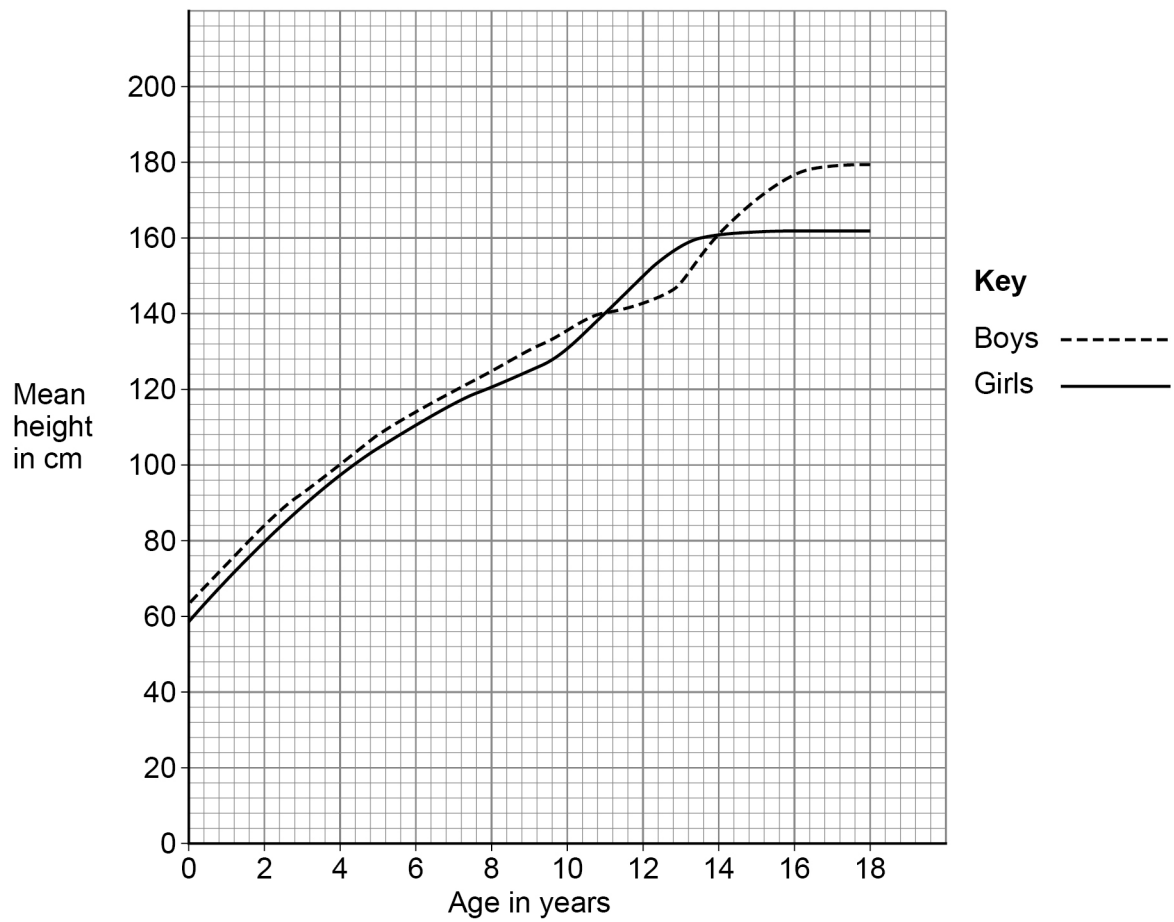
Turn over ►



Cell division is important in the growth of multicellular organisms.

0 6 . 6 **Figure 11** shows the mean height of boys and of girls from birth to age 18 years.

Figure 11



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ANSWER IN THE SPACES PROVIDED**



Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Biology Paper 2F

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.

Information

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



0 1

This question is about genetics.

0 1 . 1

Crop plants are genetically modified (GM) for useful characteristics.

Which useful characteristic are crops genetically modified for?

[1 mark]Tick (✓) **one** box.

Fewer roots

Larger yields

Smaller fruits

0 1 . 2What is **one** concern about GM crops?**[1 mark]**Tick (✓) **one** box.

GM crops will add to global warming.

GM crops will cause air pollution.

GM crops will harm wildlife.

GM crops will produce too much food.

Some inherited disorders are caused by a faulty piece of DNA.

0 1 . 3

What is the name of a piece of DNA that codes for a characteristic?

[1 mark]



0 1 . 4 DNA contains a code for making substances in the cell.

What type of substance is made using the DNA code?

[1 mark]

Tick (✓) **one** box.

Fat

Protein

Starch

Sugar

Cystic fibrosis (CF) is an inherited disorder.

The allele for having CF is recessive (**h**).

The allele for **not** having CF is dominant (**H**).

0 1 . 5 What is a recessive allele?

[1 mark]

Tick (✓) **one** box.

An allele that is always expressed.

An allele that is expressed if only one copy is present.

An allele that is only expressed if two copies are present.

Question 1 continues on the next page

Turn over ►



A man and a woman do **not** have CF. The man has the alleles **Hh**.

0 1 . 6 What word describes the alleles of the man?

[1 mark]

Tick (✓) **one** box.

Heterozygous

Homozygous

Phenotype

0 1 . 7 The man and the woman want to have a child.

Complete **Figure 1** to show the possible genotypes of the child.

Draw a ring around the genotype of a child who will have CF.

[3 marks]

Figure 1

		Woman	
		H	h
Man	H		
	h		hh



0 1 . 8

What is the chance that a child of the man and the woman will have CF?

[1 mark]

Tick (✓) **one** box.25% 50% 75% 100%

0 1 . 9

The woman is pregnant.

The woman can have embryo screening to find out if the child will have CF.

Suggest **one** reason why the woman might **not** want to have embryo screening.

[1 mark]

11

Turn over for the next question

Turn over ►



0 2 . 2 What type of factor is water in the soil?

[1 mark]

Tick (✓) **one** box.

A biotic factor

A control factor

An abiotic factor

0 2 . 3 Give **two** factors which might affect the number of buttercups growing on the school field.

Do **not** refer to water in your answer.

[2 marks]

1 _____

2 _____

0 2 . 4 Complete the sentence.

Choose the answer from the box.

[1 mark]

a control

the dependent

the independent

In this investigation the number of buttercups in each quadrat was

_____ variable.

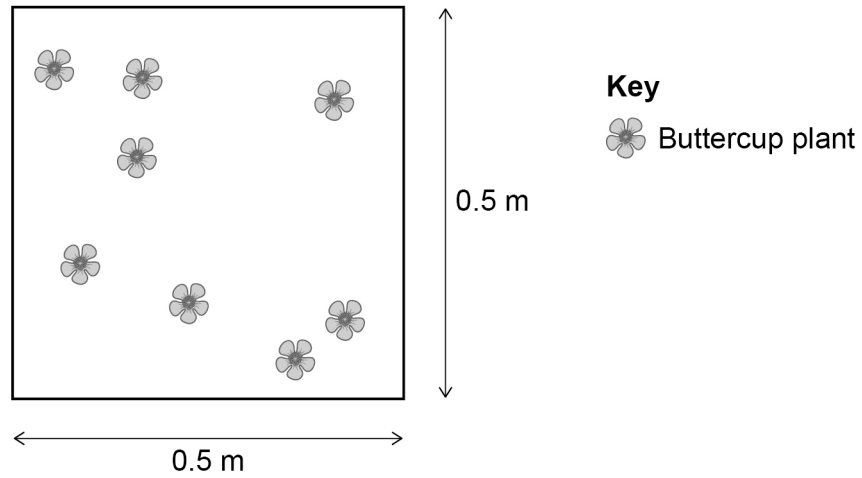
Question 2 continues on the next page

Turn over ►



Figure 2 shows a quadrat on an area of the school field.

Figure 2



0 2 . 5 Calculate the area of the quadrat.

[1 mark]

Area of the quadrat = _____ m²

0 2 . 6 The mean number of buttercups in one quadrat was 8

Calculate the number of buttercups per m²

Use your answer from Question **02.5**

[2 marks]

Number of buttercups = _____ per m²



Question 2 continues on the next page

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ANSWER IN THE SPACES PROVIDED**

Turn over ►



0 9

In a laboratory another group of students investigated the effect of soil acidity on the growth of beans.

This is the method used.

1. Put soil with a neutral pH in two large boxes.
2. Add acid to the soil in one box.
3. Plant some bean seeds in each box.
4. Water the seeds over 3 weeks.
5. After 3 weeks, measure the height of the bean plants in each box.
6. Calculate the mean height of bean plants in each box.

0 2 . 7

Give **two** improvements the students could make to the method to give more valid results.

[2 marks]

1 _____

2 _____



The students then carried out a valid investigation.

Table 1 shows the students' results.

Table 1

Bean plant	Height of bean plants in cm	
	Acid soil	Neutral soil
1	8	11
2	6	12
3	4	11
4	10	17
5	7	19
Mean	7	X

0 2 . 8 Calculate mean value **X** in **Table 1**.

[2 marks]

X = _____ cm

0 2 . 9 What conclusion can the students make about the effect of acid soil on the growth of bean plants?

[1 mark]

16

Turn over ►



0 3

The theory of evolution by natural selection was suggested by Charles Darwin in 1859.

Evidence from fossils supports Darwin's theory.

0 3**1**

What evidence supports the theory of evolution by natural selection?

[1 mark]

Tick (✓) **one** box.

Knowledge of how DNA controls inheritance

Knowledge of how the dinosaurs became extinct

Knowledge of how the Earth was formed

Knowledge of what causes global warming



0 3 . 2 **Figure 3** shows a fossil fly preserved in amber.

The fossil formed when the amber solidified with the fly trapped inside.

Figure 3



Why has the fly been preserved?

[1 mark]

Tick (✓) **one** box.

The amber has been kept at a constant temperature.

The fly was soft-bodied.

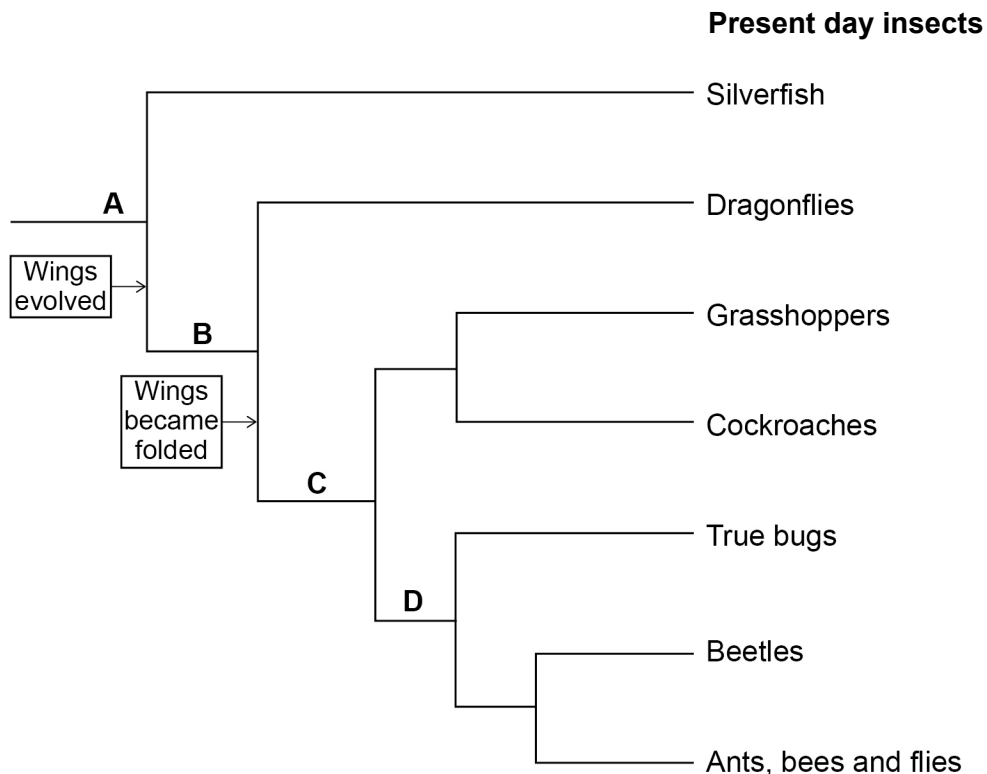
There was no oxygen in the amber.

Turn over ►



Figure 4 shows a simplified evolutionary tree for the insect group of animals.

Figure 4



0 3 . 3 Which present day insect evolved first?

[1 mark]

0 3 . 4 Animals A, B, C and D were ancestors of present day insects.

Which animal is the most recent ancestor of both grasshoppers and beetles?

[1 mark]

Tick (✓) **one** box.

A B C D

0 3 . 5 Name the group of present day insects which have wings which do **not** fold.

[1 mark]



0 3 . 6 The house fly has the binomial name *Musca domestica*.

Table 2 shows part of the classification for the house fly.

Table 2

Classification group	Name
Kingdom	
Phylum	arthropoda
Class	
Order	diptera
Family	muscidae
Genus	
Species	

Complete **Table 2**.

Choose answers from the box.

[3 marks]

animalia	domestica	Musca	insecta
-----------------	------------------	--------------	----------------

Question 3 continues on the next page

Turn over ►



03.7 Carl Woese proposed the 'three-domain system' of classification.

Which domain are insects in?

[1 mark]

Tick (✓) **one** box.

Archaea

Eukaryota

Prokaryota

9



Turn over for the next question

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Turn over ►

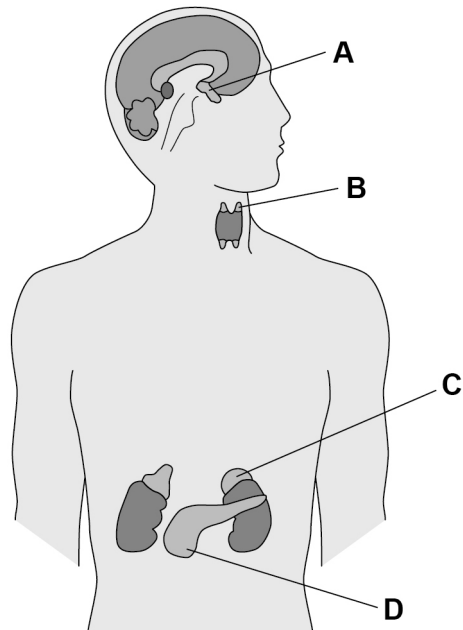


0 4

The endocrine system is made up of glands which secrete hormones.

Figure 5 shows the position of endocrine glands in the human body.

Figure 5



0 4 . 1

Which letter shows the pancreas?

[1 mark]

Tick (✓) **one** box.

A B C D

0 4 . 2

Which letter shows the thyroid gland?

[1 mark]

Tick (✓) **one** box.

A B C D



0 4 . 3 Hormones travel from the gland where they are made to the target organ where they have an effect.

How do hormones travel from the gland to the target organ?

[1 mark]

When blood glucose concentration becomes too high, hormone **X** from the pancreas causes a decrease in the glucose concentration.

0 4 . 4 Name hormone **X**.

[1 mark]

0 4 . 5 In what **two** ways does hormone **X** cause a decrease in blood glucose concentration?

[2 marks]

Tick (✓) **two** boxes.

Glucose is broken down.

Glucose is converted to glycogen.

Glucose is excreted by the kidneys.

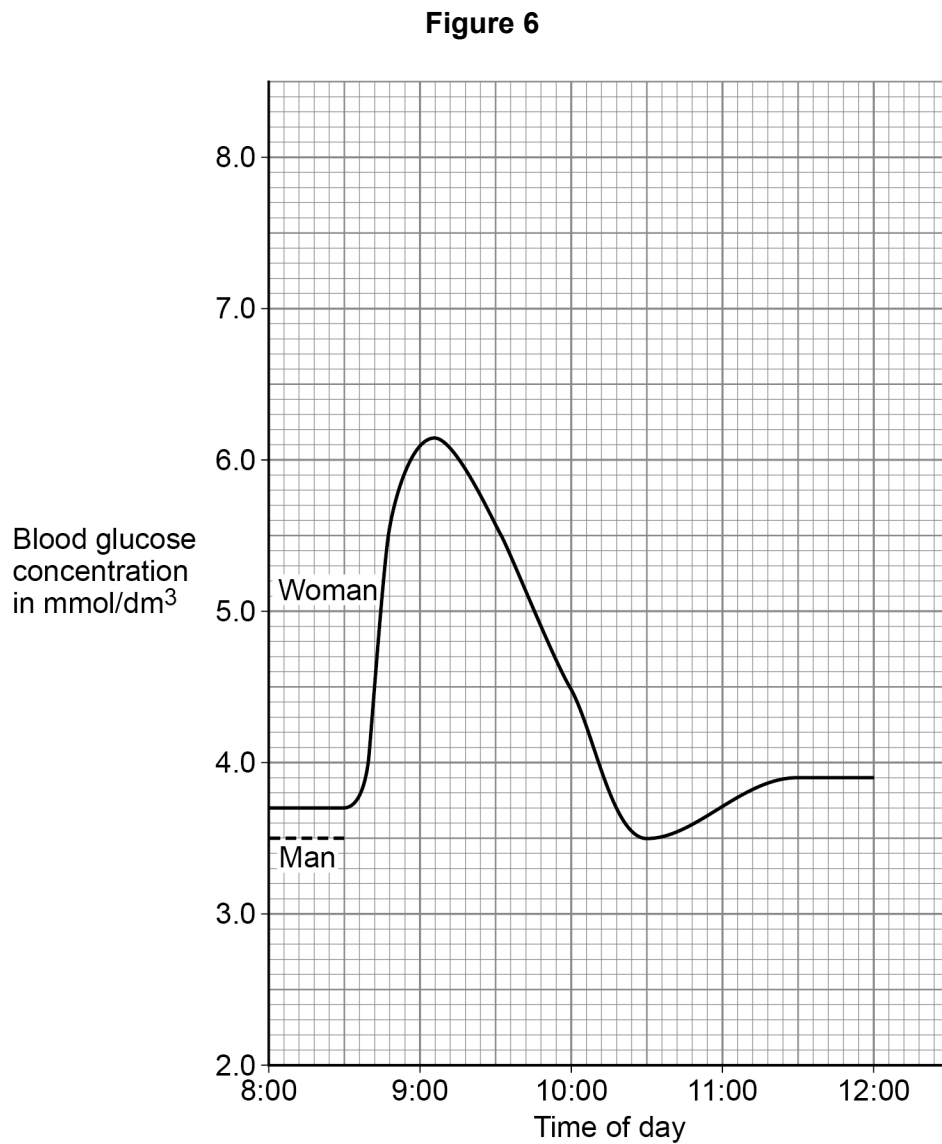
Glucose moves from the blood into the cells.

Glucose moves into the small intestine.

Turn over ►



Figure 6 shows the blood glucose concentration in a woman.



0 4 . 6 Suggest what time of day the woman ate her breakfast of sugar-coated cereal.

[1 mark]

Time of day = _____



The man in **Figure 6** has Type 2 diabetes but he has **not** been treated.

0 4 . 7

The man ate:

- the same type and amount of breakfast cereal as the woman
- at the same time as the woman.

Suggest what his blood glucose concentration would be at 9:00

[1 mark]

Blood glucose concentration = _____ mmol/dm³

0 4 . 8

The man:

- is an obese office worker
- does not exercise
- eats sugary snacks at his desk.

Give **two** lifestyle changes a doctor might recommend to the man to help him control his diabetes.

[2 marks]

1 _____

2 _____

0 4 . 9

Describe how a **low** blood glucose concentration would lead to a person feeling weak.

[2 marks]

12

Turn over ►



0 5

This question is about the cycling of water and carbon in ecosystems.

0 5 . 1

Which reaction produces water?

[1 mark]Tick (✓) **one** box.

