OCR
RECOGNISING ACHIEVEMENT

SPECIMEN H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE **A162/02**

BIOLOGY A

Unit A162: Modules B4, B5, B6 (Higher Tier)

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

OCR Supplied Materials:
None

Other Materials Required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

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

INFORMATION FOR CANDIDATES
- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks for each question is given in brackets **[ ]** at the end of the question or part question.
- The total number of marks for this paper is **60**.
- This document consists of **20** pages. Any blank pages are indicated.

For Examiner's Use		
	Max	**Mark**
1	**4**	
2	**5**	
3	**11**	
4	**4**	
5	**10**	
6	**6**	
7	**3**	
8	**4**	
9	**6**	
10	**3**	
11	**4**	
TOTAL	**60**	

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Answer **all** the questions.

1 Respiration is the process by which we release energy from our food.

(a) Anaerobic respiration is different from aerobic respiration.

Describe **two** ways in which it is different.

.....

.....

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

(b) Working muscle cells can carry out **anaerobic** respiration.

Complete the word equation for anaerobic respiration.

..... → ..... (+ energy released) **[1]**

(c) Muscle cells contain different structures.

The structures have different roles in the process of respiration.

Draw a straight line between each **structure in the muscle cell** and its **role in respiration**.

structure in the muscle cell	role in respiration
mitochondrion	contains enzymes for anaerobic respiration
cell membrane	contains the genetic code for enzymes
DNA in nucleus	allows dissolved gases and water to pass freely in and out
cytoplasm	contains enzymes for aerobic respiration

[1]

[Total: 4]

2 Plants produce food by the process of photosynthesis.

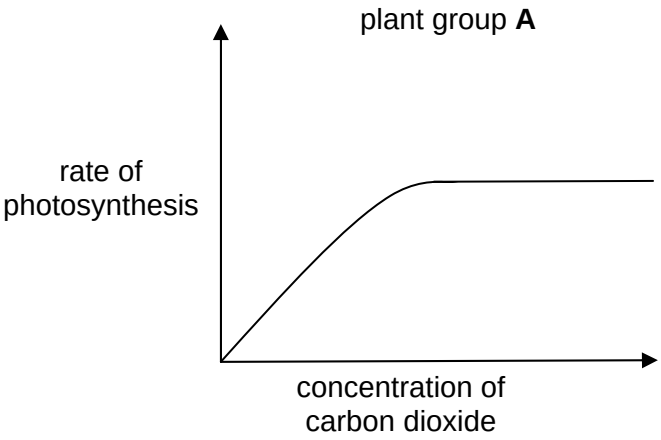
(a) Complete the balanced symbol equation to show this process.

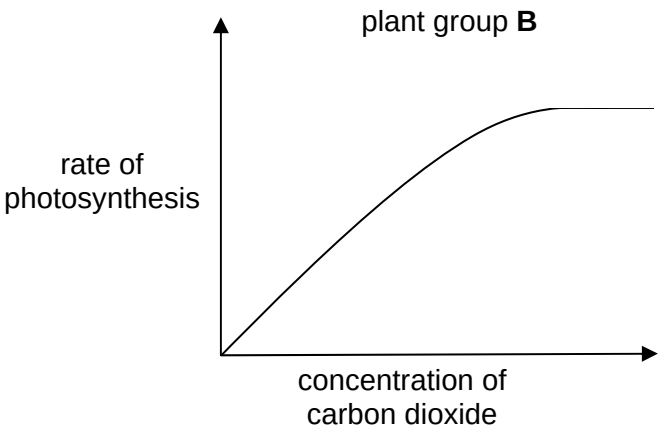
..... + $6H_2O$ → $C_6H_{12}O_6$ + ... **[1]**

(b) A student investigates the rate of photosynthesis in plants. She tests two groups of plants of the same species in different conditions.

For each group she measures the rate of photosynthesis at different concentrations of carbon dioxide.

The graphs show her results.





Suggest how the conditions for group **B** may have differed from group **A**, and explain why this has produced the results shown in the graphs.

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..... **[4]**

[Total: 5]

3 Alex is investigating the activity of an enzyme called salivary amylase. The enzyme breaks down starch into glucose, and is present in saliva in the human mouth.

(a) Alex has read that the digestion of some foods begins in the mouth.

Alex has chicken and chips for lunch. She wonders which parts of her lunch will start to be digested by salivary amylase in her mouth. She knows that chicken meat is made of protein.