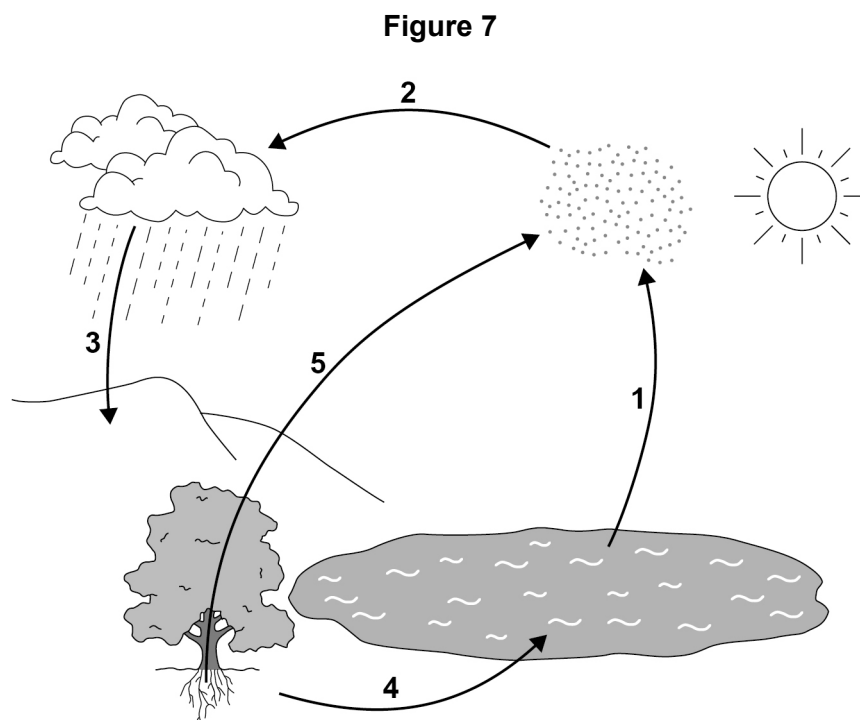
Aerobic respiration

Anaerobic respiration

Photosynthesis

The water cycle provides water for plants and animals on land before the water goes into lakes and seas.

Figure 7 represents the water cycle.



0 5 . 2 Name the processes **1** to **5** shown on **Figure 7**.

[5 marks]

- 1** _____
- 2** _____
- 3** _____
- 4** _____
- 5** _____

0 5 . 3 In 2007 the population of the world was 6 000 000 000

A study found that 4.5% of the population had severe water shortage.

Calculate how many people had severe water shortage.

Give your answer in standard form.

[3 marks]

Number of people (in standard form) = _____

Question 5 continues on the next page

Turn over ►



0 5 . 4 Why do more people have severe water shortage now than in 2007?

[2 marks]

Tick (✓) **two** boxes.

Climate change has increased the area of deserts.

Each person drinks less water.

More water is used to grow crops.

Sea levels have risen because the ice caps are melting.

Some countries have built de-salting factories for seawater.

Leaves on a tree contain carbon compounds.

In autumn the leaves fall to the ground.

0 5 . 5 Microorganisms in the soil recycle carbon from the leaves so that the carbon is used for new plant growth.

Explain how.

[4 marks]



0 5 . 6 What is **one** benefit of fallen leaves for living plants?

[1 mark]

Tick (✓) **one** box.

Energy is released for living plants.

Insect pests in the soil are killed.

Nitrates are released into the soil.

Oxygen is supplied to root cells.

16

Turn over for the next question

Turn over ►



0	6
---	---

Water pollution is a problem for humans and wildlife.

Explain how human activities are polluting rivers, lakes and seas.

[6 marks]

<hr/> 6

END OF QUESTIONS



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GCSE
COMBINED SCIENCE: TRILOGY
8464/B/1H

Biology Paper 1H

Mark scheme

June 2020

Version: 1.0 Final Mark Scheme

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[1 mark]

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[2 marks]

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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	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	concentration of the sugar solution		1	AO1 4.1.3.2 RPA 2
01.2	gained <u>water</u> (water moves) by osmosis or (because) concentration of water outside the potato is greater than inside the cells / potato	allow converse statements (because) concentration (of sugar solution) inside the potato is greater than outside the potato / cells	1 1	AO2 AO1 4.1.3.2 RPA 2
01.3	all points correctly plotted line of best fit drawn as a curve through all the points	allow $\pm \frac{1}{2}$ a square ignore extrapolation of curve	1 1	AO2 4.1.3.2 RPA 2
01.4	correct reading from their graph	allow $\pm \frac{1}{2}$ a square allow answer in range 0.23 to 0.24 (mol/dm ³) if no line drawn	1	AO3 4.1.3.2 RPA 2

<p>01.5</p>	$\frac{0.25 \times 100}{7.96}$ <p>= 3.14(070352)</p> <p>3.14 (%)</p>	<p>allow $\frac{(8.21-7.96) \times 100}{7.96}$</p> <p>allow correct rounding to 3 sig figs of an incorrectly calculated percentage change</p>	<p>1</p> <p>1</p> <p>1</p>	<p>AO2 4.1.3.2 RPA 2</p>
<p>Total</p>			<p>9</p>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	amylase	allow phonetic spelling allow carbohydrase do not accept amylose	1	AO1 4.2.2.1
02.2	small intestine		1	AO1 4.2.1 4.2.2.1
02.3	any one from: <ul style="list-style-type: none"> • greater magnification • higher resolving power 	allow can see (smaller) sub-cellular structures / parts allow can see more detail (inside cells) allow reference to 3-D images	1	AO1 4.1.1.5
02.4	capillary		1	AO2 4.2.2.1 4.2.2.2
02.5	$20 = \frac{\text{image length}}{0.8}$ image length = 0.8 x 20 image length = 16 (mm)		1 1 1	AO2 4.1.1.5 RPA 1
02.6	diffusion		1	AO3 4.1.3.1
02.7	active transport	allow active uptake	1	AO3 4.1.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	any one from: <ul style="list-style-type: none"> • respiration • to form glycogen • to make amino acids / proteins 	allow as an energy source do not accept to make / use / create / produce energy allow to make lipid / fat	1	AO1 4.4.2.1 4.4.2.3
02.9	Level 2: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.		3–4	AO2 4.1.1.3 4.1.3.1 4.1.3.3 4.2.2.1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.		1–2	
	No relevant content		0	
	Indicative content <ul style="list-style-type: none"> • have (many) microvilli • (to) increase surface area • wall of villus only one cell thick or is thin • capillaries are close to surface • (so) short pathway • good blood supply • (to) transport food molecules away or to the body • (and) maintain a diffusion gradient • cells have many mitochondria • (where) respiration takes place • (where) energy is transferred • (as) active transport requires energy • energy is needed to absorb sugar / food / molecules For Level 2 must make links between structure and it's function			
Total			14	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any one from: <ul style="list-style-type: none"> • (Type 2) diabetes • (coronary / ischaemic) heart disease / CHD • high blood pressure • cancer • depression 	ignore obesity do not accept Type 1 diabetes allow cardiovascular disease ignore heart attack / failure allow (osteo)arthritis	1	AO1 4.2.2.5 4.2.2.6
03.2	$27 = \frac{68.1}{\text{height}^2}$ $\text{height}^2 = 68.1 \div 27$ <p>or</p> $\text{height}^2 = 2.522(r) / 2.52 / 2.5$ $\text{height} = 1.59 \text{ (m)}$	allow height = $\sqrt{\frac{68.1}{27}}$ or allow height = $\sqrt{2.522(r)}$ allow a correctly rounded value if 2.5 is given in step 2 allow an answer of 1.58 (m)	1 1 1	AO2 4.2.2.5 4.2.2.6
03.3	overweight	answer must be consistent with height calculated in 03.2	1	AO3 4.2.2.5 4.2.2.6

<p>03.4</p>	<p>any three from:</p> <ul style="list-style-type: none"> • increased energy intake if more food eaten • if exercise more, more energy is transferred / released • if more energy is taken in than is transferred body mass increases or if less energy is taken in than is transferred body mass decreases • if energy intake = energy transferred body mass stays the same 	<p>max 2 marks if refer to energy being made / used / produced / created allow reference to calories / joules for energy</p> <p>allow increased energy intake if more fat / carbohydrate eaten allow converse allow energy taken in when you eat</p> <p>allow if exercise more, respiration / metabolism increases or is faster allow converse allow energy is transferred during exercise do not accept energy is burnt during exercise</p> <p>allow if less energy is transferred than is taken in body mass increases or if more energy is transferred than is taken in body mass decreases</p> <p>if no marks are awarded allow 1 mark for food eaten can increase body mass and exercise can decrease body mass or allow 1 mark for if a lot of food is eaten and little exercise is done body mass increases allow converse</p>	<p>3</p>	<p>AO2 4.2.2.5 4.2.2.6 4.4.2.2 4.4.2.3</p>
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Question	Answers	Mark	AO / Spec. Ref.
03.5	Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 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	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content During exercise: <ul style="list-style-type: none"> • increased breathing rate • increased breath volume • (to) take in more oxygen for (aerobic) respiration • (and) exhale more carbon dioxide • increased heart rate • (so) increased blood flow (to muscles) • (to) transport oxygen / glucose to respiring cells faster • (and) increase rate of carbon dioxide removal • glycogen converted to glucose <ul style="list-style-type: none"> • insufficient oxygen supplied (during prolonged vigorous exercise) • (so) lactic acid is formed (during anaerobic respiration) • (and) an oxygen debt is created • (lactic acid causes) <u>muscles</u> become fatigued / tired or (causes) <u>muscles</u> to stop contracting efficiently • allow reference to sweating or increased body temperature or vasodilation (during or after exercise) After exercise: <ul style="list-style-type: none"> • heart rate remains high or heart rate slowly decreases • continue to breathe rapidly or breathing rate slowly decreases • (to) pay back oxygen debt • oxygen debt is the amount of oxygen needed to break down lactic acid • (and to) provide more oxygen to react with the lactic acid and remove it from cells • (some) lactic acid transported to liver • (lactic acid) is converted back into glucose <p>For Level 3 need reference to:</p> <ul style="list-style-type: none"> • changes during and after exercise • lactic acid and its removal. 		
Total		14	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	<p>any four from:</p> <ul style="list-style-type: none"> • bacterial cell is smaller (than a plant cell) • bacterial cell does not have chloroplasts (plant cell does) • bacterial cell does not have its DNA / genetic material inside a nucleus (plant cell does) • bacterial cell (may) have plasmids (plant cell does not) • bacterial cell does not have mitochondria (plant cell does) • cell wall in bacterial cells is not made of cellulose (cell wall in plant cells is) • bacterial cell does not have a large / permanent vacuole (plant cell does) • bacterial cell has smaller ribosomes (than plant cells) 	<p>allow converse statements 'it' refers to bacteria</p> <p>ignore chlorophyll</p> <p>allow bacterial cell does not have a nucleus (plant cell does)</p> <p>allow bacterial cell has DNA / genetic material in a ring / loop (plant cell does not)</p> <p>allow bacterial cell has DNA / genetic material free in cytoplasm</p> <p>do not accept idea that bacterial cells do not have ribosomes</p> <p>allow bacterial cell (may) have a flagellum (plant cells do not)</p> <p>allow bacterial cell (may) have a slime capsule (plant cell does not)</p>	4	AO1 4.1.1.1 4.1.1.2

<p>04.2</p>	<p>any four from:</p> <ul style="list-style-type: none"> • dead / inactive / weakened form of pathogen / bacterium / microorganism is introduced / injected • white blood cells stimulated to produce antibodies • reference to memory cells made or remain • on re-exposure specific / correct antibodies are made (very) quickly • bacteria / pathogens / microorganisms killed and do not produce a large enough population to cause the disease 	<p>allow introduce / inject antigen(s) from the pathogen</p> <p>allow dead / inactive / weakened form of <i>Gonorrhoea</i> (bacteria) introduced / injected</p> <p>do not accept inject Gonorrhoea disease</p> <p>do not accept incorrect white blood cell, eg phagocyte</p> <p>allow on re-exposure specific / correct antibodies are produced in large quantities</p> <p>allow bacteria / pathogens / microorganisms killed and do not produce a large enough population to produce toxins</p>	<p>4</p>	<p>AO1 4.3.1.7</p> <p>AO2 4.3.1.1</p>
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<p>04.3</p>	<p>fewer bacteria / pathogens in chicken / eggs / food</p> <p>(so) fewer bacteria are ingested (by humans)</p> <p>or</p> <p>fewer bacteria / pathogens ingested (by humans) (1)</p> <p>(so) fewer toxins produced (1)</p>	<p>ignore references to immunity unqualified</p> <p>allow fewer chickens / eggs will carry the bacteria / pathogens</p> <p>ignore chickens do not get disease / infected</p> <p>allow idea of fewer bacteria being passed on to humans in food</p> <p>allow idea of fewer bacteria being passed on to humans in food (1)</p>	<p>1</p> <p>1</p>	<p>AO2</p> <p>4.3.1.3</p> <p>4.3.1.1</p>
<p>04.4</p>	<p>wash hands before preparing food</p> <p>wash hands after using the toilet</p>	<p>ignore wash hands unqualified</p> <p>allow good food hygiene</p> <p>allow clean areas where a person has been ill</p> <p>allow do not shake hands (with someone who has food poisoning)</p>	<p>1</p>	<p>AO1</p> <p>4.3.1.1</p> <p>4.3.1.3</p>
<p>04.5</p>	<p>warmer weather so bacteria reproduce / increase faster</p>	<p>ignore bacteria are killed at low temperatures</p> <p>allow food not cooked properly on barbeques</p>	<p>1</p>	<p>AO3</p> <p>4.3.1.1</p> <p>4.3.1.3</p>
<p>Total</p>			<p>12</p>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	measure the volume of oxygen produced in a given time or when more oxygen is produced in a given time the rate of photosynthesis is faster	a reference to rate is needed allow gas for oxygen allow when oxygen is produced faster the rate of photosynthesis is faster ignore the faster the rate of photosynthesis, the more oxygen is produced allow the slower the oxygen is produced the slower the rate of photosynthesis or less oxygen being produced in a given time, the slower the rate of photosynthesis	1	AO1 4.4.1.1 4.4.1.2 RPA 5
05.2	light (intensity)	ignore temperature	1	AO2 4.4.1.2
05.3	20 000 (lux)	allow answers in range 19 500 to 20 500 (lux)	1	AO3 4.4.1.2

05.4	there is a cost for heating the greenhouse		1	AO3 4.4.1.1 4.4.1.2
	there is a cost for increasing the carbon dioxide in the atmosphere (of the greenhouse)	allow there is a cost for lighting (in winter)	1	
	(therefore) the additional costs might exceed the (additional) sale price / profit or (additional) costs could not be recovered by increasing the sale price of the tomatoes	ignore these additional costs would reduce profits unqualified	1	
05.5	when there is no light there is no photosynthesis		1	AO1
	(so) no oxygen is produced		1	AO1
	(but) respiration happens (all the time) and oxygen is used		1	AO1
	(therefore) the net / overall oxygen production is negative / - 2 (arbitrary units)	do not accept an answer of -2 (arbitrary units) unqualified	1	AO2 4.4.1.1 4.4.1.2 4.4.2.1
Total			10	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	3 years		1	AO2 4.3.1.9
06.2	any one from: <ul style="list-style-type: none"> • to reduce any risk • to look for side effects 	allow idea (if it is unsafe) less harm will be caused with a lower dose ignore that it may be unsafe / dangerous unqualified ignore unknown side effects unqualified	1	AO1 4.3.1.9
06.3	too great a risk for ill person / patient patient might be taking another drug or side effects of drug are easier to identify	allow may make their condition worse allow less risk to healthy person ignore references to immune system allow unhealthy person might be taking another drug ignore to see side effects unqualified	1 1	AO2 4.3.1.9
06.4	any one from: <ul style="list-style-type: none"> • to prevent false claims • to make sure the results / conclusions are correct / valid • to avoid bias 	ignore references to accuracy, reliability or precision	1	AO2 4.3.1.9

Question	Answers	Mark	AO / Spec.
06.5	Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3 4.3.1.9
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	<p>Indicative content</p> <p>arguments for use:</p> <ul style="list-style-type: none"> • will save the NHS money • (approximately) 20 times as many people or 19 more people can be treated compared to Drug A • (approximately) 29 times as many people can be treated compared to Drug B (allow 28 times or 28 / 27 more people) • more people can be treated for the same cost • patients will be treated sooner • improves patient choice • used in other countries so likely to be effective • used in other countries so likely to be safe • likely to have been tested in other countries <p>arguments against use:</p> <ul style="list-style-type: none"> • injections of drug not tested (in UK) • cannot be sure it is as effective as Drug A / Drug B • cannot be sure if it is safe to use • may have unknown side effects • doctors cannot be confident in prescribing Drug C • goes against regulations / laws regulating drug development / use • might set a precedent for other drugs not to be fully tested • might set a precedent for other non- approved / unlicensed drugs to be used <p>Need advantages and disadvantages for Level 2</p>		
Total		11	

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8464/B/2H**

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Version: 1.0 Final



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[2 marks]

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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.