Explain why salivary amylase will start digesting the chips in her mouth but will not start digesting the chicken.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

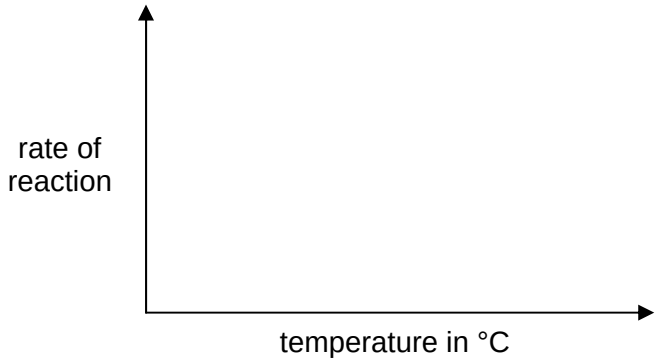
(b) Alex calculates the rate of reaction when salivary amylase breaks down starch.

She does this reaction four times at seven different temperatures.

Here are her results.

temperature in °C	rate of reaction in arbitrary units			
	experiment 1	experiment 2	experiment 3	experiment 4
20	5	8	5	4
30	9	11	6	10
40	14	17	19	16
50	9	4	3	5
60	2	3	1	2
70	1	0	0	1
80	0	0	0	0

(i) Sketch on the axes the **shape** of the graph that these data would give. Do not plot any data points.



[1]

(ii) Alex concludes that salivary amylase is well adapted to perform its role in the body.

Explain how the data and the graph you have drawn support this conclusion.

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

(iii) Alex repeats the experiment at 40 °C but uses solutions of the substrate and enzyme in dilute acid instead of water.

Suggest what effects this could have on the rate of reaction, and explain why.

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

[Total: 11]

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4 Human enzymes can be made by genetically modified yeast cells.

- Human DNA is inserted into the yeast cells.
- The **modified** yeast cells now have the ability to synthesise human enzymes.

(a) Complete the sentences about the production of human enzymes by modified yeast cells.

Choose words from this list.

amino acids

bases

fatty acids

proteins

sugars

The modified yeast cells can code for the production of the human enzymes because their DNA now contains the correct sequence of ..... .

The human enzymes produced will have the correct number and sequence of …… . **[1]**

(b) The modified yeast cells go through the cell cycle and reproduce to form a culture.

The two main parts of the cell cycle are cell growth and mitosis.

Which statements about the cell cycle are true?

Put ticks (✓) in the boxes next to the correct statements.

The nucleus divides during cell growth.	☐
The chromosomes are copied to form new strands of DNA.	☐
The number of organelles in each cell decreases as the cell grows.	☐
The copies of each chromosome stay together when a cell divides during mitosis.	☐
The number of chromosomes doubles in each cell before the cell divides.	☐

[1]

(c) **Meiosis** is a type of cell division that takes place in humans.

Use ideas about chromosomes to describe how cells made by meiosis are different from cells made by mitosis, and why this is important.

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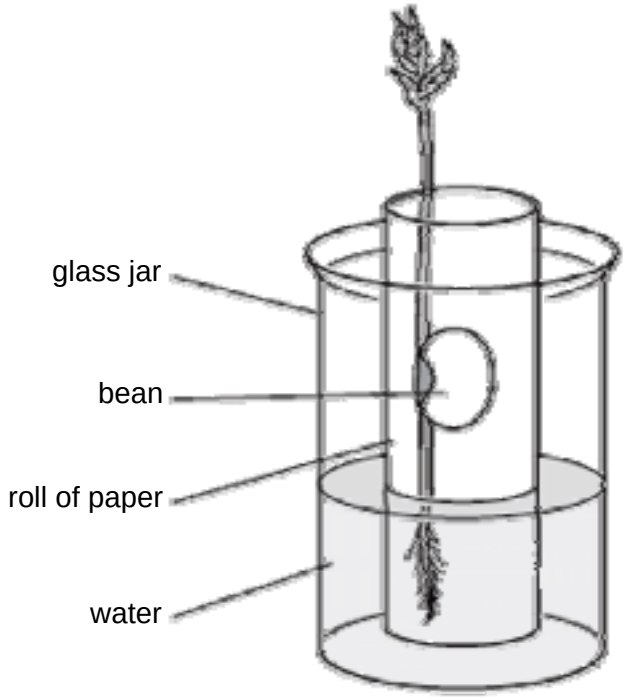
..... **[2]**

[Total: 4]

5 Joe does an experiment to investigate the effect of light on the growth of a bean seedling.

He sets up the experiment as shown in the diagram.



(a) Some parts of the seedling contain meristems.

Explain why these meristems are important to the seedling.

.....

.....

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

(b) Joe puts the glass jar containing the bean seedling next to a window.

After several days he notices that the tip of the seedling stem has grown towards the window.

Explain how the seedling stem grows towards the light coming through the window.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

(c) A team of plant scientists predict that a chemical they have produced will make plant roots grow.

The team test their prediction by growing plants with and without the chemical and then measuring root growth.

They found that there was **agreement** between the data and their prediction. The scientists concluded that this proved the chemical made roots grow.

Write down whether you agree or disagree with this conclusion, and explain why.

.....

.....

.....

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

[Total: 10]

6 A scientist is trying to produce specialised cells from adult stem cells. She hopes to use the specialised cells to replace damaged tissues in the human body.

She divides a sample of identical adult stem cells into two different solutions of chemicals. She wants to find out whether the chemicals affect the rate of cell division of the stem cells.

She counts the number of live cells present in each solution every six hours over a 24-hour period.

Here are her results.

solution	**number of live cells to the nearest thousand**			
	6 hours	**12 hours**	**18 hours**	**24 hours**
A	4000	16 000	16 000	32 000
B	2000	8000	32 000	128 000

(a) The scientist concludes that the **rate** of cell division increased steadily between 6 and 24 hours in solution **B**.

Is this conclusion correct? Justify your answer.

.....

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..... **[1]**

(b) The scientist also concludes that there was no cell division in solution **A** between hours 12 and 18 of the experiment.

(i) Suggest **two** reasons why this conclusion may **not** be correct.

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

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(ii) The scientist realises that a fault in the incubator for solution **A** caused the temperature to vary between hours 12 and 18 of the experiment.

Suggest how this could account for the results at hours 12 and 18.

.....

.....

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

(c) The scientist needs to make the stem cells specialise so that she can use them to replace damaged tissues in the body.

One way to make the cells specialise is to expose them to certain chemicals.

What is the first thing that must happen in a cell before it can form a specific tissue type?

.....

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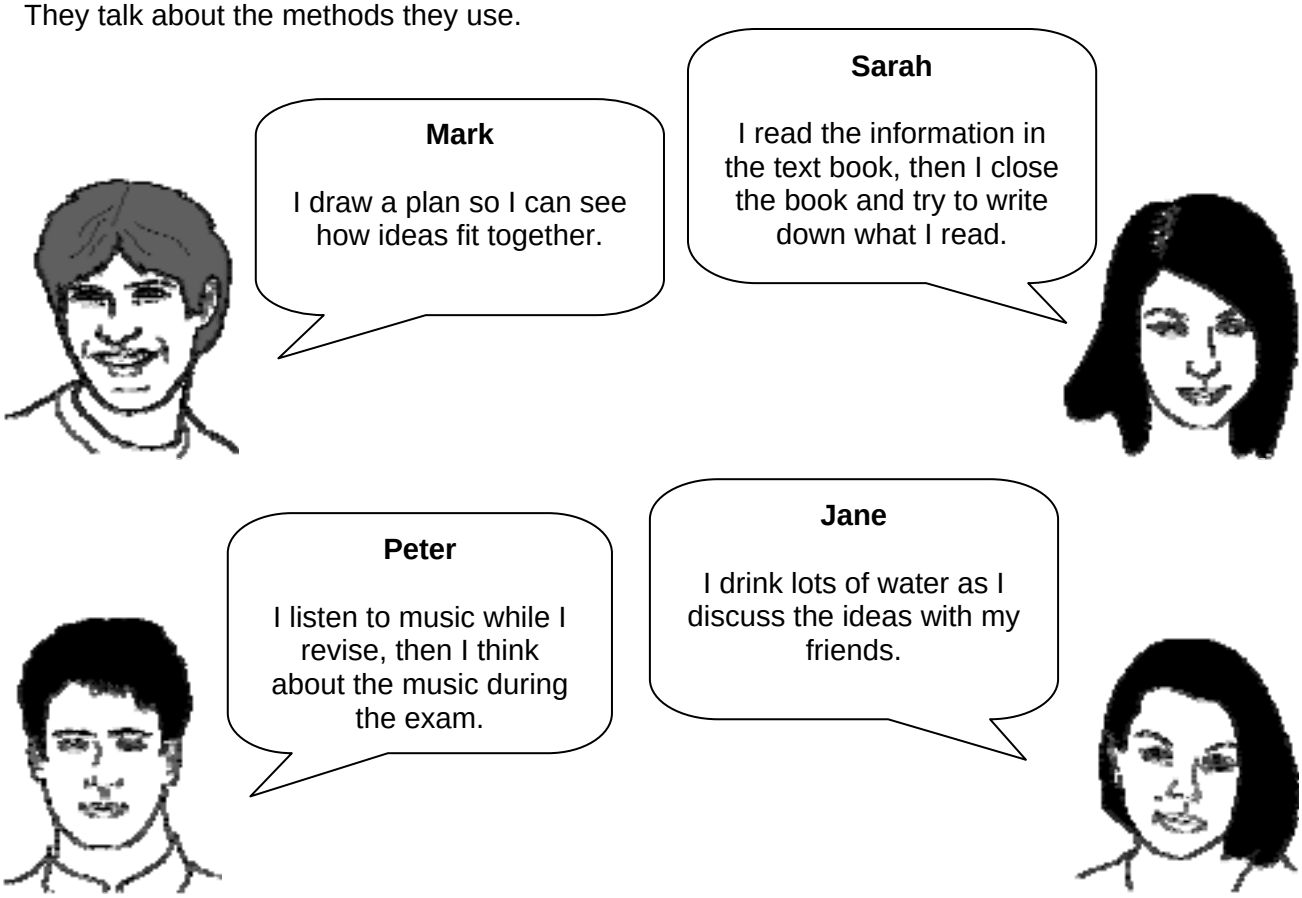
..... **[1]**