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	Answers	Extra information	Mark	AO / Spec. Ref.
01.1			1	AO2 4.6.1.3
01.2	any one from: <ul style="list-style-type: none"> • 2 strands / chains that are twisted / coiled / spiralled • double helix • (long) polymer 	allow cross links between 2 strands / chains allow reference to nucleotides or sugars, phosphates and bases	1	AO1 4.6.1.3
01.3	amino acids protein	in this order only allow polypeptide	1 1	AO1 4.6.1.3
01.4	all the genetic material (of an organism)	allow DNA / genes for genetic material ignore chromosomes	1	AO1 4.6.1.3
01.5	tracing how aboriginal people spread across Australia		1	AO2 4.6.1.3
01.6	variation	ignore genetic/environmental	1	AO1 4.6.2.1

<p>01.7</p>	<p>stronger / larger (shell)</p> <p>(so) more likely to (survive and) breed</p> <p>or</p> <p>(so) more likely to (survive and) pass on genes</p> <p>OR</p> <p>(better) camouflaged (1)</p> <p>(so) less likely to be eaten and will breed more (1)</p>		<p>1</p> <p>1</p>	<p>AO2</p> <p>4.6.2.2</p>
<p>Total</p>			<p>9</p>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	any four from: <ul style="list-style-type: none"> • (stimulus is) detected by the receptor • (initiates) an electrical impulse • (impulse) travels via the neurones • sensory, relay and motor • crosses synapses • (crosses synapses) as a chemical 	allow in this order only	4	AO1 AO2 4.5.2
02.2	Level 2: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		3–4	AO2
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.		1–2	AO1
	No relevant content		0	4.5.2 RPA 6
	Indicative content <ul style="list-style-type: none"> • select at least 3 people • do reaction time test at least 3 times using right hand • details on how to do test in valid manner • find a mean • remove anomalous readings • repeat for each person for left hand • select people of same age • select people of same gender • same time of day • other control such as amount of coffee, sleep. <p>To access level 2 the right hand and left hand of each person must be compared</p>			
02.3	$\frac{(0.2 + 0.4 + 0.3 + 0.4 + 0.2 + 0.3)}{6}$		1	AO2 4.5.2 RPA 6
	or $\frac{1.8}{6}$ 0.3		1	

02.4	reaction time	allow time	1	AO2 4.5.2 RPA 6
02.5	students who play tennis (regularly) had shorter / faster (mean) reaction time(s)		1	AO3 4.5.2 RPA 6
02.6	any one from: <ul style="list-style-type: none"> • overlap in times between two groups • small difference in (mean) times • small sample used 	allow correctly described as comparative data allow students who did not play tennis may have played other (ball) games	1	AO3 4.5.2 RPA 6
Total			13	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	the variety of all the different <u>species</u> (of organisms) on Earth or the variety of all the different <u>species</u> (of organisms) in a habitat / area / ecosystem		1	AO1 4.7.3.1
03.2	any one from: <ul style="list-style-type: none"> • compost / fertiliser • (burned as) a fuel 	allow to grow food / crops / plants allow to improve soil texture	1	AO1 4.7.3.3
03.3	decay / burning of peat releases carbon dioxide (into the atmosphere) which is increasing global warming	do not accept peat bogs release carbon dioxide into the atmosphere allow a description of global warming or consequences if no other mark awarded allow removal of a carbon sink / store for 1 mark	1 1	AO1 4.7.3.3 4.7.3.5

<p>03.4</p>	<p>any two from:</p> <ul style="list-style-type: none"> • takes minerals from the soil as crops are harvested / removed • leads to soil erosion • farmers have to use fertilisers which pollute water / streams / lakes • burning crop waste produces carbon dioxide • using large farm machinery causes soil compaction 	<p>ignore nutrients</p> <p>allow burning crop waste causes global warming</p> <p>allow using large farm machinery releases carbon dioxide</p>	<p>2</p>	<p>AO3 4.7.3.2 4.7.3.3 4.7.3.5 4.7.3.6</p>
<p>03.5</p>	<p>antibiotic passed into the environment in animal faeces / urine / sewage</p> <p>or</p> <p>antibiotic in animal faeces / urine / sewage flows into rivers</p> <p>bacteria in water / land become antibiotic resistant</p> <p>some of these bacteria are human pathogens</p> <p>(so) cause (human) diseases which now cannot be cured because they are antibiotic resistant</p>	<p>allow named water or land pathogen such as typhoid / cholera / E coli</p> <p>If no other marks awarded allow 1 mark for mention of antibiotics in milk / meat being consumed by humans.</p>	<p>1</p> <p>1</p> <p>1</p>	<p>AO2</p> <p>AO2</p> <p>AO3</p> <p>AO3</p> <p>4.6.3.4 4.7.3.2</p>
<p>Total</p>			<p>10</p>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.												
04.1	four daughter cells are formed		1	AO1 4.6.1.2												
	the parent cell divides twice		1													
04.2	thyroid (gland)	in this order only	1	AO1 4.5.3.1												
	adrenal (gland)		1													
	ovary / ovaries		1													
04.3	<table border="1"> <thead> <tr> <th>Hormone</th> <th>Name of gland which releases hormone</th> <th>Target organ of hormone</th> </tr> </thead> <tbody> <tr> <td>Luteinising hormone (LH)</td> <td>Pituitary gland</td> <td>Ovary</td> </tr> <tr> <td>Adrenaline</td> <td>Adrenal gland</td> <td>Heart / lungs / liver</td> </tr> <tr> <td>Glucagon</td> <td>Pancreas</td> <td>Liver / muscle</td> </tr> </tbody> </table>		Hormone	Name of gland which releases hormone	Target organ of hormone	Luteinising hormone (LH)	Pituitary gland	Ovary	Adrenaline	Adrenal gland	Heart / lungs / liver	Glucagon	Pancreas	Liver / muscle		AO2 4.5.3.3 4.5.3.6 4.5.3.2
	Hormone	Name of gland which releases hormone	Target organ of hormone													
	Luteinising hormone (LH)	Pituitary gland	Ovary													
	Adrenaline	Adrenal gland	Heart / lungs / liver													
Glucagon	Pancreas	Liver / muscle														
		1														
		1														
		1														
04.4	only need 1 parent plant		1	AO3 4.6.1.1												
	will produce (many genetically) identical plants		1													
		allow for 1 mark it is a faster process allow for 1 mark will produce a large number of plants at one time ignore clones unqualified														

<p>04.5</p>	<p>any two from:</p> <ul style="list-style-type: none"> • genetically identical so will all be susceptible to same diseases / pathogens • no genetic variety for new colours / characteristics to offer customers • no genetic variety leads to weaker / unhealthy plants (due to lack of evolution) 		<p>2</p>	<p>AO3 4.6.1.1 4.6.2.2</p>
<p>Total</p>			<p>12</p>	

Question	Answers	Extra information	Mark	AO / Spec. Ref.									
<p>05.1</p>	<p>(male gametes) X and Y</p> <p>all offspring correct</p> <div style="text-align: center;"> <p>Female</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>X</td> <td>X</td> </tr> <tr> <td>X</td> <td>XX</td> <td>XX</td> </tr> <tr> <td>Y</td> <td>XY</td> <td>XY</td> </tr> </table> <p>Male</p> </div>		X	X	X	XX	XX	Y	XY	XY	<p>allow correct offspring from incorrect gametes</p>	<p>1</p> <p>1</p>	<p>AO1</p> <p>AO2</p> <p>4.6.1.6</p>
	X	X											
X	XX	XX											
Y	XY	XY											
<p>05.2</p>	<p>It is (50%) chance if sperm cells which fertilised the egg has X (or Y) chromosome</p>	<p>allow each / every child / baby / pregnancy has a 50% chance of being male or female (so can be all same sex)</p>	<p>1</p>	<p>AO2</p> <p>4.6.1.6</p> <p>4.6.1.4</p>									

<p>05.3</p>	<p>both parents shown as heterozygous</p> <p>derivation correct to show 1 unaffected, 2 carriers and 1 affected offspring.</p> <div style="text-align: center;"> <p>Woman</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>T</td> <td>t</td> </tr> <tr> <td>Man</td> <td>T</td> <td>Tt</td> </tr> <tr> <td></td> <td>t</td> <td>Tt</td> </tr> </table> </div> <p>tt identified as offspring with CF</p> <p>correct ratio / probability from their derivations of tt e.g. 1:3, 1 in 4, 25%, 0.25</p>		T	t	Man	T	Tt		t	Tt	<p>allow correct derivation from incorrect gametes</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>AO2</p> <p>AO2</p> <p>AO2</p> <p>AO3</p> <p>4.6.1.5</p> <p>4.6.1.4</p>
	T	t											
Man	T	Tt											
	t	Tt											
<p>05.4</p>	<p>any three from:</p> <ul style="list-style-type: none"> • does not need IVF which is stressful / invasive • higher chance of successful pregnancy as risk of miscarriage is low compared to (30%) success rate of IVF • the test is freely available • the test can be carried out even once the mother is pregnant 	<p>allow method 2 is not available to all couples who want it</p>	<p>3</p>	<p>AO3</p> <p>4.5.3.5</p> <p>4.6.1.5</p>									

05.5	<p>any one from:</p> <ul style="list-style-type: none"> • child will (definitely) not have CF • do not need to consider termination • it is a way to have a child if couples are having fertility problems 		1	AO3 4.5.3.5 4.6.1.5
Total			11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	archaea	allow archea or archaia as phonetic spelling	1	AO1 4.6.4
06.2	horizontal line from –415 to –65 (labelled ammonites)	allow -410 to -420 for -415 (to -65) allow oblique line	1	AO2 4.6.3.3
06.3	ammonites = 350 (million years) and trilobites = 266 (million years) 84 million (years) or 84 000 000	allow range 345 to 355	1	AO2 4.6.3.3
		allow correct calculation from their answer for ammonites allow answers in standard form	1	
06.4	68 and 96 [(96-68) ÷ 68] × 100 41.17647... or 41.2 or 41	allow +/- half a small square	1	AO2 4.6.3.3
			1	
			1	
Total			7	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.		4–6	AO1 4.7.3.4 4.7.3.5 4.7.1.2 4.7.3.6 4.7.2.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.		1–3	
	No relevant content		0	
	Indicative content Reasons <ul style="list-style-type: none"> • tropical rainforests cleared for land • that land used to raise cattle, plant rice or plant crops such as coffee • land cleared for mining • that land used to grow biofuels or palm oil • (temperate) forests cut down for wood for building / paper • (temperate) forests cleared for farming (wheat / sheep) Effects <ul style="list-style-type: none"> • less trees to take in carbon dioxide for photosynthesis • decay by microorganisms respiring releases carbon dioxide • burning waste wood releases carbon dioxide • build-up of carbon dioxide in atmosphere leads to greenhouse effect • build-up of carbon dioxide in atmosphere leads to global warming • consequences of global warming • habitat loss • leading to reduced biodiversity • leading to soil erosion Must consider both reasons and effects for Level 2.			
07.2	(forests) involve gas exchange with the atmosphere		1	AO1 4.4.1.2

07.3	(in forests) carbon dioxide is used and oxygen is released whereas in lungs it is oxygen used and carbon dioxide is released	allow gas exchange occurs by diffusion in the leaves of trees, but involves ventilation / breathing in the lungs of animals	1	AO1 4.4.2.1
Total			8	

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE COMBINED SCIENCE: TRILOGY

H

Higher Tier
Biology Paper 1H

Tuesday 12 May 2020

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.
- 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.

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	
6	
TOTAL	



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ANSWER IN THE SPACES PROVIDED**



0 1

A student investigated the effect of different concentrations of sugar solution on pieces of potato.

This is the method used.

1. Cut five pieces of potato.
2. Record the starting mass of each piece of potato.
3. Place each piece of potato in a different concentration of sugar solution.
4. After 24 hours remove the pieces of potato from the solutions.
5. Record the final mass of each piece of potato.
6. Calculate the change in mass for each piece of potato.

0 1 . 1

What is the independent variable?

[1 mark]

Tick (✓) **one** box.

Change in mass of the pieces of potato

Concentration of the sugar solution

Length of time the pieces of potato are in the solution

Starting mass of the pieces of potato

Question 1 continues on the next page

Turn over ►

Table 1 shows the results.

Table 1

Concentration of sugar solution in mol/dm ³	Mass of potato at start in grams	Mass of potato after 24 hours in grams	Change in mass in grams
0.0	7.94	10.14	2.20
0.1	7.95	9.10	1.15
0.2	7.96	8.21	0.25
0.3	7.93	7.53	-0.40
0.4	7.93	7.18	-0.75
0.5	7.95	7.00	-0.95

0 1 . 2

Explain why the potato in 0.0 mol/dm³ sugar solution increased in mass.

[2 marks]



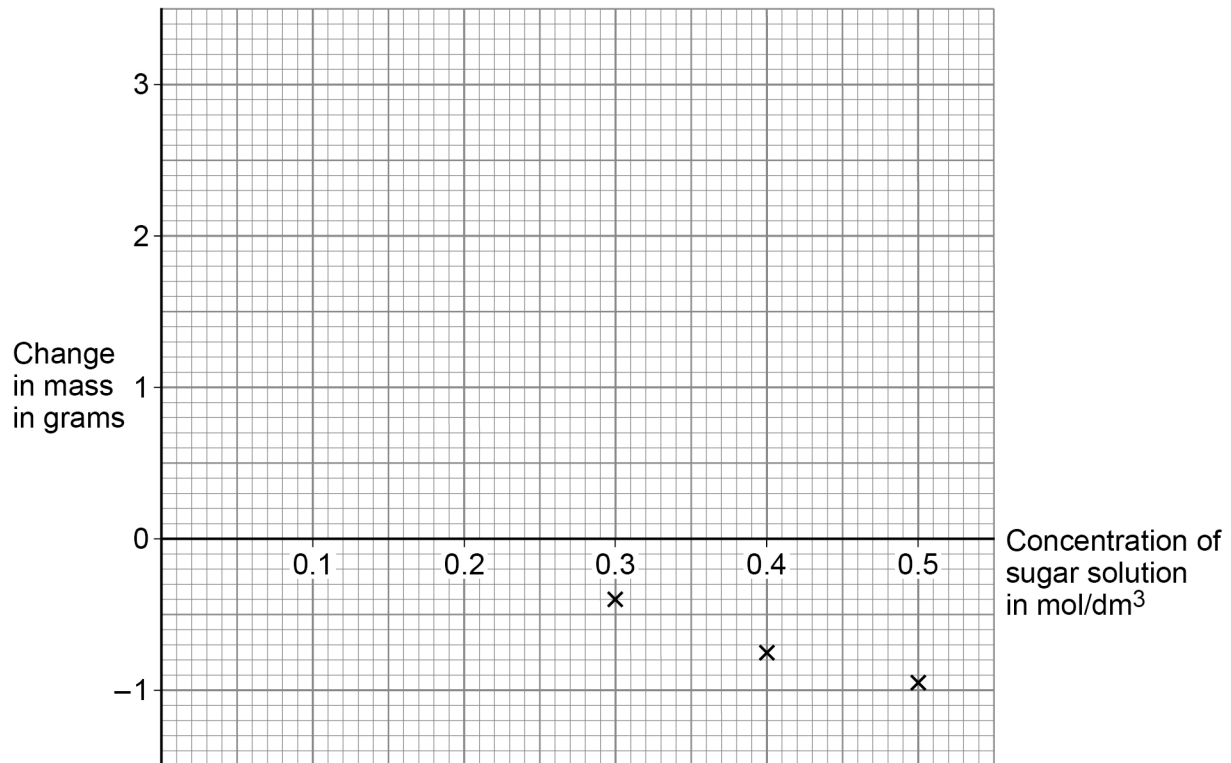
0 1 . 3

Complete **Figure 1**.

Some of the results have been plotted for you.

You should:

- plot the data from **Table 1**
- draw a line of best fit through all the points.

[2 marks]**Figure 1**

0 1 . 4

The mass of a piece of potato does **not** change when:

concentration of solution inside cells = concentration of solution outside cells

Determine the concentration of sugar solution inside the potato cells.

Use **Figure 1**.**[1 mark]**Concentration = _____ mol/dm³**Turn over ►**

Table 1 is repeated below.

Table 1

Concentration of sugar solution in mol/dm ³	Mass of potato at start in grams	Mass of potato after 24 hours in grams	Change in mass in grams
0.0	7.94	10.14	2.20
0.1	7.95	9.10	1.15
0.2	7.96	8.21	0.25
0.3	7.93	7.53	-0.40
0.4	7.93	7.18	-0.75
0.5	7.95	7.00	-0.95

0 1 . 5

Calculate the percentage change in mass for the potato in 0.2 mol/dm³ sugar solution.

Use Table 1.

Use the equation:

$$\text{percentage change in mass} = \frac{\text{change in mass}}{\text{mass of potato at start}} \times 100$$

Give your answer to 3 significant figures.

[3 marks]

Percentage change in mass (3 significant figures) = _____ %

9



0 2

Starch is digested to form sugar molecules in the digestive system.

0 2 . 1

What is the name of the enzyme that digests starch?

[1 mark]

0 2 . 2

Where are most food molecules absorbed?

[1 mark]

Tick (✓) **one** box.

Large intestine

Liver

Small intestine

Stomach

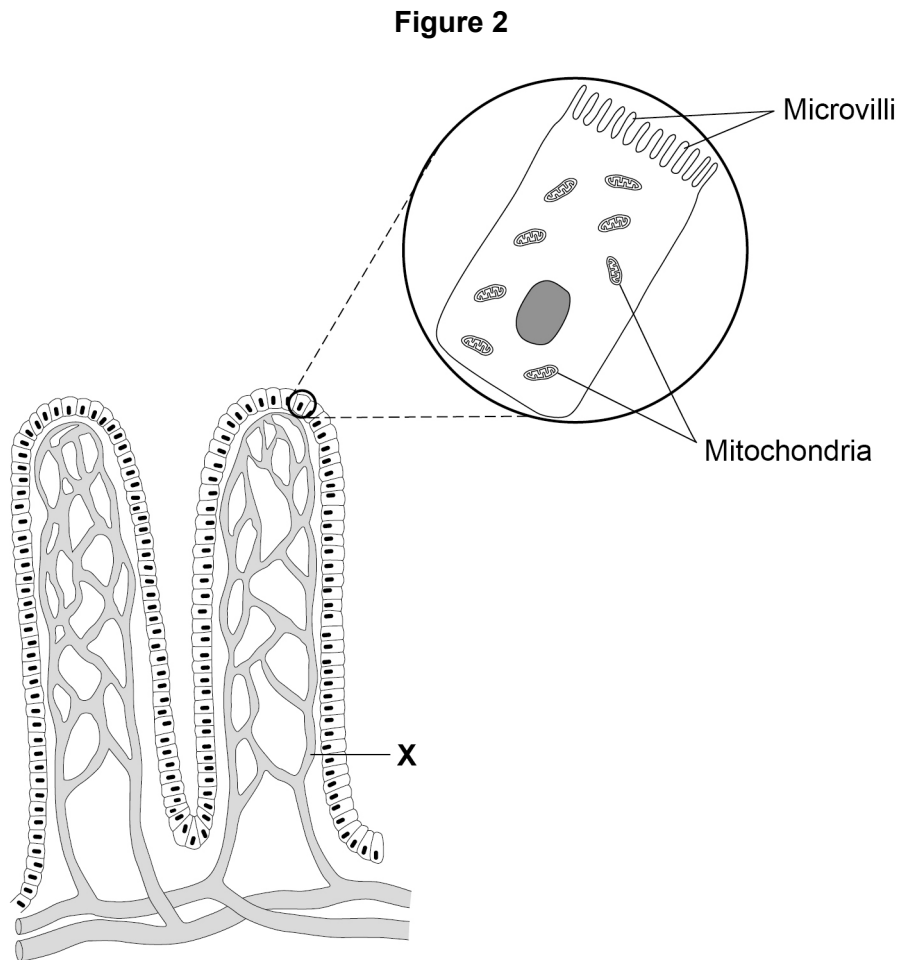
Question 2 continues on the next page

Turn over ►



Figure 2 shows two villi.

Figure 2 also shows one cell on the surface of a villus as seen using an electron microscope.



0 2 . 3

Give **one** advantage of using an electron microscope compared with using a light microscope.

[1 mark]



0 2 . 4 What type of blood vessel is labelled **X**?

[1 mark]

Tick (✓) **one** box.

Artery

Capillary

Vein

0 2 . 5 The real length of one villus is 0.8 mm

Calculate the image length if the villus is viewed at a magnification of $\times 20$

Use the equation:

$$\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$$

[3 marks]

Image length = _____ mm

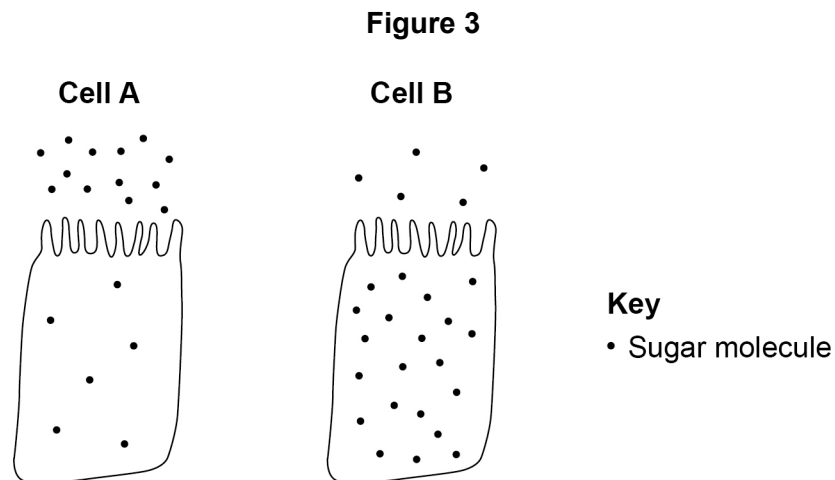
Question 2 continues on the next page

Turn over ►



Figure 3 shows two cells from the surface of a villus.

There are sugar molecules inside and next to each cell.



0 2 . 6 Name the process by which sugar moves into cell **A**.

[1 mark]

0 2 . 7 Name the process by which sugar moves into cell **B**.