[Total: 6]

7 Four friends are revising for their exams.

They talk about the methods they use.



(a) Which person is using a stimulus to help them remember?

name ..... **[1]**

(b) Memory depends on two different processes.

Which person describes the use of both of these processes? Explain why you have chosen this person.

.....

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

[Total: 3]

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8 Brian walks out of the cinema into bright sunshine.

The bright light dazzles his eyes, and at first he cannot see properly.

Then, his eyes adjust as his pupils get smaller. This is the pupil reflex.

(a) Draw straight lines to join each **component** to the correct **part of the reflex**.

component	part of the reflex
muscle cells in iris	processor
light sensitive cells in retina	effector
central nervous system	receptor

[2]

(b) Newborn babies have some reflexes that disappear after time.

Write down two newborn reflexes.

1 .....

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

[Total: 4]

9 Pujitha is reading about an anti-depressant drug called paroxetine.

He reads that paroxetine increases the transmission of nerve impulses in the brain by increasing the concentration of serotonin.

Suggest how paroxetine could cause this change in serotonin concentration and the increase in transmission of nerve impulses in the brain.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

[Total: 6]

10 Some scientists are investigating the speed at which nerve impulses travel along different human neurons.

They measure the length of four different neurons and record how long it takes for a nerve impulse to travel from one end of each neuron to its other end.

They repeat the experiment five times for each neuron. Here are their results.

neuron	length of neuron in m	mean time taken for impulse to travel along neuron in seconds
A	1.3	1.25
B	1.0	0.05
C	1.2	0.06
D	0.1	0.06

(a) How far would a nerve impulse travel along neuron **A** in 1 second?

answer = ... m **[1]**

(b) One of these neurons was a motor neuron that connected the spinal cord to a muscle in the big toe. The neuron was in a patient with multiple sclerosis (MS).

MS is a disease in which the patient's own immune system breaks down the fatty sheath on their neurons.

Which neuron was the motor neuron in the patient with MS? Justify your answer.

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

[Total: 3]

11 Stuart is a doctor. He has a patient with a brain injury.

Stuart wants to do research on this patient's brain.

Some people think he should be allowed to do this, while other people think he should not be allowed.

Discuss reasons in **support** of Stuart's plan to study this patient's brain.

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..... **[4]**

[Total: 4]

[Paper Total: 60]

END OF QUESTION PAPER

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RECOGNISING ACHIEVEMENT

SPECIMEN H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

BIOLOGY A **A162/02**

Unit A162: Modules B4, B5, B6 (Higher Tier)

MARK SCHEME

MAXIMUM MARK 60

This document consists of 20 pages

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Guidance for Examiners

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

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

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

Eg mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)
work done = 0 marks
work done lifting = 1 mark
change in potential energy = 0 marks
gravitational potential energy = 1 mark

5. Annotations:
The following annotations are available on SCORIS.

✓	=	correct response
✗	=	incorrect response
bod	=	benefit of the doubt
nbod	=	benefit of the doubt **not** given
ECF	=	error carried forward
^	=	information omitted
I	=	ignore
R	=	reject

6. If a candidate alters his/her response, examiners should accept the alteration.

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

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

Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.
☐	☐	☑
☐	☐	☑
✓	☑	✓
☑	☑	✓
☐	☐	☐
This would be worth 0 marks.	This would be worth one mark.	This would be worth one mark.

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

9. Marking method for tick boxes:

   Always check the additional guidance.

   If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.
   If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, eg shading or crosses.
   Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

   Eg If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

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

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

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10. Three questions in this paper are marked using a Level of Response (LoR) mark scheme with embedded assessment of the Quality of Written Communication (QWC). When marking with a Level of Response mark scheme:

- Read the question in the question paper, and then the list of relevant points in the 'Additional guidance' column of the mark scheme, to familiarise yourself with the expected science. The relevant points are not to be taken as marking points, but as a summary of the relevant science from the specification.
- Read the level descriptors in the 'Expected answers' column of the mark scheme, starting with Level 3 and working down, to familiarise yourself with the expected levels of response.
- *For a general correlation between quality of science and quality of QWC*: determine the level based upon which level descriptor best describes the answer; you may awarded either the higher or lower mark within the level depending on the quality of the science and/or the QWC.
- *For high-level science but very poor QWC*: the candidate will be limited to Level 2 by the bad QWC no matter how good the science is; if the QWC is so bad that it prevents communication of the science the candidate cannot score above Level 1.
- *For very poor or totally irrelevant science but perfect QWC*: credit cannot be awarded for QWC alone, no matter how perfect it is; if the science is very poor the candidate will be limited to Level 1; if there is insufficient or no relevant science the answer will be Level 0.

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Question			Expected answers	Marks	Additional guidance
1	(a)		**any two from:** oxygen is used in aerobic respiration / oxygen is not used in anaerobic respiration lactic acid/lactate/ethanol is produced in anaerobic respiration / lactic acid/lactate/ethanol is not produced in aerobic respiration aerobic respiration releases more energy per glucose molecule / anaerobic respiration releases less energy per glucose molecule	[2]	
	(b)		glucose → lactic acid	[1]	**both** required for the mark **accept** "lactate" instead of lactic acid **reject** carbon dioxide and ethanol (as this is anaerobic respiration in muscle cells, not plant cells/microorganisms/yeast) **reject** formulae
	(c)		**structure in the muscle cell** → **role in respiration** mitochondria → contains enzymes for anaerobic respiration cell membrane → contains the genetic code for enzymes DNA in nucleus → allows dissolved gases and water to pass freely cytoplasm → contains enzymes for aerobic respiration	[1]	all four correct lines = 1 mark
			Total	[4]	

Question			Expected answers	Marks	Additional guidance
2	(a)		$6CO_2$ and $6O_2$	[1]	**both** required for the mark, in correct order
	(b)		(the rate of) photosynthesis can be limited by carbon dioxide, light intensity and temperature in group **A**, light intensity or temperature is limiting the rate of photosynthesis (at high carbon dioxide levels) in group **B** there is greater light intensity / higher temperature so a faster rate of photosynthesis is possible before light intensity/temperature becomes limiting	[4]	**accept** "brighter" / "warmer" etc.
			Total	[5]	