[1 mark]

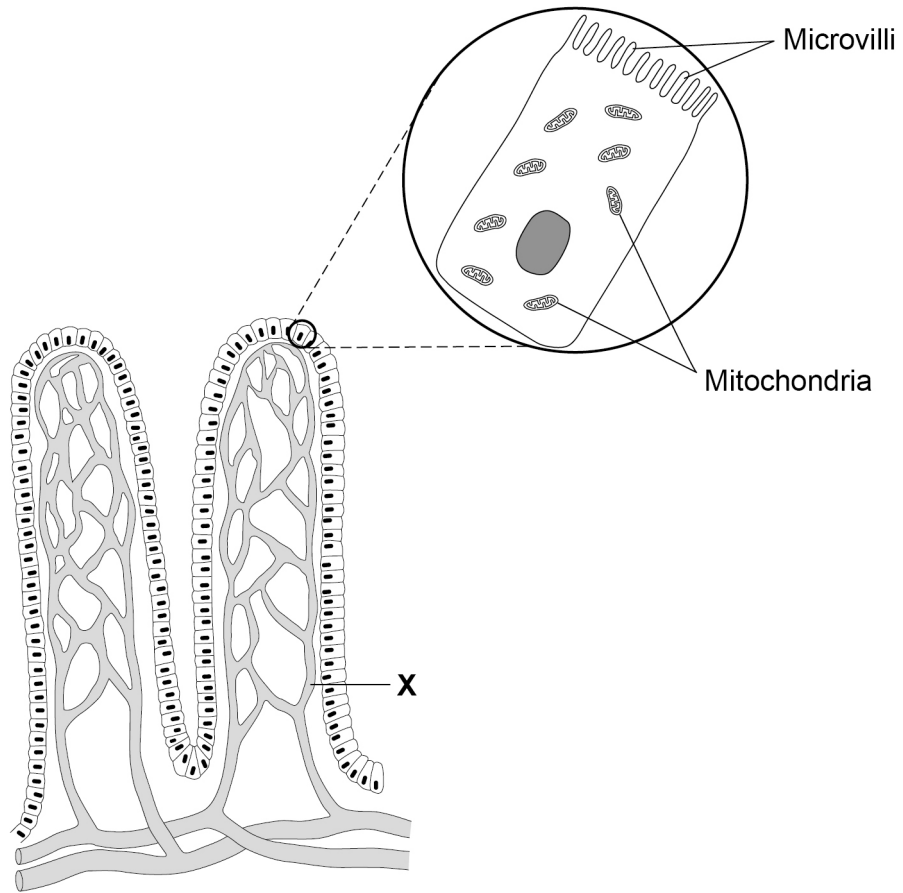
0 2 . 8 Give **one** use of sugar in the body.

[1 mark]



0 2 . 9 Figure 2 is repeated below.

Figure 2



Explain how villi are adapted for efficient absorption of sugar molecules.

[4 marks]

14

Turn over ►



0 3 Being overweight can affect the health and life expectancy of a person.

0 3 . 1 Give **one** disease related to being overweight.

[1 mark]

0 3 . 2 Body mass index (BMI) helps to show if a person has a healthy body mass for their height.

BMI is calculated using the equation:

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

A woman has a BMI of 27 and a body mass of 68.1 kg

Calculate the woman's height in metres.

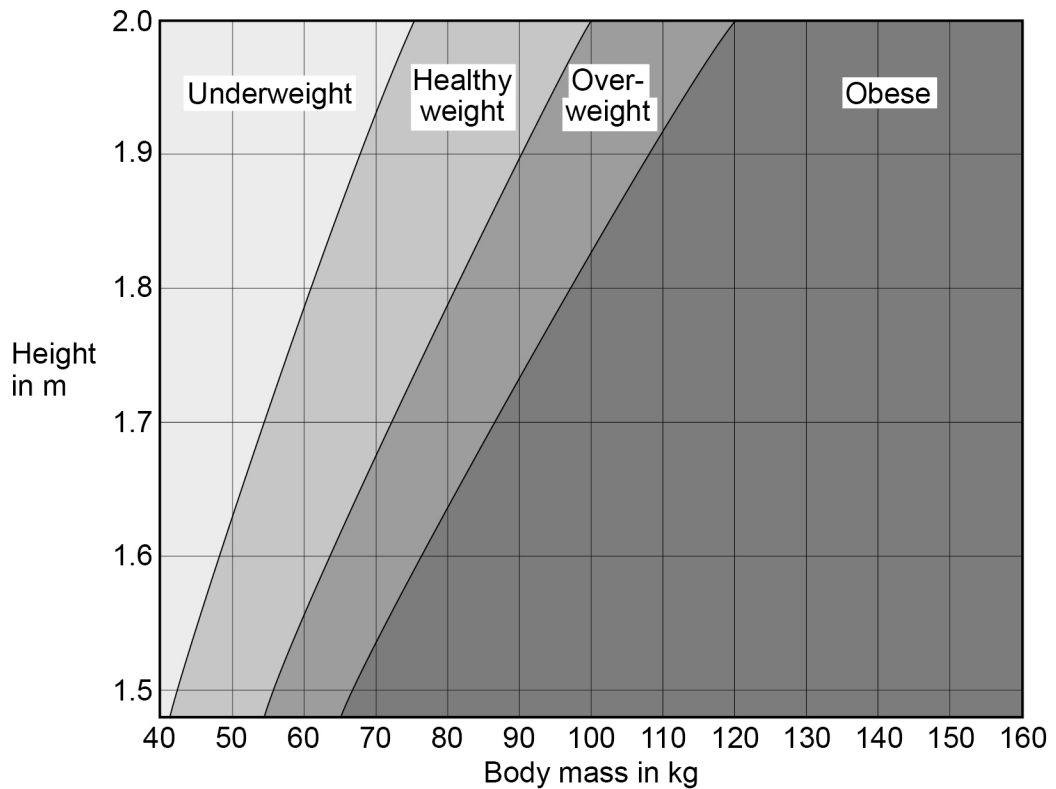
[3 marks]

Height = _____ m



0 3 . 3 Figure 4 shows a height-body mass chart for adults.

Figure 4



Which weight category describes the woman in Question **03.2**?

[1 mark]

Tick (✓) **one** box.

Underweight

Healthy weight

Overweight

Obese

Turn over ►



0	3	.	4
---	---	---	---

People are encouraged to control their body mass with diet and exercise.

Describe how the balance between the mass of food eaten and the amount of exercise a person does controls body mass.

[3 marks]



0 3 . 5

During long periods of vigorous exercise the body respire anaerobically.

Explain the changes that happen in the body during **and** after vigorous exercise.

[6 marks]

14

Turn over for the next question

Turn over ►



0 4

Cells are the basic units of all forms of life.

0 4 . 1

Describe **four** differences between a bacterial cell and a plant cell.

[4 marks]

1 _____

2 _____

3 _____

4 _____

0 4 . 2

Gonorrhoea is a bacterial disease.

A new vaccine is being developed against gonorrhoea.

Describe how a vaccine would work to prevent gonorrhoea.

[4 marks]



Another disease caused by bacteria is salmonella food poisoning.

In the UK, chickens are vaccinated against *Salmonella* bacteria to reduce the number of cases of food poisoning in humans.

0 4 . 3 Explain how vaccinating chickens reduces the number of cases of salmonella food poisoning.

[2 marks]

0 4 . 4 Give **one** way that the spread of salmonella food poisoning from one human to another is controlled.

Do **not** refer to vaccination in your answer.

[1 mark]

0 4 . 5 The number of cases of salmonella food poisoning is usually higher in summer than in winter.

Suggest **one** reason why.

[1 mark]

12

Turn over ►



0 5

This question is about photosynthesis and food production.

0 5 . 1

How can oxygen production be used to show the **rate** of photosynthesis?

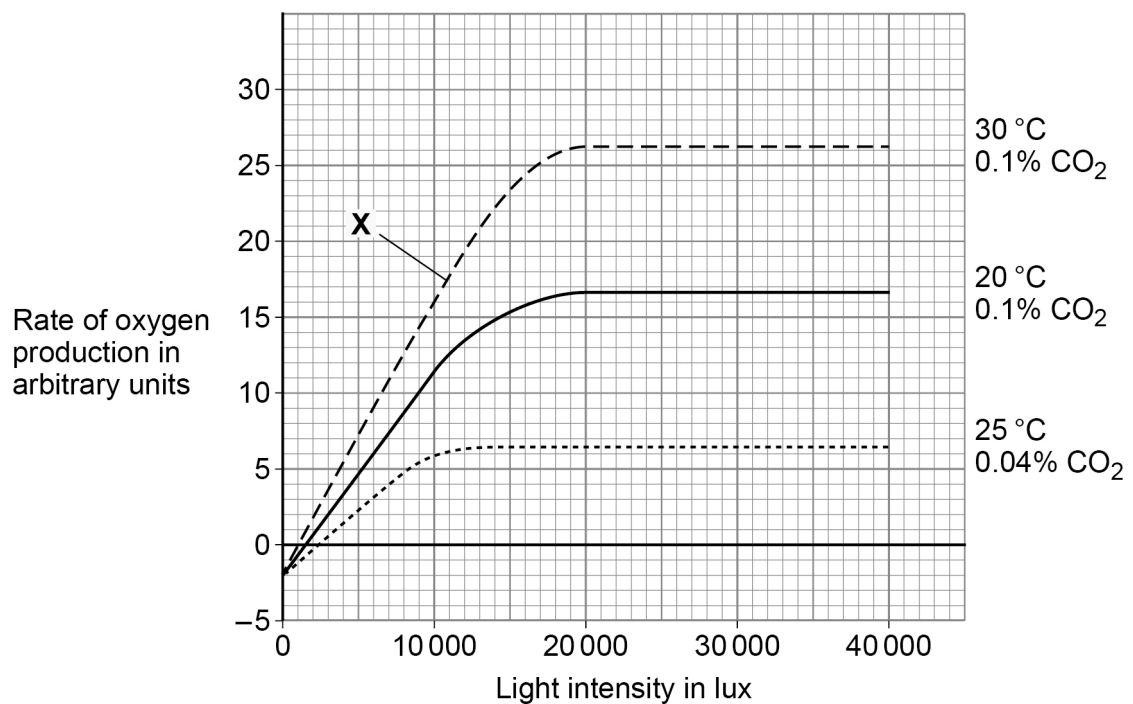
[1 mark]

Scientists investigated factors affecting the rate of photosynthesis in tomato plants.

The tomato plants were growing in a commercial greenhouse in the UK during winter.

Figure 5 shows the results.

Figure 5



The percentage of carbon dioxide in the Earth's atmosphere is 0.04%

0 5 . 2

Name the factor that is limiting the rate of photosynthesis at point **X**.

[1 mark]



Farmers growing tomatoes commercially try to control the rate of photosynthesis and make maximum profit.

A farmer can control the temperature and carbon dioxide concentration in a greenhouse.

0 5 . 3

What is the **minimum** light intensity a farmer should use to get the maximum rate of photosynthesis shown in **Figure 5**?

[1 mark]

Light intensity = _____ lux

0 5 . 4

The light intensity you gave in Question **05.3** may **not** give the farmer maximum profit.

Explain why.

[3 marks]

0 5 . 5

Explain the results when the light intensity was 0 lux.

Use **Figure 5**.

[4 marks]

10

Turn over ►

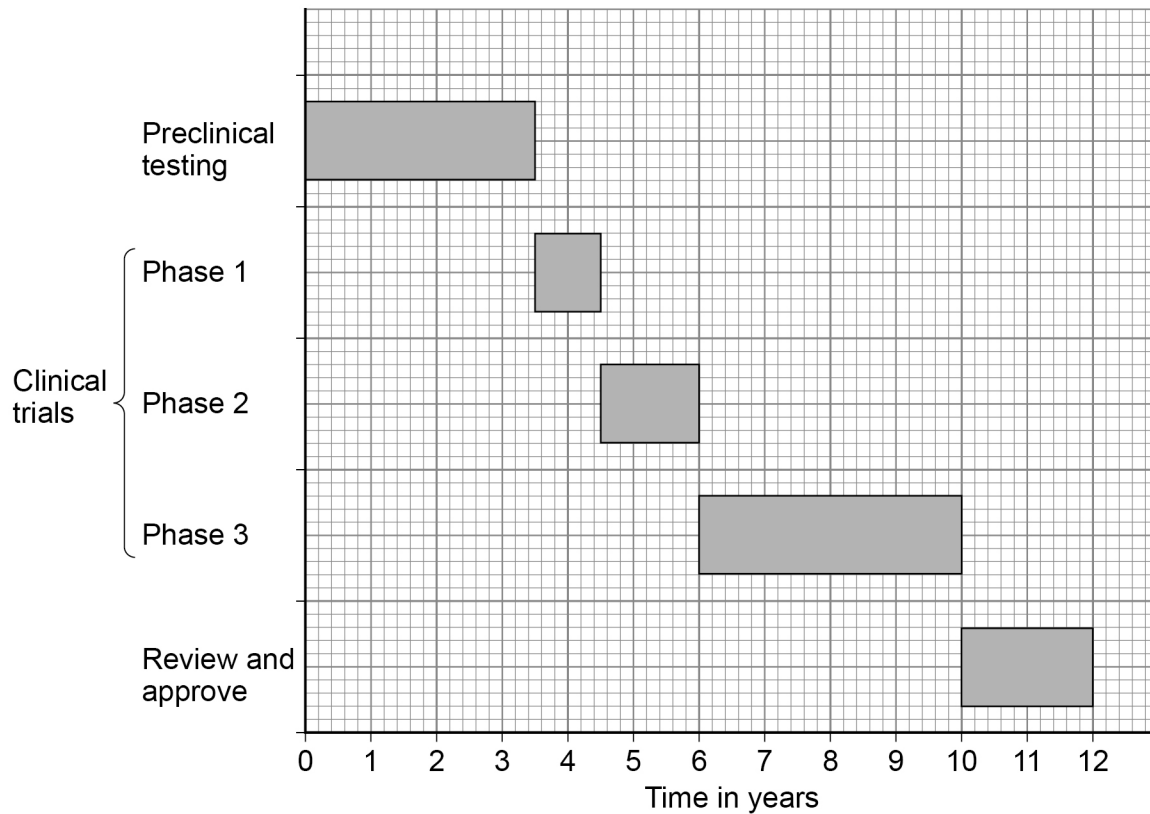


0 6

New drugs are tested and trialled before they can be licensed to treat patients.

Figure 6 shows how much time the different stages of testing took for one new drug.

Figure 6



0 6 . 1

How much more time did the clinical trials take compared with the preclinical testing?

[1 mark]

Tick (✓) **one** box.

3 years

3.5 years

5 years

6.5 years



During Phase 1 clinical trials low doses of the drug are tested on healthy volunteers.

0 6 . 2

Suggest **one** reason why **low doses** of the drug are used in Phase 1 clinical trials.

[1 mark]

0 6 . 3

Suggest **two** reasons why **healthy** volunteers are used in Phase 1 clinical trials.

[2 marks]

1 _____

2 _____

0 6 . 4

The results of clinical trials can only be published after peer review by other scientists.

Suggest **one** reason why the results must be reviewed by other scientists.

[1 mark]

Question 6 continues on the next page

Turn over ►



0 6 . 5

A drug is only licensed for the medical conditions it was tested to treat in the clinical trials.

Drug regulations:

- control what drugs a doctor can prescribe
- ensure doctors can prescribe a drug with confidence
- protect patients.

AMD is an eye condition that can result in very poor vision.

Doctors treat approximately 40 000 new cases of AMD each year.

Two drugs licensed to treat AMD in the UK are drug **A** and drug **B**.

In many other countries drug **C** is used to treat AMD. Drug **C** is only licensed in the UK to treat cancer.

The cost per injection for each drug is:

- drug **A** £561
- drug **B** £800
- drug **C** £28

The number of injections required to treat AMD is the same for each drug.



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2 8



2 0 6 G 8 4 6 4 / B / 1 H

IB/M/Jun20/8464/B/1H

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE COMBINED SCIENCE: TRILOGY

H

Higher Tier
Biology Paper 2H

Monday 1 June 2020

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.
- 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.

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	
6	
7	
TOTAL	



J U N 2 0 8 4 6 4 B 2 H 0 1

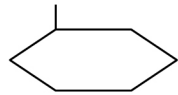
0 1

This question is about DNA and genes.

0 1 . 1

Which diagram represents a DNA molecule?

[1 mark]

Tick (✓) **one** box.





0 1 . 2

Describe the structure of a DNA molecule.

[1 mark]

0 1 . 3

A gene is a small section of DNA on a chromosome.

Complete the sentences.

[2 marks]

A gene codes for a particular sequence of _____.

This sequence makes a specific _____.



0 1 . 4 What is meant by the term genome?

[1 mark]

0 1 . 5 The complete human genome is now known.

Which important scientific advance was made using knowledge of the human genome?

[1 mark]

Tick (✓) **one** box.

Discovering antibiotic resistant bacteria

Finding more foods to eat from tropical forests

Tracing how aboriginal people spread across Australia

Working out when the last ice age ended

Question 1 continues on the next page

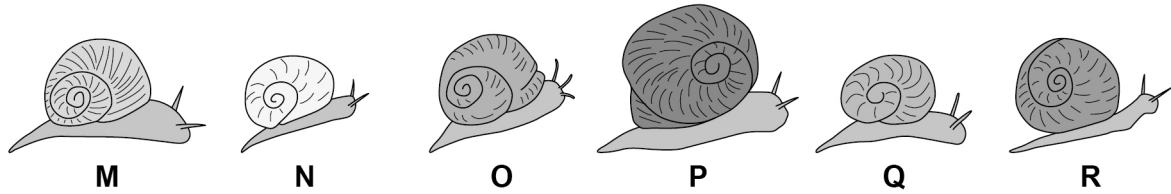
Turn over ►



A student found six different snails of one species in his garden.

Figure 1 shows the snails.

Figure 1



0 1 . 6 All the snails are different.

What scientific term describes differences in characteristics between individuals of a species?

[1 mark]

0 1 . 7 A change in DNA has caused snail **P** to be very different from the other five snails.

Suggest why there might be an increasing number of snails similar to snail **P** in each future generation.

[2 marks]



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0 2

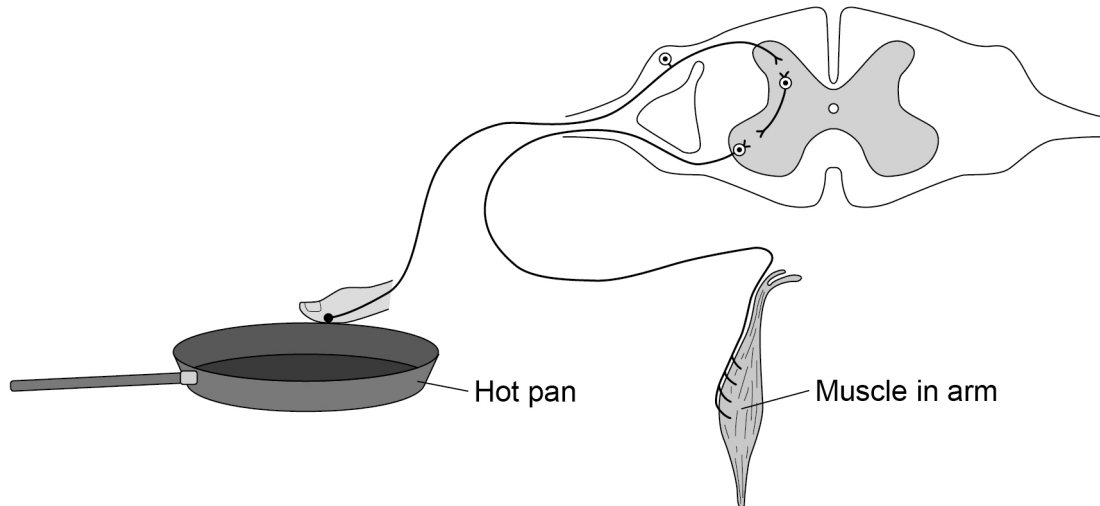
Human reactions are a response to an external change.

0 2 . 1

Reflex actions help to protect the body against damage.

Figure 2 shows the nervous pathway for a reflex action.

Figure 2



A stimulus from the hot pan will cause the muscle in the arm to contract and move the finger away.

Describe how the stimulus from the hot pan reaches the muscle in the arm.

[4 marks]



0 2 . 2

A student investigated whether using the right hand or the left hand had an effect on reaction time.

The student only tested right-handed people.

Describe a method for the student's investigation.

Include details of the test you would use for reaction time.

[4 marks]

Question 2 continues on the next page

Turn over ►



A different student carried out an investigation to see if playing tennis improved reaction time.

The student used two groups of six people.

Table 1 shows the results.

Table 1

Person	Reaction time in seconds	
	People who play tennis	People who do not play tennis
1	0.2	0.3
2	0.4	0.4
3	0.3	0.6
4	0.4	0.5
5	0.2	0.3
6	0.3	0.2
Mean	X	0.4

0 2 . 3 Calculate mean value **X** in **Table 1**.

[2 marks]

X = _____ seconds

0 2 . 4 What is the dependent variable in the student's investigation?

[1 mark]



The student concluded:

'Playing tennis improves reaction time.'

0 2 . 5

Give **one** piece of evidence which supports the conclusion.

[1 mark]

0 2 . 6

Give **one** piece of evidence which does **not** support the conclusion.

[1 mark]

13

Turn over for the next question

Turn over ►



0 3

There is a need to grow enough food for all the people in the world.

Growing enough food affects habitats and biodiversity.

0 3 . 1

What is meant by the term biodiversity?

[1 mark]

Peat bogs are being destroyed because peat is used by humans.

Destroying peat bogs also reduces biodiversity.

0 3 . 2

Give **one** use of peat taken from peat bogs.

[1 mark]

0 3 . 3

Explain why the use of peat is harmful to the environment.

Do **not** refer to biodiversity in your answer.

[2 marks]



0 3 . 4

Intensive farming, where a single crop is grown on a large area of land year after year, is more cost effective for farmers.

It is efficient to use fertilisers and to burn the waste so the land is ready to use the next year.

Planting a single crop reduces biodiversity.

Suggest **two** ways that this type of farming can damage the environment.

Do **not** refer to biodiversity in your answer.

[2 marks]

1 _____

2 _____

0 3 . 5

Most of the world's production of antibiotics is used in farming.

Antibiotics are given to animals to prevent the spread of disease.

Explain how the widespread use of antibiotics in farming is a threat to human life.

[4 marks]

10

Turn over ►



0 4 . 1 In sexual reproduction, cells divide by meiosis to form gametes.

Which **two** statements are true for cell division by meiosis?

[2 marks]

Tick (✓) **two** boxes.

Daughter cells have two sets of chromosomes.

Four daughter cells are formed.

The daughter cells are genetically identical.

The DNA replicates twice.

The parent cell divides twice.

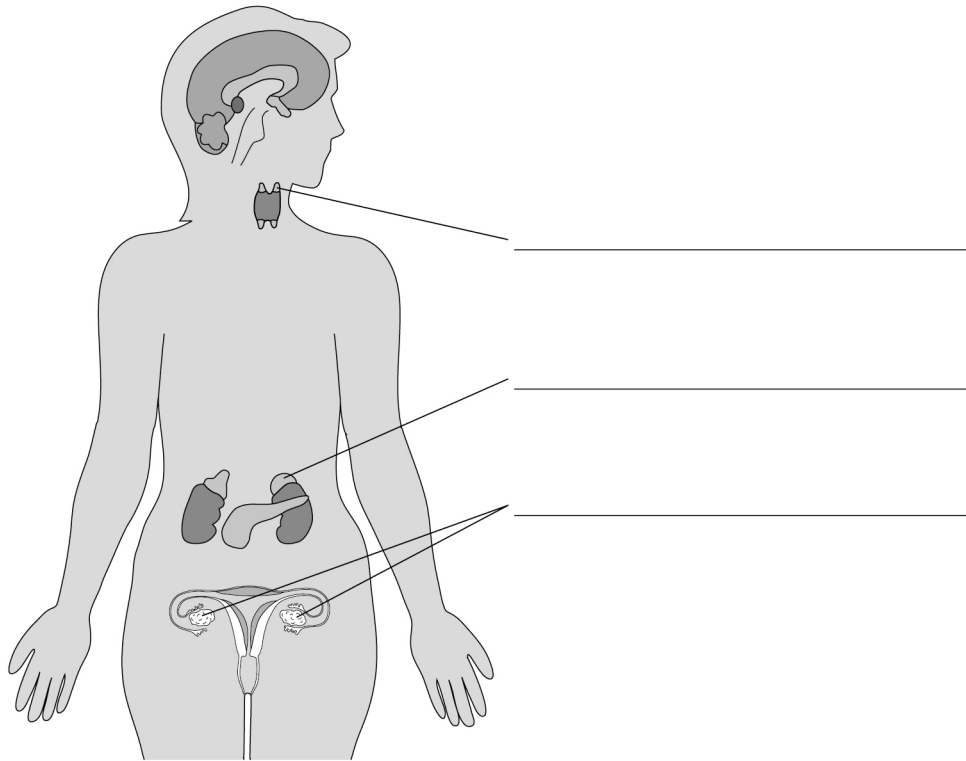


Hormones are released from endocrine glands.

Each hormone travels in the bloodstream to a target organ.

Figure 3 shows the position of endocrine glands in a female.

Figure 3



0 4 . 2 Label the endocrine glands on **Figure 3**.

[3 marks]

Question 4 continues on the next page

Turn over ►



0 4 . 3 Complete **Table 2**.**[3 marks]****Table 2**

Hormone	Name of gland which releases hormone	Target organ of hormone
Luteinising hormone (LH)	Pituitary gland	
	Adrenal gland	
Glucagon		

Millions of geranium plants are sold each year in garden centres.

Geraniums can be reproduced asexually or sexually.

Figure 4 shows a potted geranium plant.

Figure 4

Garden centres usually grow new geranium plants by asexual reproduction.

0 4 . 4

Suggest **two** advantages for garden centres of growing geraniums by asexual reproduction compared with sexual reproduction.

[2 marks]

1 _____

2 _____

0 4 . 5

Suggest **two** disadvantages for garden centres of growing geraniums by asexual reproduction compared with sexual reproduction.

[2 marks]

1 _____

2 _____

12

Turn over for the next question

Turn over ►



0 5

This question is about inheritance.

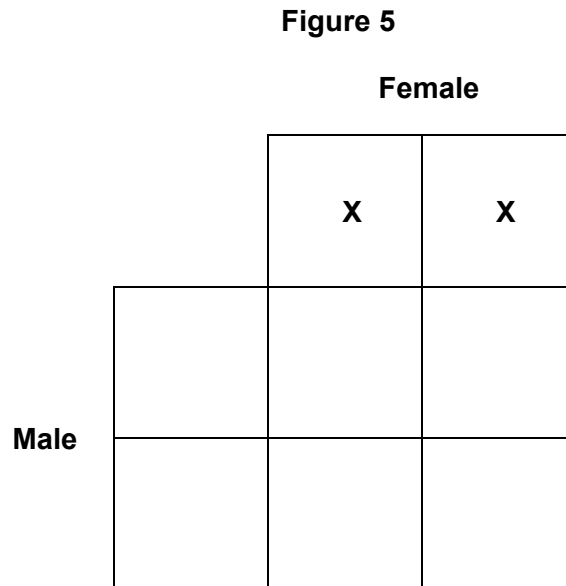
Humans have 23 pairs of chromosomes in each body cell.

One pair of chromosomes determines sex.

0 5 . 1

Complete **Figure 5**.

[2 marks]



0 5 . 2

In some families all children are the same sex.

Give the reason why.

[1 mark]



Cystic fibrosis (CF) is an inherited disorder.

0 5 . 3 A man and a woman do **not** have CF.

The man and the woman have a child who has CF.

Draw a Punnett square diagram to find the probability that their next child will have CF.

Use the symbols:

T = dominant allele

t = recessive allele

Draw a ring around the genotype of any children with CF.

[4 marks]

Probability = _____

Question 5 continues on the next page

Turn over ►



Embryo screening for CF can be done by two methods.

Method 1

- The woman becomes pregnant by sexual intercourse.
- After 10 weeks of pregnancy a fine needle is inserted into the uterus.
- A sample of the fluid surrounding the embryo is taken.
- The DNA of the embryo is tested for CF.

The screening is done free by specialist hospitals for couples who are at risk of having a child with CF.

There is a small risk of miscarriage.

Method 2

- The couple use In Vitro Fertilisation (IVF) to produce a small number of embryos.
- Each embryo is tested for CF.
- One or two embryos without CF are implanted in the woman's uterus.

In 2017 the success rate for having a baby by IVF for women under 35 years was 30%

IVF is a stressful, invasive procedure.

In most UK areas the free public health service does not provide IVF for all women asking for it.



0 5 . 4

Suggest **three** reasons for choosing **Method 1** instead of **Method 2**.**[3 marks]**

1 _____

2 _____

3 _____

0 5 . 5

Suggest **one** advantage of **Method 2**.**[1 mark]**

11

Turn over for the next question**Turn over ►**

0 6

Scientists believe that the first life on Earth was primitive anaerobic bacteria which first appeared billions of years ago.

0 6 . 1

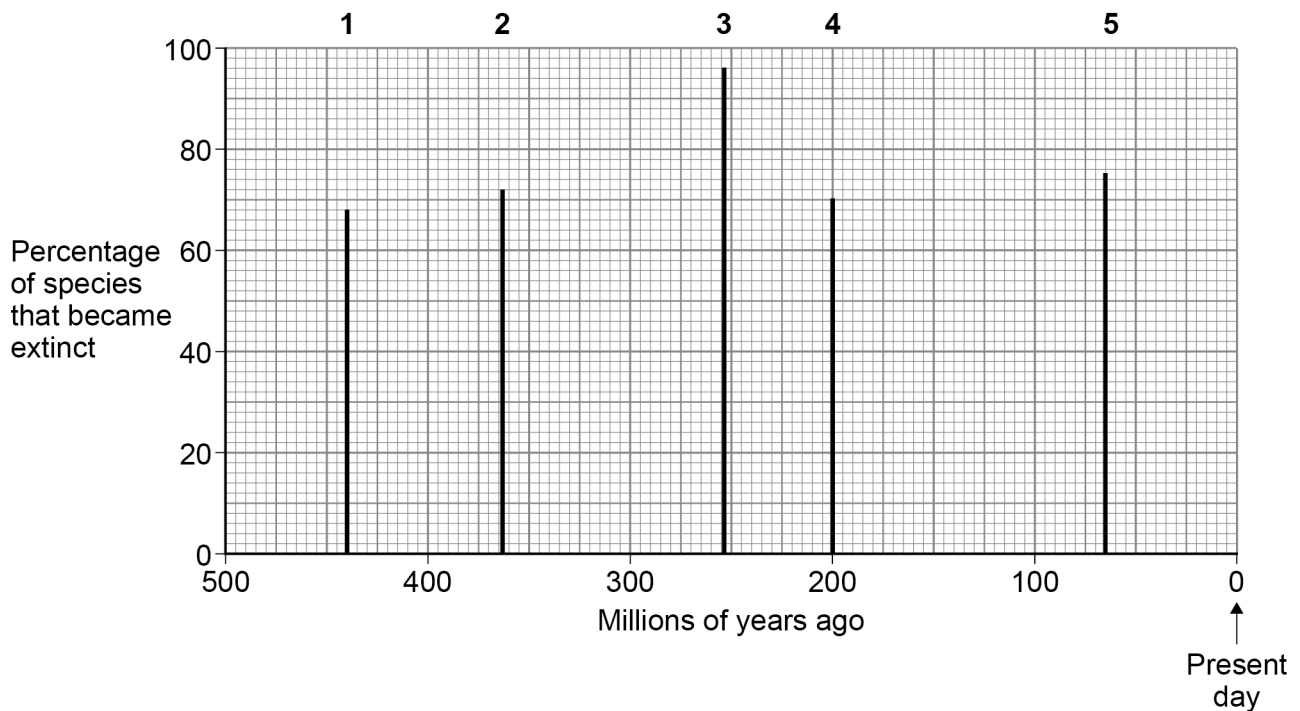
Which domain of the three-domain classification system do these primitive anaerobic bacteria belong to?

[1 mark]

Scientists have identified five periods of mass extinction since the fossil record began.

Figure 6 shows the timeline of the five mass extinction events.

Figure 6



0 6 . 2

Ammonites were organisms that first appeared in the oceans 415 million years ago.

Ammonites disappeared in the 5th mass extinction.

Draw a horizontal line on **Figure 6** to show the time period that ammonites existed on Earth.

Label the line 'ammonites'.

[1 mark]



0 6 . 3

Another type of organism that existed in the oceans was called trilobites.

Trilobites existed from 544 million years ago until 278 million years ago.

How many more years did ammonites exist than trilobites?

[2 marks]

_____ years

0 6 . 4

There was an increase in the percentage of species which became extinct in the third mass extinction compared to the first mass extinction.

Calculate the percentage increase.

[3 marks]

Percentage increase = _____ %

7

Turn over for the next question

Turn over ►



0 7

Human activities affect the environment.

0 7 . 1

Describe the reasons why deforestation takes place and the effects deforestation has on the environment.

[6 marks]



Forests have been called:

'The lungs of the planet.'

0 7 . 2

Describe **one** way forests being called 'The lungs of the planet' can be considered to be a **correct** statement.

[1 mark]

0 7 . 3

Trees do **not** have lungs.

Describe **one** other way forests being called 'The lungs of the planet' is an **incorrect** statement.

[1 mark]

8

END OF QUESTIONS



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IB/M/Jun20/8464/B/2H

**GCSE
COMBINED SCIENCE: TRILOGY
8464/B/1H**

Biology Paper 1H

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme



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

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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 not 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		1	AO1 4.1.1.1
	both have cytoplasm		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	any one from: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> 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
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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: <ul style="list-style-type: none"> • (cell) growth • increase in number of sub-cellular structures 	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: <ul style="list-style-type: none"> • DNA replicates • chromosomes double / duplicate / replicate 	ignore mitosis occurs allow chromosomes line up across the centre of the cell allow chromosomes move to opposite ends of the cell	1	
	Stage 3 any one from: <ul style="list-style-type: none"> • (one set of) chromosomes pulled to each end of cell • two nuclei form 	allow nucleus divides / splits (into two)	1	
	Stage 3 any one from: <ul style="list-style-type: none"> • cytoplasm / membrane divides • two identical cells formed 	allow cytokinesis		

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	

<p>Indicative content</p> <p>General comparisons:</p> <ul style="list-style-type: none"> • 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 <p>Rate comparisons:</p> <ul style="list-style-type: none"> • 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 <p>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.</p>		<p>4.1.2.2</p>
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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
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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	
	<p>Indicative content</p> <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • (so) amylase can no longer digest starch • (so) rate of digestion decreases <p>For Level 3 reference to enzyme structure and effect of pH on enzyme activity are needed</p>		4.2.2.1

Total Question 3		15
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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	$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$		1	AO1 4.4.1.1

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	independent variable in student's investigation is categoric / discrete	ignore answers relating to the scale on the y-axis allow colour of light is a categoric / discrete variable ignore discontinuous	1	AO2 4.4.1.2 RPA5
	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
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Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	<p>any four from:</p> <p>Similarities:</p> <ul style="list-style-type: none"> • result from changes in the cell / DNA / genes • uncontrolled cell growth / division • can form a lump of cells • made up of abnormal cells <p>Differences:</p> <p>Malignant tumours:</p> <ul style="list-style-type: none"> • are made of cancer cells, benign tumours are not <p>or</p> <p>benign tumours are made up of cells that are more similar to normal cells</p> <ul style="list-style-type: none"> • (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 <p>or</p> <p>cells can travel in the blood, but benign tumours do not</p> <ul style="list-style-type: none"> • can form secondary tumours, benign tumours do not 	<p>max three marks if only similarities or differences given</p> <p>allow result from mutations</p> <p>allow benign tumours (often) have a layer of covering cells, malignant tumours (usually) do not</p> <p>ignore references to level of harm</p>	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	1	AO3
	(so) less cell / DNA / gene damage	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	AO2 4.2.2.6 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	<p>any two from:</p> <ul style="list-style-type: none"> • 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	<p>allow there are different numbers of people / males / females of different ages</p> <p>allow so the different group sizes can be compared</p> <p>allow so it can be compared to populations in other countries</p> <p>ignore to compare unqualified</p>	1	AO3 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	any two from: <ul style="list-style-type: none"> • 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
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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.
<p>06.3</p>	<p>any four from:</p> <p>(advantages of biological valve):</p> <ul style="list-style-type: none"> • 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 <p>(disadvantages of biological valve):</p> <ul style="list-style-type: none"> • may be rejected • may have to go through surgery more than once • may have to take immunosuppressant drugs • have to wait for (suitable) donor 	<p>max three marks if only advantages or disadvantages of biological valve given</p> <p>ignore do not need to take blood thinners allow do not need to take drugs for life</p> <p>allow problems related to losing / obtaining drugs when travelling</p> <p>do not credit reference to rejection twice</p> <p>allow no risk of side effects from drugs</p> <p>do not credit reference to rejection twice ignore risks from surgery unqualified</p> <p>allow an animal might be killed</p>	<p>4</p>	<p>AO3 4.2.2.2 4.2.2.3 4.2.2.4</p>

<p>Total Question 6</p>		<p>9</p>
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GCSE
COMBINED SCIENCE: TRILOGY
8464/B/2H

Biology Paper 2H

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme



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.