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Question			Expected answers	Marks	Additional guidance
3	(a)	✎	**[Level 3]** Answer correctly and clearly describes the lock and key model, notes that chips/potatoes contain starch and explains that substrate specificity is why digestion of starch molecules in the chips by salivary amylase will start in the mouth but digestion of protein molecules in the chicken will not. All information in the answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **[Level 2]** Answer correctly describes some aspects of the lock and key model but may not use the appropriate terminology and may not make clear the importance of the specificity of the active site on the salivary amylase molecule for the shape of the starch molecule. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **[Level 1]** Answer demonstrates understanding that salivary amylase will start to digest starch in the chips but will not digest protein in the chicken, but does not clearly attribute this to the specificity of the enzyme's active site for the shape of the starch molecule. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	[6]	**relevant points include:** • chips/potatoes/plants contain starch (as an energy store) • salivary amylase has an active site • the shape of the active site complements the shape of a starch molecule • only a starch molecule will fit into the enzyme's active site and form an enzyme-substrate complex • this is the 'lock and key' model • chicken meat is made of protein, not starch • protein will not fit into the enzyme's active site • and will not form an enzyme-substrate complex • so will not be digested

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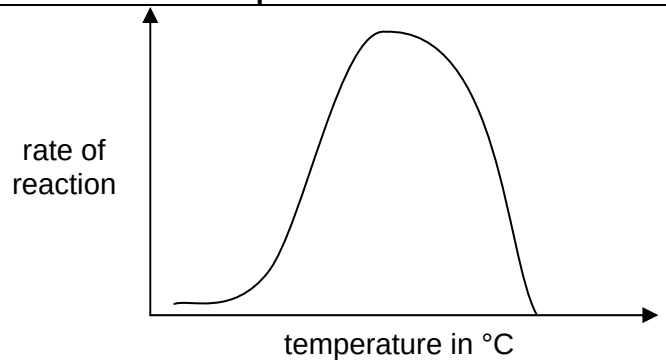
Question			Expected answers	Marks	Additional guidance
	(b)	(i)		[1]	as temperature increases the rate should climb to an optimum, then drop to zero
		(ii)	the optimum temperature for the enzyme / the maximum rate of reaction occurs at around 40 °C which is close to human body temperature	[2]	
		(iii)	lower/different pH will change the shape of the active site, which will affect the ability of the enzyme to form an enzyme-substrate complex this means the rate of reaction will be higher if the pH is closer to the enzyme's optimum pH, or lower if the pH is further from the enzyme's optimum pH	[2]	
			Total	[11]	

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Question			Expected answers	Marks	Additional guidance
4	(a)		bases amino acids	[1]	**both** required for the mark **must** be in correct order
	(b)		The nucleus divides during cell growth. [ ] The chromosomes are copied to form new strands of DNA. [✓] The number of organelles in each cell decreases as the cell grows. [ ] Together when the cell divides during mitosis. [ ] The number of chromosomes doubles in each cell before the cell divides. [✓]	[1]	**both** required for the mark
	(c)		cells made by meiosis contain half the number of chromosomes of the parent cell but cells made by mitosis have the same number of chromosomes. this is important because meiosis produces gametes, which fuse with other gametes during fertilisation to make a cell/zygote with the correct number of chromosomes	[2]	**accept** "meiosis produces variation" for 1 mark
			Total	[4]	

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Question			Expected answers	Marks	Additional guidance
5	(a)		cells in meristem tissue are the only cells in the seedling that divide (by mitosis) and allow the seedling to grow/elongate by producing new cells	[2]	
	(b)	✎	**[Level 3]** Answer correctly describes the production, distribution and effect of auxin at the shoot tip under conditions of directional light. All information in the answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **[Level 2]** Answer may correctly identify some aspects of auxin activity at the shoot tip under conditions of directional light but may not make the correct links between events. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **[Level 1]** Answer refers to phototropism and/or diffusion of auxin but without describing the details correctly. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	[6]	**relevant points include:** • auxin is produced by the tip of the stem • auxin diffuses down into the lower tissues of the stem • (strong) directional light causes the auxin to diffuse towards the darker side of the stem • auxin promotes cell division/growth • higher auxin concentration on the darker side of the stem increases the division/growth rate on this side • more/faster division/growth on the darker side produces a stem that is curved towards the directional light source • this is phototropism **ignore** references to the shoot "bending" towards the light without this being linked to growth **reject** references to light destroying/breaking down auxin

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Question			Expected answers	Marks	Additional guidance
5	(c)		*disagree because:* observations/data that agree with a prediction <u>increase</u> <u>confidence</u> in the explanation but this does not <u>prove</u> that the explanation is correct	[2]	
			Total	**[10]**	