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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 not 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	aerobic respiration		1	AO1 4.4.2.1 4.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	1. evaporation	allow evaporate(s) / evaporating	1	AO1 4.7.2.2
	2. condensation	allow condense(s) / condensing	1	
	3. precipitation	allow rain(ing) / rainfall allow named precipitation ignore precipitates	1	
	4. draining / drainage	allow run-off / percolation / infiltration allow groundwater / underground flow	1	
	5. transpiration		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$6\,000\,000\,000 \times \frac{4.5}{100}$	allow $6\,000\,000\,000 \times 0.045$	1	AO2 4.7.2.2
	270 000 000		1	
	2.7×10^8	allow an incorrectly calculated number of people given in correct standard form	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	climate change has increased the area of deserts		1	AO3 4.7.2.2
	more water is used to grow crops		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	decay / decomposition of leaves	allow leaves are broken down	1	AO2
	respiration (by microorganisms / decomposers)	ignore aerobic / anaerobic ignore respiration by worms / detritivores / insects / leaves	1	AO1
	respiration releases carbon dioxide or microorganisms release carbon dioxide		1	AO1
	carbon dioxide is used in photosynthesis (for new plant growth)	do not accept carbon dioxide absorbed in the roots	1	AO1 4.7.2.2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	nitrites are released into the soil		1	AO2 4.7.2.2 4.4.1.3

Total Question 1			16	
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Question 2

Question	Answers	Mark	AO / Spec. Ref.
02	Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO3
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO3 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	

2 cont.	<p>Indicative content</p> <p>Increase in world population</p> <ul style="list-style-type: none"> • sewage (released into rivers / lakes / seas) <ul style="list-style-type: none"> ○ causes algae to grow ○ algae block light ○ causing plants to die and decompose ○ leading to lack of oxygen in the water ○ (sewage) could contain pathogens <p>Need to produce more food for world's population</p> <ul style="list-style-type: none"> • fertilisers (used on farms to increase crop yield, leach into rivers / lakes / seas) <ul style="list-style-type: none"> ○ causes algae to grow ○ leading to lack of oxygen in the water • herbicides / pesticides (used on farms to increase crop yield, run into rivers / lakes / seas) <ul style="list-style-type: none"> ○ build-up in food chains <p>Increasing demand for products / energy</p> <ul style="list-style-type: none"> • toxic chemicals or named toxic chemicals (run into rivers / lakes / seas) <ul style="list-style-type: none"> ○ from factories / industry or power stations ○ build-up in food chains ○ chemicals may cause mutations or chemicals may act as hormones ○ radiation leaks from nuclear (power stations) ○ (oil) spills from extraction / rigs / tankers in oceans ○ acid rain formation ○ acidification of lakes ○ increased carbon dioxide emissions causes acidification of oceans <p>Buildup of waste products</p> <ul style="list-style-type: none"> • litter / plastics (thrown in rivers / lakes / seas) <ul style="list-style-type: none"> ○ example of effect on living organisms, such as plastics consumed or plastics build up in stomach or plastics get stuck around beaks ○ (most) plastics are not biodegradable ○ build-up of microplastics in water animals <p>Consequence of the above is that organisms living in rivers / lakes / seas are harmed / die</p> <p>For Level 3 students need to consider different types of pollution</p>	<p>4.7.3.2 4.7.2.1</p>
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Total Question 2	6
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Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any one from: <ul style="list-style-type: none"> • competition • herbivores • trampling / mowing • pollinators • pathogens 	allow other plants / trees (growing in the field) allow named herbivore allow pests allow insects or named pollinator allow infection ignore disease unqualified	1	AO2 4.7.1.3 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	<p>any six from:</p> <ul style="list-style-type: none"> • mark out (grid) area in wet and in dry area • method for placing <u>quadrat(s)</u> <ul style="list-style-type: none"> • count / record number of buttercups (in the quadrat) • use at least 5 quadrats in each area • take soil moisture readings • use suitable equipment for readings, eg soil moisture meter • calculate the mean (in each area) • use the mean and area to calculate total number in wet area and total number in dry area <p>OR</p> <p>any six from (6):</p> <ul style="list-style-type: none"> • transect between wet area and dry area • place <u>quadrat(s)</u> regularly along transect • count / record number of buttercups (in the quadrat) • use at least 5 quadrats along transect • take soil moisture readings • use suitable equipment for readings, eg soil moisture meter • repeat transects • calculate the mean at each distance along the transects 	<p>allow mark out a transect in each of the two areas</p> <p>allow description of a method to place <u>quadrat(s)</u> randomly / systematically do not accept throwing quadrats randomly ignore percentage cover of buttercups</p> <p>} allow (for each area) total number of buttercups divided by total area sampled, multiplied by total area for 2 marks</p> <p>allow description of a method to place <u>quadrat(s)</u> systematically</p>	6	AO1 4.7.2.1 RPA7

Total Question 3		7
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Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	any two from: <ul style="list-style-type: none"> • light (intensity) • water • temperature • mass / volume of soil • soil type or (soil) pH • other mineral content of the soil • number of plants (in a box) • starting mass / height / age of corn • type / variety of corn • harvested at the same time 	do not accept nitrate ion concentration allow size of box allow depth of soil ignore fertiliser allow planting density allow species of corn allow harvested when mature	2	AO2 4.7.2.1 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	suitable scale and axis labelled (mean <u>mass</u> (of corn) per plant in <u>grams / g</u>) all points plotted correctly suitable line of best fit	max 3 marks for bar chart allow a tolerance of $\pm \frac{1}{2}$ a small square allow 1 mark for 4 or 5 correct plots ignore line extended beyond 50ppm ignore line joined point to point with straight lines	1 2 1	AO2 4.7.2.1 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	<p>as (soil) nitrate / concentration increases, (mean) mass (of corn) increases and then decreases</p> <p>with a maximum (mean mass of corn) at 30 (ppm)</p>	<p>allow a maximum consistent with graph in question 04.2</p> <p>if no other mark awarded, allow 1 mark for (mean mass of corn) increases to 30 (ppm) or (mean mass of corn) decreases above 30 (ppm)</p>	<p>1</p> <p>1</p>	<p>AO2 4.7.1.2 4.7.2.1</p>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
<p>04.4</p>	<p>any four from:</p> <p>(economic)</p> <ul style="list-style-type: none"> • increasing nitrate / ion (concentration) up to 30 ppm will give high(er) yield / income / sales • greater than 30 ppm will decrease yield / mass / income / sales and therefore waste money / fertiliser • any increase in yield / mass / income / sales must be balanced with cost (of fertiliser) • quantity to add will depend on original nitrate (ion concentration) of soil <p>(environmental)</p> <ul style="list-style-type: none"> • (when it rains) fertiliser / nitrate will enter rivers / lakes / sea / ocean causing pollution 	<p>max 3 marks if no reference to environmental implication</p> <p>ignore mass for this marking point only</p> <p>allow greater than 30 ppm, the yield / mass / income / sales / will not increase (as much) and therefore waste money / fertiliser</p> <p>allow profit / benefit will depend on yield / mass / income / sales and cost (of fertiliser)</p> <p>allow fertiliser / nitrate run-off causes pollution allow eutrophication or description of eutrophication</p> <p>allow description of effect of fertiliser / nitrate pollution eg health impact of fertiliser in drinking water</p> <p>allow environmental implication of (significant) energy use in fertiliser production / transport</p>	<p>4</p>	<p>AO3 4.7.3.2 4.7.2.2 4.1.3.3 4.4.2.3</p>

<p>Total Question 4</p>		<p>12</p>
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Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	negative feedback (control)	ignore homeostasis	1	AO2 4.5.3.6 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	A = glucagon B = insulin	both required in correct order correct or phonetic spelling only	1	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
<p>05.3</p> <p>indirect marking</p> <p>view with 5.2</p>	(when blood glucose concentration is high after a meal) insulin / B is secreted (by the pancreas) causing glucose to enter <u>cells</u>		1	AO2
	(glucose is) converted to glycogen in the liver / muscle (cells for storage)		1	AO1
	(this causes) blood glucose concentration to return to normal so insulin / B secretion slows / stops / decreases		1	AO2
	when blood glucose concentration is low glucagon / A is secreted (by the pancreas)		1	AO2
	(which causes) breakdown of glycogen in the liver (into glucose)		1	AO1
	(this causes) blood glucose concentration to return to normal so glucagon / A secretion slows / stops / decreases		1	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	FSH causes (several) ova / eggs to mature (in the ovary)	allow singular ovum / egg allow follicle for ovary	1	AO2 4.5.3.3 4.5.3.5
	(then) LH causes ovulation or LH causes release of the ova / eggs	allow singular ovum / egg	1	
	so more eggs / ova present therefore higher probability / chance of fertilisation or so more eggs / ova present therefore higher probability / chance of sperm fusing with an egg		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	collection of (mature) egg(s) from the ovary	allow follicle for ovary	1	AO1 4.5.3.5
	(which are) fertilised (in the laboratory)	do not accept if in fallopian tube allow egg and sperm fuse	1	
	develop into embryo(s) (in the laboratory)	allow develop / divide into small balls of cells (in the laboratory) do not accept foetus	1	
	embryo(s) inserted into uterus / womb		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	any three from: <ul style="list-style-type: none"> • meiosis forms sperm and mitosis forms liver (cells) • two cell divisions to form sperm and one cell division to form liver (cells) • four genetically different sperm cells and two genetically identical liver cells • sperm cells have 23 chromosomes and liver cells have 46 chromosomes 	ignore reproduction max 2 marks if reference to sperm cells dividing allow four genetically different cells formed from meiosis and two genetically identical cells formed from mitosis allow sperm cells have 23 chromosomes and liver cells have 23 pairs of chromosomes allow haploid (sperm) and diploid (liver cells)	3	AO1 4.6.1.2 4.1.2.2

Total Question 5		18
-------------------------	--	-----------

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1		2 marks for all 4 correct 1 mark for 2 or for 3 correct ignore italics and upper / lower case letters	2	AO1 AO2 4.6.4
	eukaryote / eukaryota			
	animal(ia)			
	phylum / phyla			
	family			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2 view with Figure 5	<i>two readings from graph</i> 7.75 and 4.32	allow in range of 7.7 to 7.8 and 4.3 to 4.4 allow two readings from two identified points on the line, allowing a tolerance of $\pm \frac{1}{2}$ a small square	1	AO2 4.7.3.5
	<i>calculation of gradient</i> 3.43 <u>32</u>	allow calculation of gradient using correct readings from graph, $\frac{dy}{dx}$	1	
	<i>correct answer</i> 0.1(071875)	allow correct answer using student's correct readings from graph	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	any two from: <i>in autumn</i> <ul style="list-style-type: none"> • no / fewer seals left on ice or all / most seals are in the sea • seals are adults / older so swim faster • more <u>competition</u> between polar bears 	ignore seals are in the sea unqualified	2	AO3 4.7.3.5

Question	Answers	Mark	AO / Spec. Ref.
06.4	Level 2: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4	AO3
	Level 1: Some logically linked reasons are given. There may also be a simple judgement.	1–2	AO2
	No relevant content	0	
	<p>Indicative content</p> <p><i>may decrease because:</i></p> <ul style="list-style-type: none"> • global warming is melting sea ice • less sea ice each year so less habitat / hunting area • as ice / habitat disappears seals will decrease in number • having to swim longer distances to find seals, wastes energy • increased metabolic rate means more food is required • not building up fat stores in the autumn means fewer will survive each winter • decrease in mass / height may reduce hunting ability / strength • hunting in some / most areas continues • less likely to find mates • eventually the species may become extinct <p><i>may increase / maintain numbers if:</i></p> <ul style="list-style-type: none"> • more laws put in place to stop hunting or laws to stop hunting will allow bears to reproduce • quotas introduced to reduce hunting • nations / people work to reduce carbon dioxide emissions to halt global warming • (feeding / hunting) behaviour of polar bears changes <p>For Level 2 both increase / maintenance and decrease of the polar bear population must be considered</p>		4.7.1.1 4.7.3.5

Total Question 6		11
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Please write clearly in block capitals.

Centre number

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Candidate number

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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.

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	
6	
TOTAL	



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ANSWER IN THE SPACES PROVIDED**



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

Turn over ►

0 1 . 3

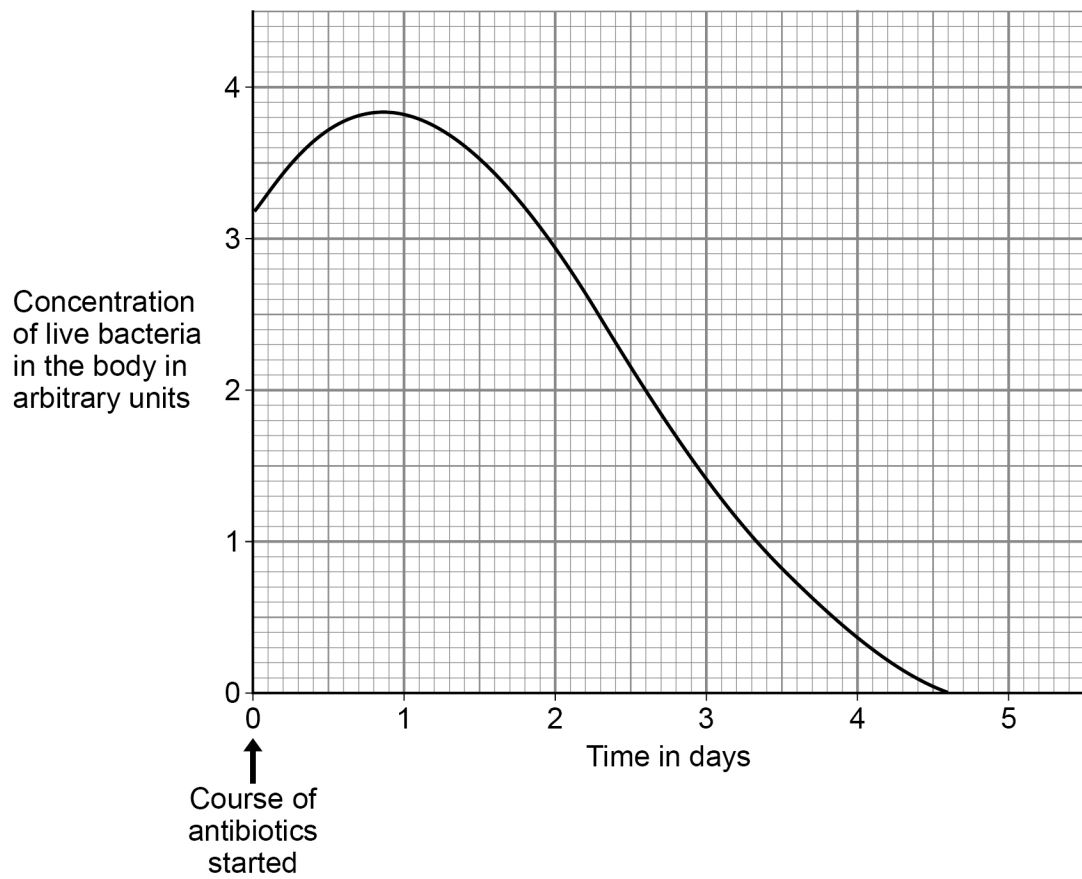
What is the name of the first antibiotic developed?

[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



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]

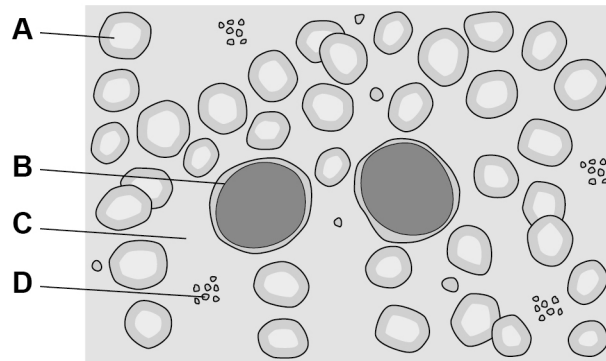
Question 1 continues on the next page

Turn over ►



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



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
------	------------	------	---------

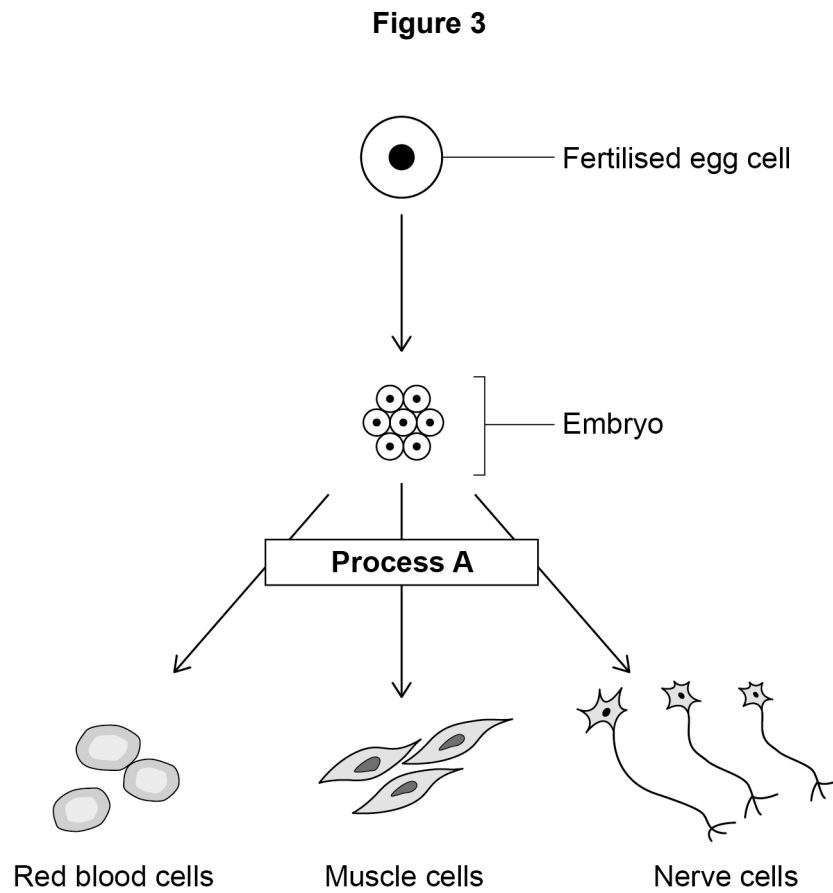
Smallest



Largest

Question 2 continues on the next page**Turn over ►**

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



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 = _____



0 2 . 4

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

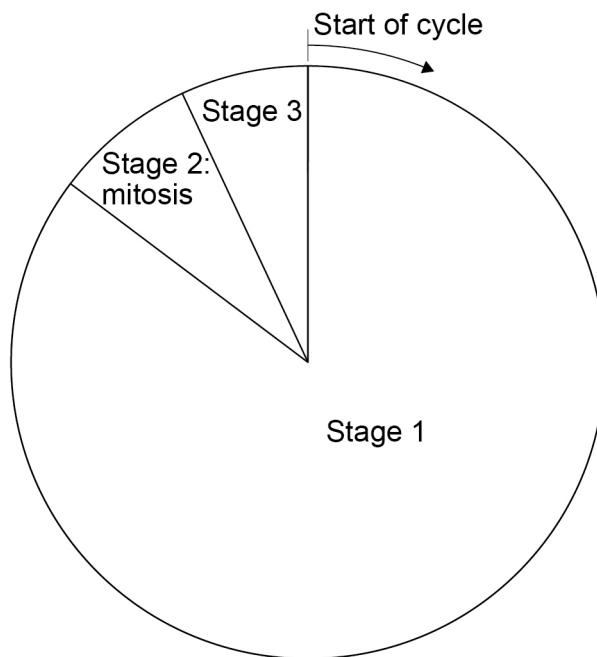
How many chromosomes will there be in each of the embryo cells?

[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 _____

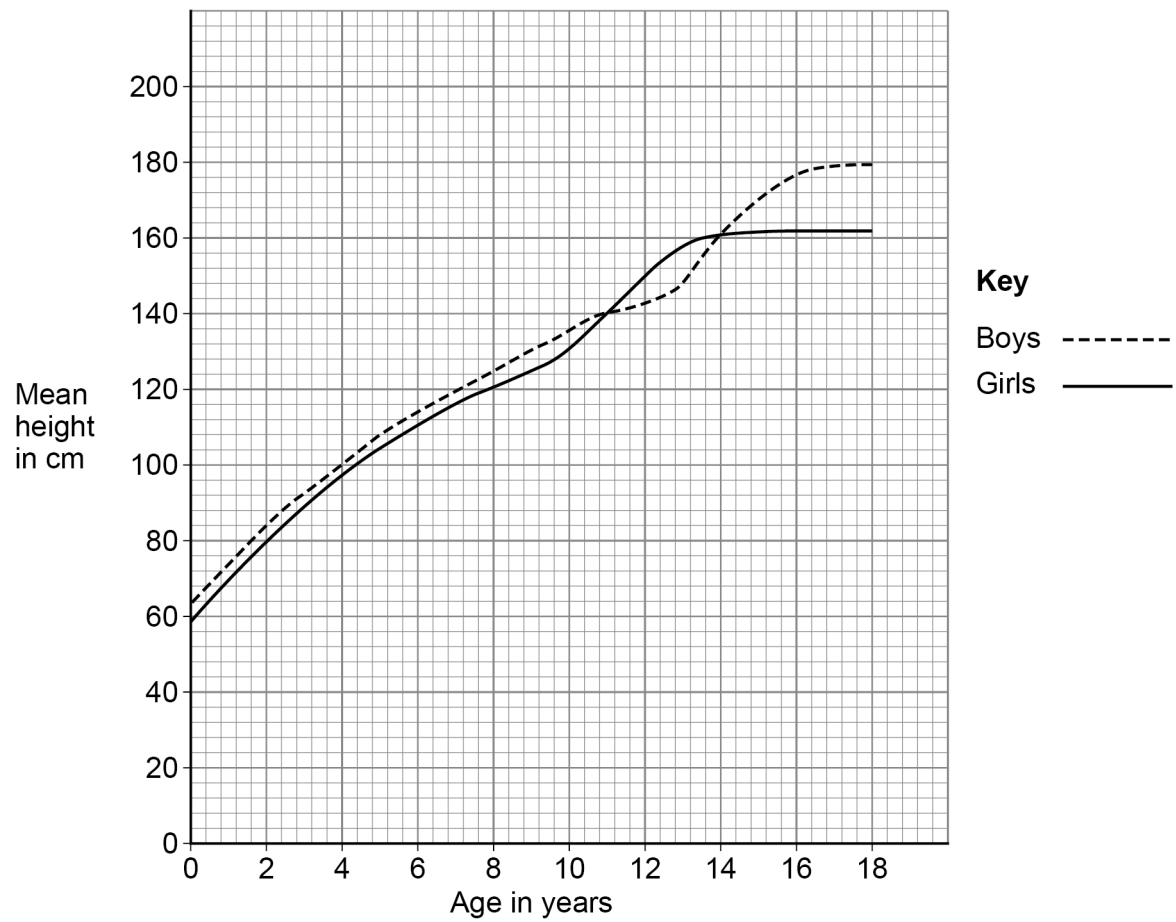
Turn over ►



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



Key

Boys -----

Girls —————



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

Turn over ►



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]

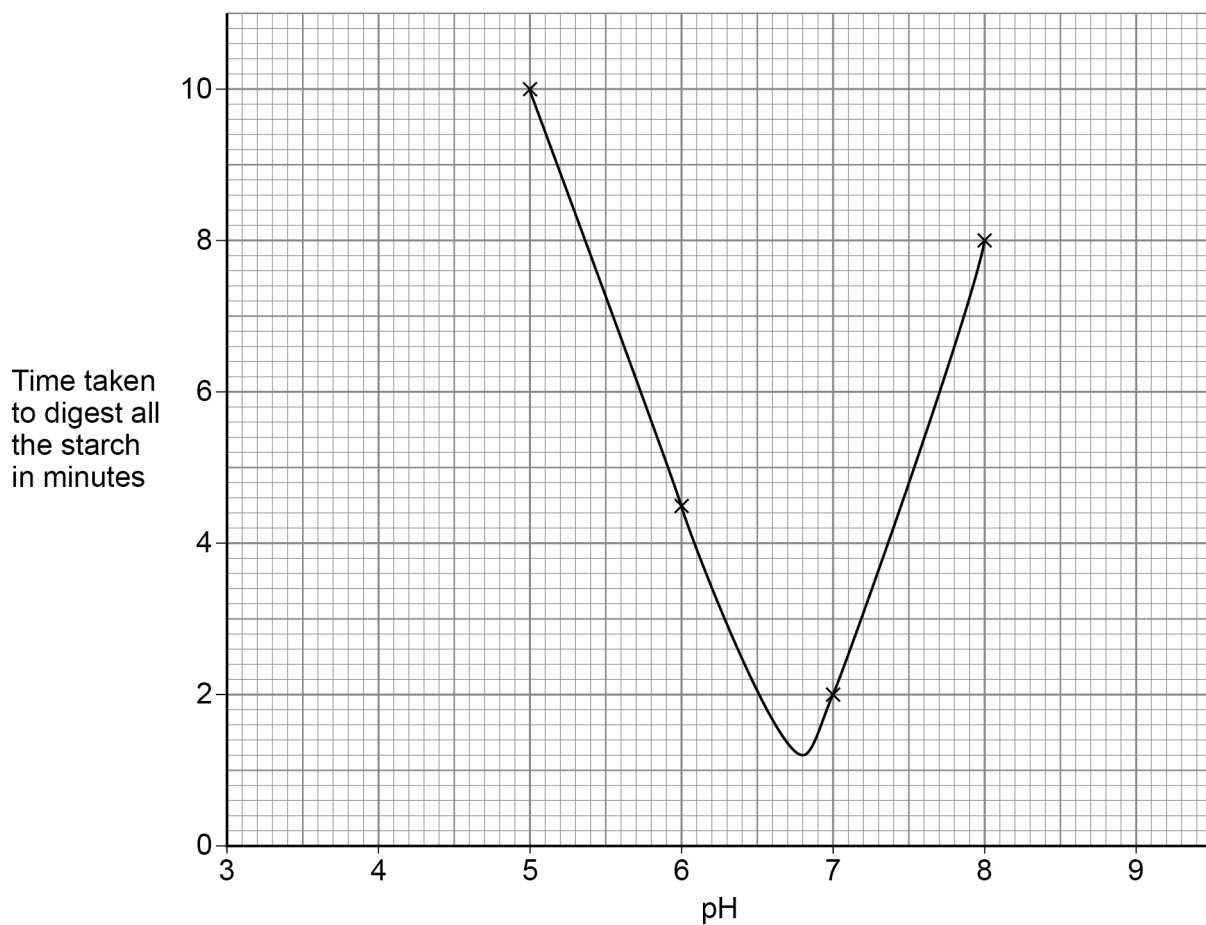


0 3 . 3 Describe how the student would know when all the starch had been digested.

[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 ►



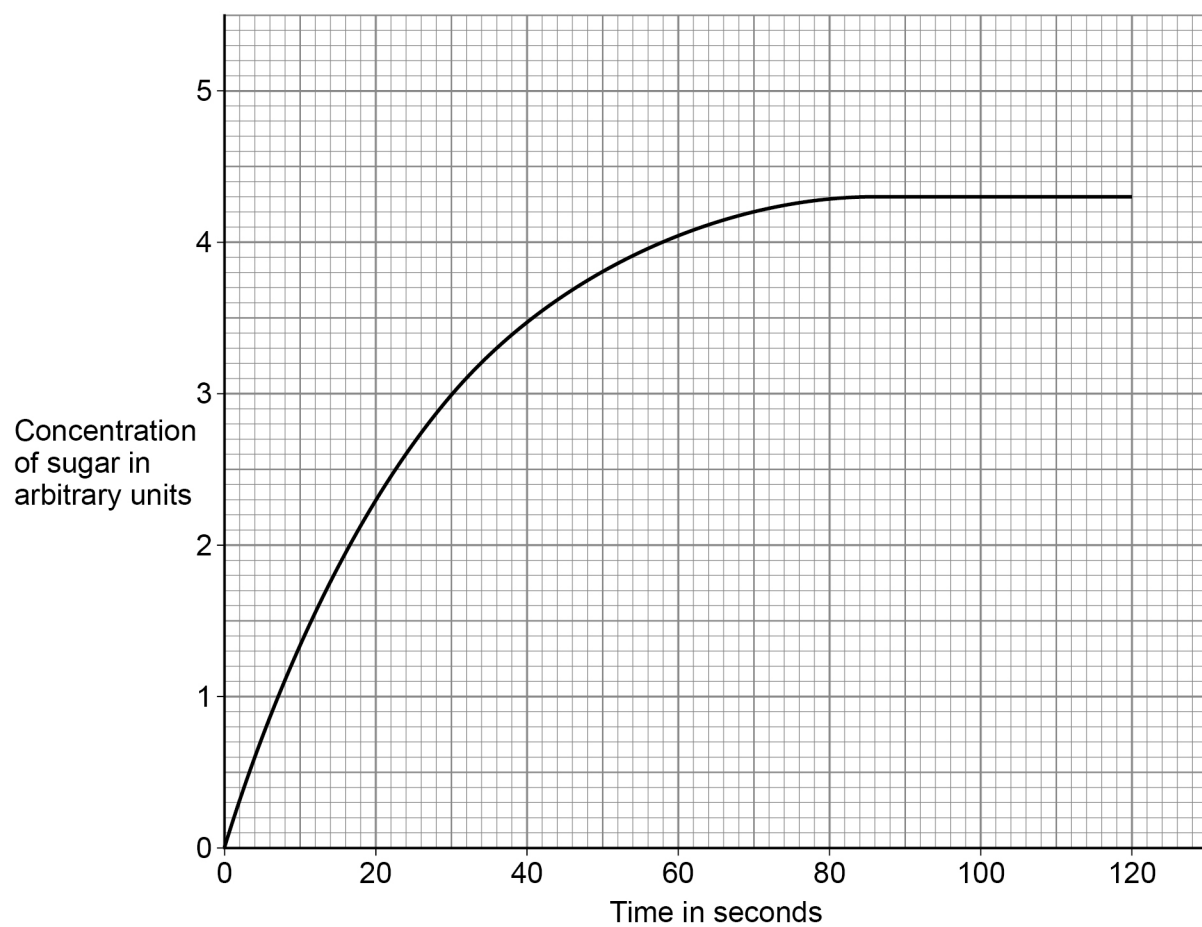
A scientist did a different investigation.

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



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

Turn over ►



0 4

Photosynthesis is an important chemical reaction in plants.

0 4 . 1

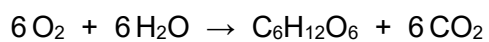
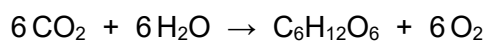
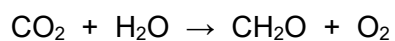
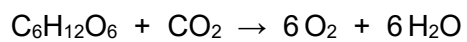
Why is light needed for photosynthesis?

[1 mark]

0 4 . 2

What is the equation for photosynthesis?

[1 mark]

Tick (✓) **one** box.

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

Turn over ►



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

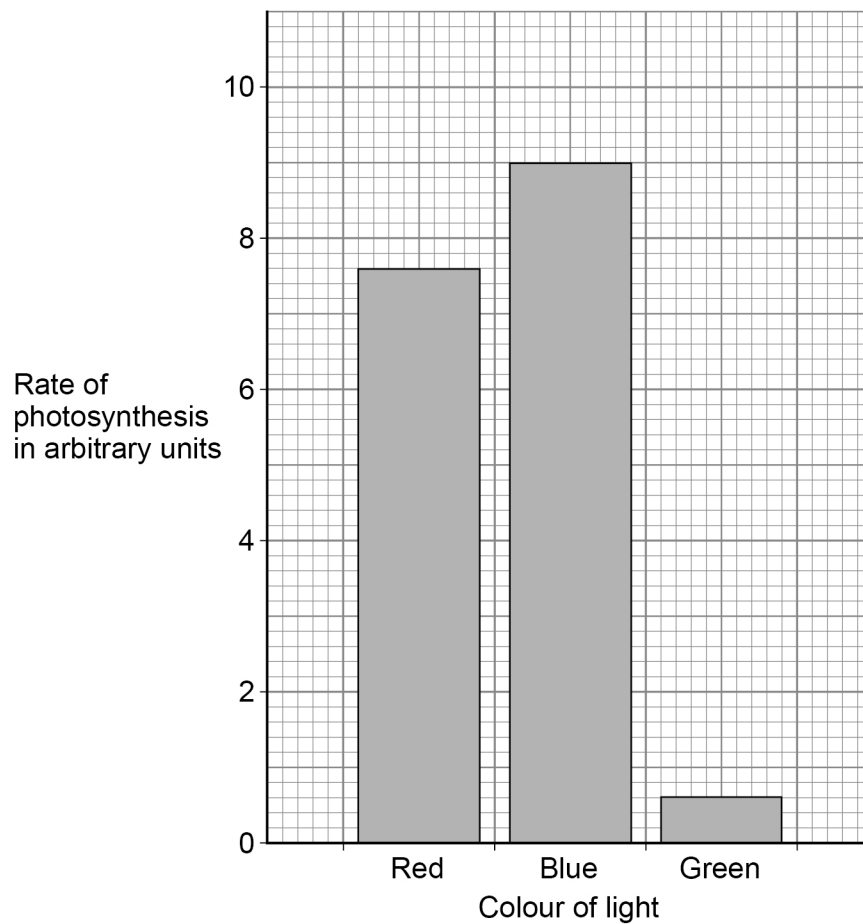
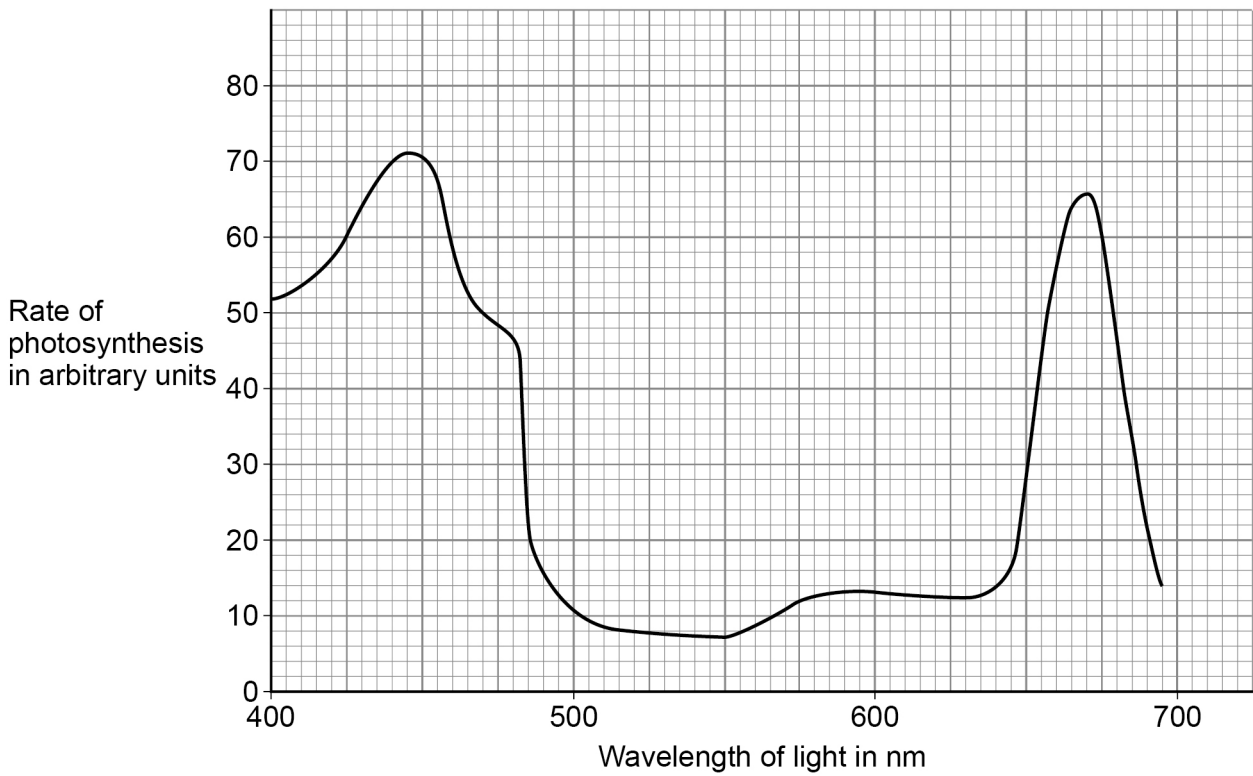


Figure 9



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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0 5

This question is about tumours.

0 5 . 1

Describe the similarities and differences between benign tumours and malignant tumours.

[4 marks]

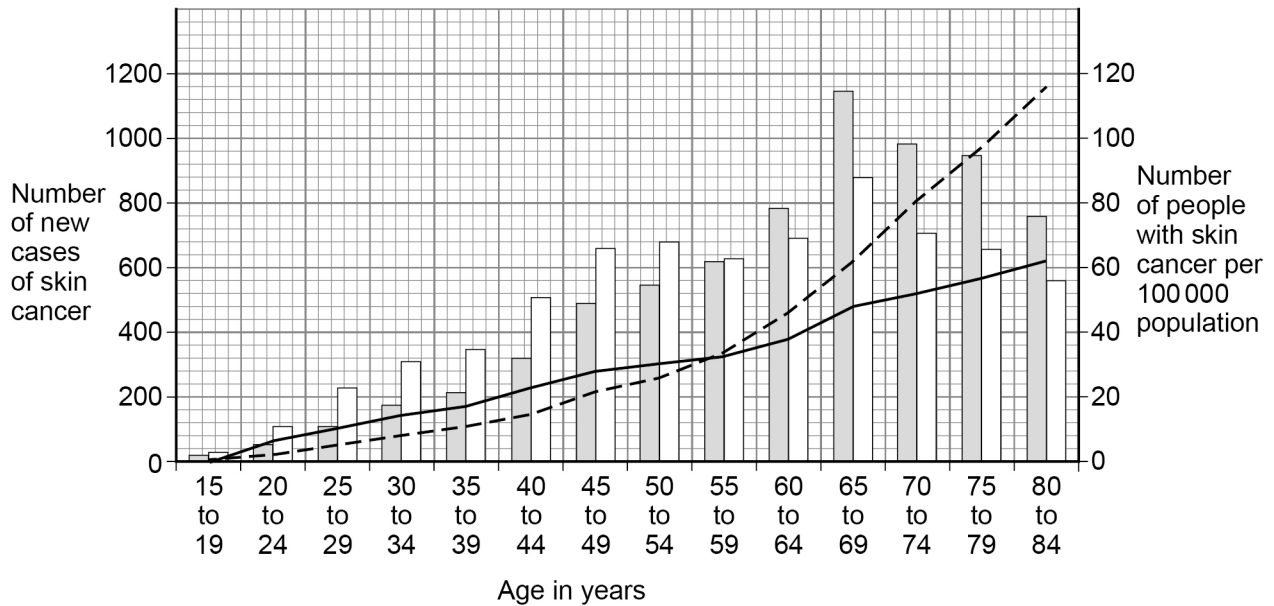
Question 5 continues on the next page**Turn over ►**

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



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]

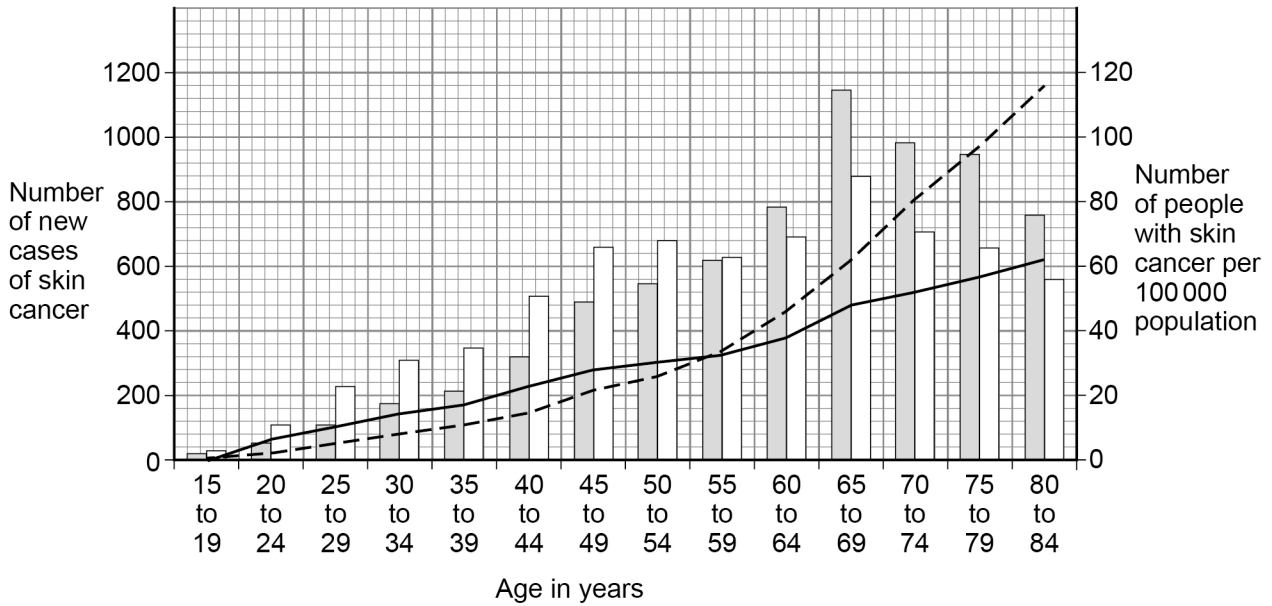
Question 5 continues on the next page

Turn over ►



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 _____



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

Turn over ►



0 6

This question is about the heart.