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Question			Expected answers	Marks	Additional guidance
6	(a)		*the conclusion is not correct because:* the rate of cell division is constant between 6 and 24 hours / there are two rounds of division between each time point	[1]	no mark for saying the conclusion is not correct, only for saying why
	(b)	(i)	recording to the nearest thousand made the cell count appear the same even though different numbers of cells were present / there may have been a counting error cells were dividing but an equal number of cells died as were formed	[2]	
		(ii)	cells may only divide at a specific temperature / within a certain temperature range but would be able to survive (without dividing) even if the temperature was higher or lower than this	[2]	
	(c)		inactive genes (in the nucleus) need to be reactivated/switched on	[1]	
			Total	[6]	

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Question			Expected answers	Marks	Additional guidance
7	(a)		Peter	[1]	
	(b)		Sarah because she is using storage and retrieval of information	[2]	
			Total	[3]	

8	(a)		**component** → **part of the reflex** muscle cells in the iris → effector light sensitive cells in the retina → receptor central nervous system → processor	[2]	
	(b)		**any two from:** stepping grasping sucking	[2]	**accept** ”suckling” for sucking
			Total	[4]	

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Question			Expected answers	Marks	Additional guidance
9		✎	**[Level 3]** Answer clearly links paroxetine to serotonin synapses, describes the blocking of serotonin removal sites, and attributes the subsequent propagation of nerve impulses to the increased concentration of serotonin allowing increased binding to receptors on the next neuron. All information in the answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **[Level 2]** Answer describes the correct mode of action but does not provide all of the details, or does not get the order quite right, or does not use all of the correct technical terms. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **[Level 1]** Answer may compare the action of paroxetine to the action of Ecstasy/MDMA but does not provide many details of how it works. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**relevant points include:** • paroxetine could work in the same way as Ecstasy/MDMA • at <u>synapses</u> (in the brain) • that use serotonin as a <u>transmitter substance</u> • by blocking sites where serotonin is removed from the synapse • when a nerve impulse is transmitted across the synapse, serotonin is released from the first neuron and binds to receptors on the membrane of the second/next/relay neuron • this causes nerve impulses in the second neuron • serotonin is not removed from the synapse, which leads to an increased concentration of serotonin in the synapse • more serotonin molecules are able to bind to receptors on the second neuron • and this causes more nerve impulses in the second neuron
			Total	**[6]**	

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Question			Expected answers	Marks	Additional guidance
10	(a)		1.04	[1]	**accept** "104" if the candidates has clearly given the unit as "cm"
	(b)		*neuron **A** because:* the speed of the nerve impulse is slow (which indicates that it does not have/has lost the fatty sheath) and it is long enough to reach from the toes to the spinal cord / neuron **D** would not be long enough to reach from the toes to the spinal cord	[2]	no marks for neuron **A**, only for the justification of the choice
			Total	[3]	

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Question			Expected answers	Marks	Additional guidance
11			**any four from:** the patient could benefit if a treatment for the brain injury is developed the knowledge gained may help to treat other people / benefit to society outweighs cost to individual / more people will benefit in the long term Stuart could use (non-invasive) procedure(s) that will not cause damage/pain to the patient research that uses human participants can yield more useful information than research that uses models/simulations/animals/other organisms if Stuart wants to study the effects of brain damage on language/intelligence/etc this can only be done using humans the patient may have given their consent / volunteered to be part of the research a study that uses humans can get consent from the participants, but a study that uses other organisms/animals can not	[4]	**credit** any appropriate named procedure (e.g. MRI, PET, CAT scan)
			Total	[4]	

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Assessment Objectives (AO) Grid

(includes quality of written communication✎)

Question	AO1	AO2	AO3	Total
1(a)	2			**2**
1(b)	1			**1**
1(c)	1			**1**
2(a)	1			**1**
2(b)	1	2	1	**4**
3(a)✎	3	3		**6**
3(b)(i)		1		**1**
3(b)(ii)		1	1	**2**
3(b)(iii)	1	1		**2**
4(a)		1		**1**
4(b)	1			**1**
4(c)	2			**2**
5(a)	1	1		**2**
5(b)✎	5	1		**6**
5(c)			2	**2**
6(a)			1	**1**
6(b)(i)		1	1	**2**
6(b)(ii)		1	1	**2**
6(c)		1		**1**
7(a)		1		**1**
7(b)	1	1		**2**
8(a)	1	1		**2**
8(b)	2			**2**
9✎	3	3		**6**
10(a)		1		**1**
10(b)			2	**2**
11		4		**4**
Totals	**26**	**25**	**9**	**60**

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