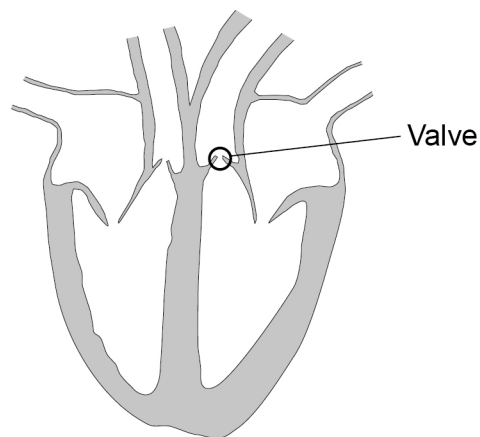
0 6 . 1

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]**



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3 2



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

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Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE COMBINED SCIENCE: TRILOGY

H

Higher Tier
Biology Paper 2H

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.

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	
6	
TOTAL	



0 1

This question is about the cycling of water and carbon in ecosystems.

0 1 . 1

Which reaction produces water?

[1 mark]Tick (✓) **one** box.

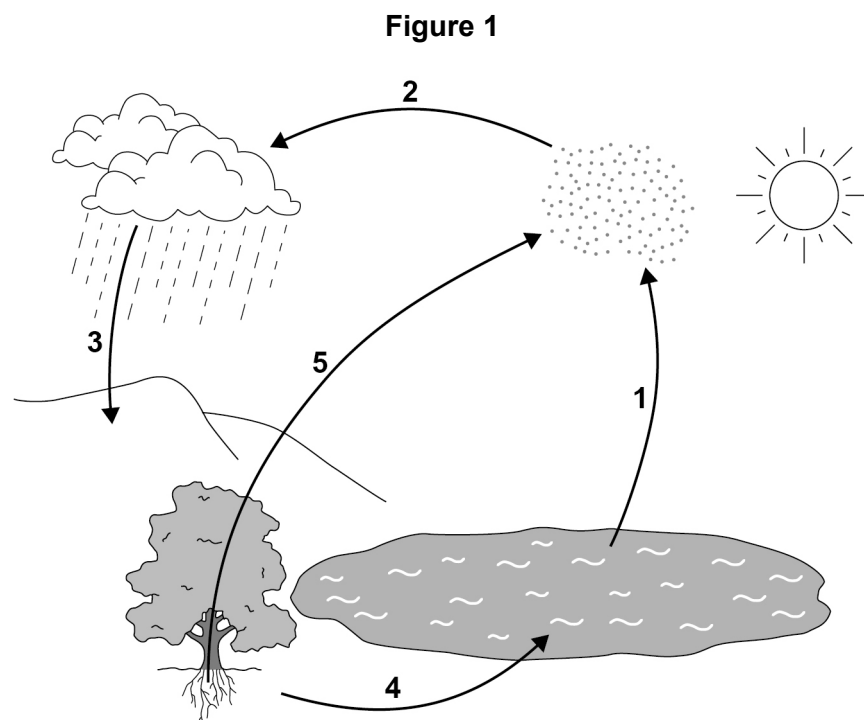
Aerobic respiration

Anaerobic respiration

Photosynthesis

The water cycle provides water for plants and animals on land before the water goes into lakes and seas.

Figure 1 represents the water cycle.



0 1 . 2 Name the processes **1** to **5** shown on **Figure 1**.

[5 marks]

- 1** _____
- 2** _____
- 3** _____
- 4** _____
- 5** _____

0 1 . 3 In 2007 the population of the world was 6 000 000 000

A study found that 4.5% of the population had severe water shortage.

Calculate how many people had severe water shortage.

Give your answer in standard form.

[3 marks]

Number of people (in standard form) = _____

Question 1 continues on the next page

Turn over ►



0 1 . 4 Why do more people have severe water shortage now than in 2007?

[2 marks]

Tick (✓) **two** boxes.

Climate change has increased the area of deserts.

Each person drinks less water.

More water is used to grow crops.

Sea levels have risen because the ice caps are melting.

Some countries have built de-salting factories for seawater.

Leaves on a tree contain carbon compounds.

In autumn the leaves fall to the ground.

0 1 . 5 Microorganisms in the soil recycle carbon from the leaves so that the carbon is used for new plant growth.

Explain how.

[4 marks]



0 1 . 6 What is **one** benefit of fallen leaves for living plants?

[1 mark]

Tick (✓) **one** box.

Energy is released for living plants.

Insect pests in the soil are killed.

Nitrates are released into the soil.

Oxygen is supplied to root cells.

16

Turn over for the next question

Turn over ►



0 3

On a school field:

- one area of the soil was usually wet
- another area of the soil was usually dry.

Students investigated the effect of water in the soil on the number of buttercup plants growing in each area.

0 3 . 1

Water is an abiotic factor.

Name **one biotic** factor which may affect the number of buttercups growing on the field.

[1 mark]

0 3 . 2

Describe a method to investigate if the amount of water in the soil affects the number of buttercups in the field.

[6 marks]

Turn over ►



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0 4

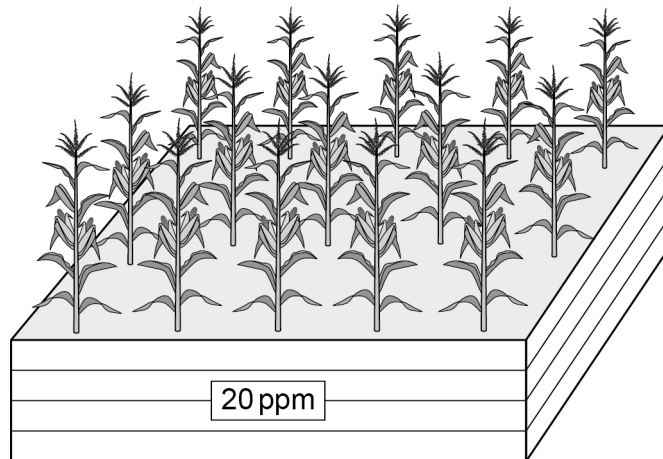
Scientists investigated the effect of soil nitrate ion concentration on the yield of corn.

This is the method used.

1. Corn plants were grown in a large box of soil.
2. The soil nitrate ion concentration in the box was kept at 0 parts per million (ppm).
3. All the corn from each plant in the box was removed and weighed.
4. The mean mass of corn per plant was calculated.
5. Steps 1 to 4 were repeated for boxes containing soil with different concentrations of nitrate ions.

Figure 2 shows the corn plants in the box with a 20 ppm soil nitrate ion concentration.

Figure 2



0 4 . 1

Give **two** variables the scientists should have controlled in this investigation.

[2 marks]

1 _____

2 _____

Turn over ►



The scientists carried out a valid investigation.

Table 1 shows the scientists' results.

Table 1

Soil nitrate ion concentration in ppm	Mean mass of corn per plant in grams
0	122
10	190
20	256
30	268
40	240
50	184



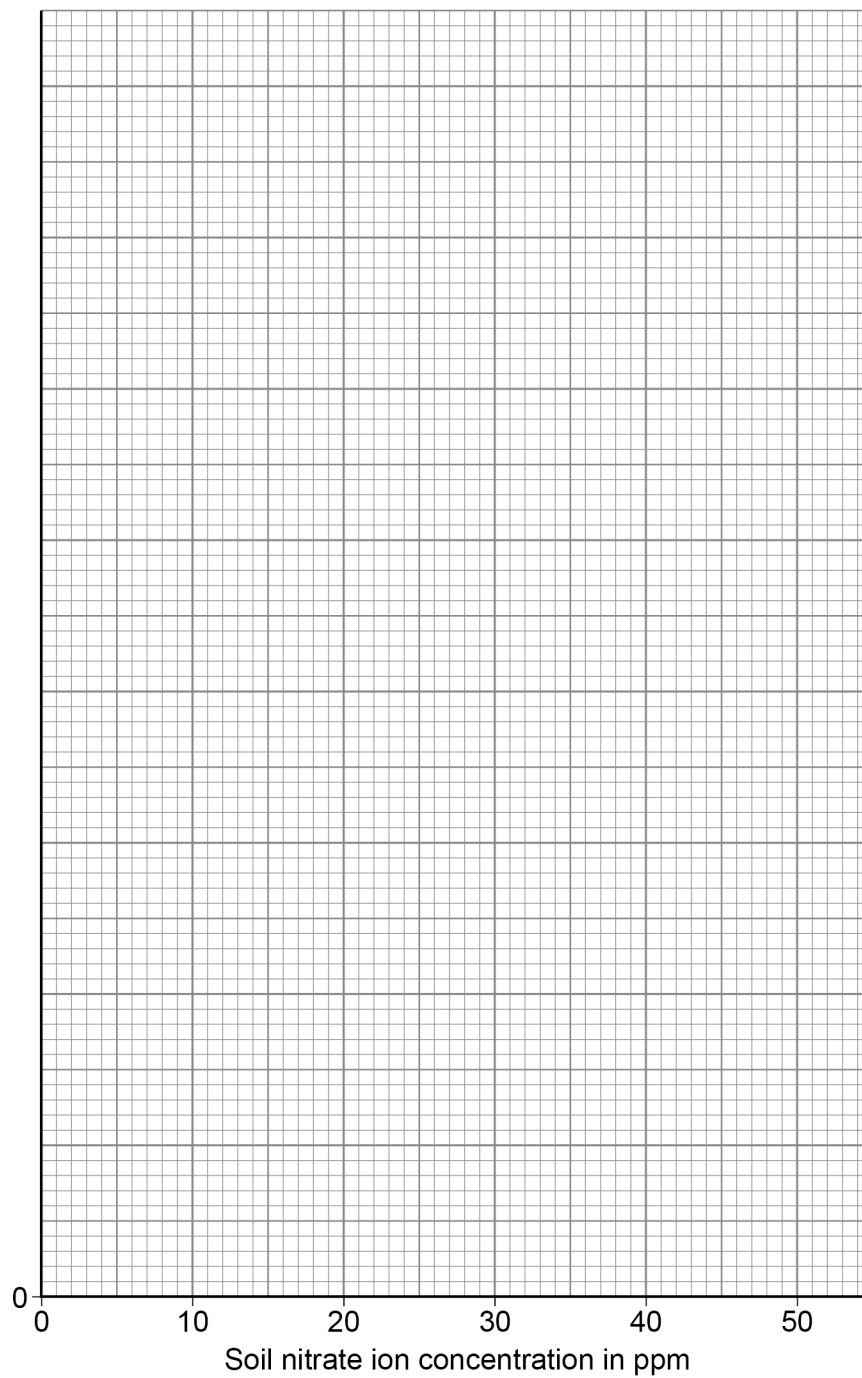
0 4 . 2 Complete **Figure 3**.

You should:

- label the *y*-axis
- use a suitable scale for the *y*-axis
- plot the data from **Table 1**
- draw a line of best fit.

[4 marks]

Figure 3



Turn over ►



Table 1 is repeated below.

Table 1

Soil nitrate ion concentration in ppm	Mean mass of corn per plant in grams
0	122
10	190
20	256
30	268
40	240
50	184

0 4 . 3

Describe the relationship between soil nitrate ion concentration and the mean mass of corn per plant.

Use data from **Table 1** in your answer.

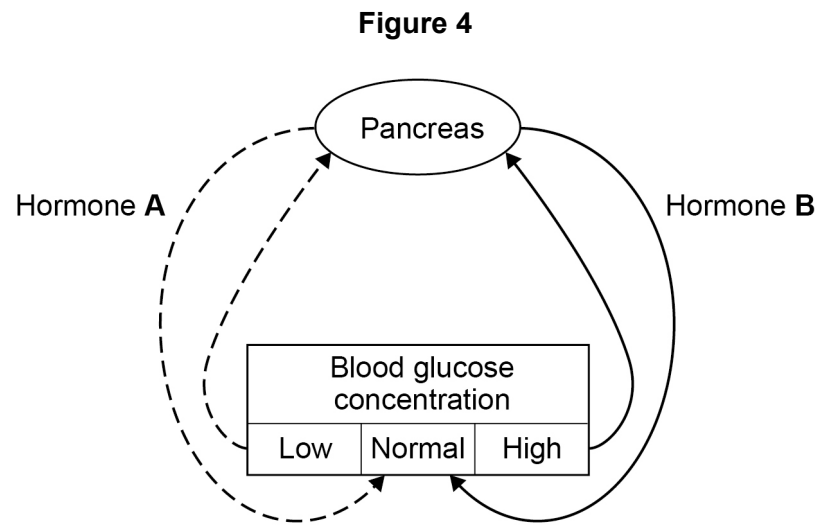
[2 marks]



0 5

Blood glucose concentration in the human body needs to be kept within the normal range.

Figure 4 shows that two hormones control blood glucose concentration.



0 5

1

Name the type of hormonal control shown in **Figure 4**.

[1 mark]

0 5

2

Name hormones **A** and **B** in **Figure 4**.

[1 mark]

A _____

B _____



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outside the
box*

0 5 . 3

Explain how the two hormones in **Figure 4** keep the blood glucose concentration within the normal range for 3 hours after a meal.

[6 marks]

Question 5 continues on the next page

Turn over ►



Female reproductive hormones are used to treat infertility in women.

0 5 . 4

Follicle Stimulating Hormone (FSH) and then Luteinising Hormone (LH) can be injected into a woman to help her become pregnant by sexual intercourse.

Explain how injecting FSH and then LH will help a woman to become pregnant.

[3 marks]

0 5 . 5

In some women the injections of FSH and LH are the first steps for In Vitro Fertilisation (IVF).

Describe the remaining steps in IVF.

[4 marks]



0 5 . 6

There are two different processes of cell division in humans.

Describe **three** differences between cell division to form sperm cells compared with cell division to form liver cells.

[3 marks]

1 _____

2 _____

3 _____

18

Turn over for the next question

Turn over ►



0 6

The polar bear is a mammal that lives in arctic habitats.

0 6 . 1

Complete **Table 2** for the classification of the polar bear, *Ursus maritimus*.**[2 marks]****Table 2**

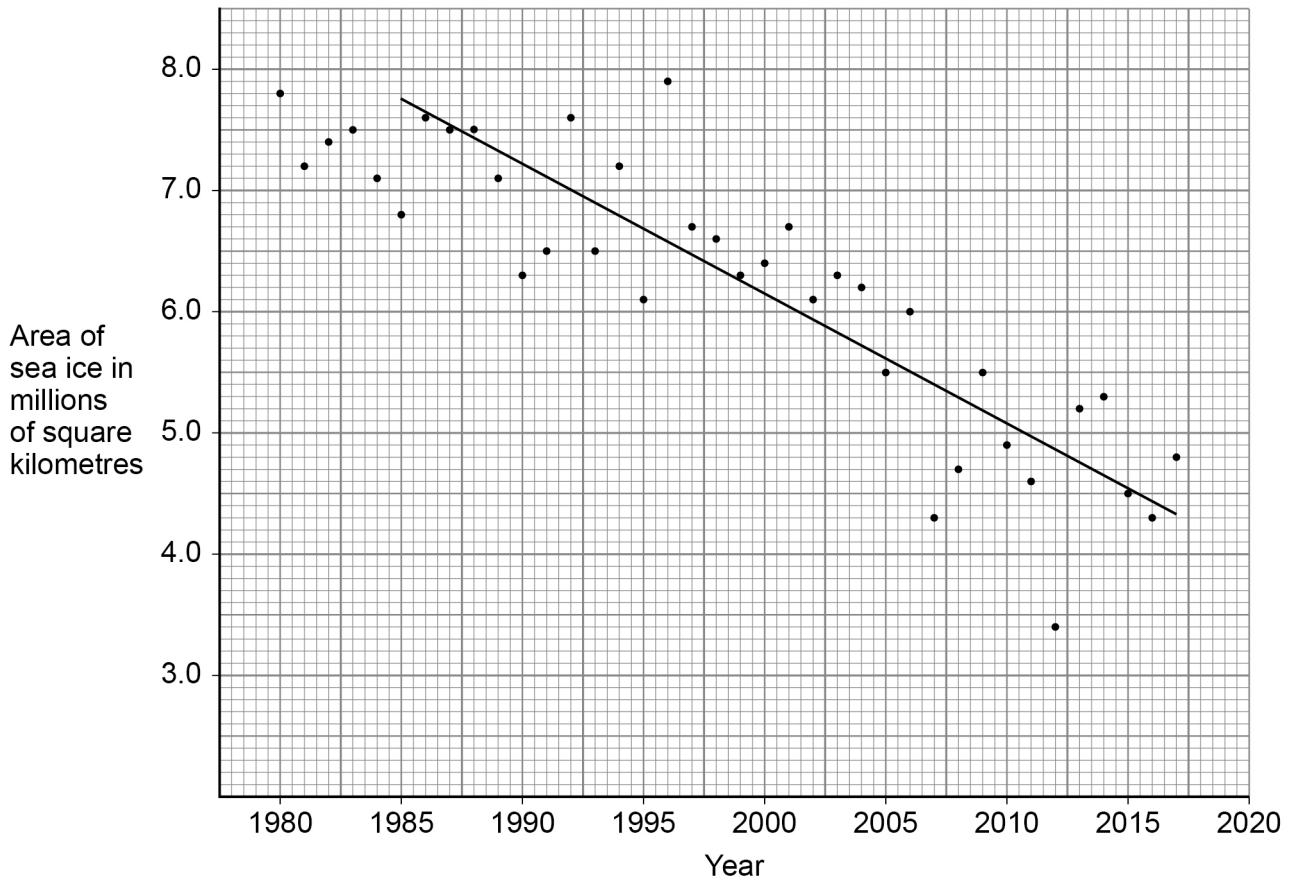
Classification group	Name
Domain	
Kingdom	
	chordata
Class	mammalia
Order	carnivora
	ursidae
Genus	Ursus
Species	maritimus



Scientists have been measuring the area of sea ice in the Arctic since 1980.

Figure 5 shows the area covered by sea ice every September.

Figure 5



0 6 . 2 Determine the annual rate of loss of sea ice between 1985 and 2017.

A trend line has been drawn on **Figure 5** to help you.

[3 marks]

Rate of loss = _____ million square kilometres per year

Question 6 continues on the next page

Turn over ►



The total number of polar bears living on the arctic ice is not known.

The hunting of polar bears has been banned or reduced in some areas.

In some populations the average mass and height of polar bears has decreased.

Polar bears eat seals. Seals live on the sea ice in winter and raise their pups there in early spring. In the summer seals live mainly in the sea catching fish to eat.

Polar bears spend much of the year hunting seals on the sea ice and in the sea nearby. The sea ice area is at its lowest each year in September at the end of summer. The polar bears feed mainly in early spring, and again in autumn to build fat stores to survive the next winter.

During the winter of 2017 scientists measured the metabolic rates of nine female polar bears and found them to be much higher than expected. Cameras attached to the female polar bears showed they had to swim long distances to find seals to eat.

0 6 . 3

Suggest why polar bears find it harder to catch seals in autumn than in spring.

[2 marks]

0 6 . 4

Evaluate what might happen to the population of polar bears in the Arctic in the future.

[4 marks]

11

END OF QUESTIONS



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