

Qualification accredited

**Sample Assessment Material**

**A Level**

# **Biology A**

**Cambridge OCR Level 3 Advanced GCE in Biology A**

**H420/01**

Version 3.0

[ocr.org.uk/alevelbiologya](http://ocr.org.uk/alevelbiologya)

## Introduction

**This is Sample Assessment Material (SAM). It is an example exam paper that we publish alongside a specification to help illustrate the intended style and structure of our question papers.**

During the lifetime of the qualification, updates to the question paper template may happen. We always recommend you look at the most recent set of past papers where available.

We also produce two further specific resources to support you with using this SAM:

- An assessment story where we explain the research we have undertaken during the development of the qualification and how consultation with teachers, students and schools has helped shape our assessment approach.
- Annotated SAMs in which we take you through the key points of the assessment and highlight the different types of questions your students will experience in the exam.

Summary of updates		
Date	Version	Change
January 2019	2.0	Minor accessibility changes to the paper: i) Additional answer lines linked to Level of Response questions ii) One addition to the rubric clarifying the general rule that working should be shown for any calculation questions
May 2020	2.1	Updated copyright acknowledgements.
July 2020	2.2	Mark scheme Question 12 – corrected to answer A
February 2026	3.0	Rearranged MCQ's Accessibility changes Updated the marking instructions Creation of Sample Assessment Material wrapper pages.

**A Level Biology A**  
**H420/01 Biological processes**  
Sample Question Paper

**Date – Morning/Afternoon**

Version 3.0

Time allowed: 2 hours 15 minutes



**You can use:**

- a scientific or graphical calculator
- a ruler (cm/mm)



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name (s) \_\_\_\_\_

Last name \_\_\_\_\_

**INSTRUCTIONS**

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.

**INFORMATION**

- The total mark for this paper is **100**.
- The marks for each question are shown in brackets [ ].
- Quality of extended response will be assessed in questions marked with an asterisk (\*).
- This document has **36** pages.

**ADVICE**

- Read each question carefully before you start your answer.

**Section A**

You should spend a **maximum of 20 minutes** on this section.

**1** Which option is **not** a role of the cytoskeleton?

- A** Giving mechanical strength to cells
- B** Movement of chromosomes during mitosis
- C** Phagocytosis
- D** Preventing entry of pathogens

Your answer

**[1]**

**2** A solution containing an unknown single sugar is tested. The results are shown in the table.

<b>Colour observed after testing</b>	
<b>Benedict's test for reducing sugars</b>	<b>Benedict's test for non-reducing sugars</b>
blue	brick red

Identify the unknown sugar.

- A** Fructose
- B** Glucose
- C** Lactose
- D** Sucrose

Your answer

**[1]**

- 3 An anticodon sequence of five tRNA molecules has the following percentage base composition: Adenine 40: Cytosine 27: Guanine 13: Thymine 0: Uracil 20.

What is the percentage base composition of the template strand of the original DNA molecule?

	<b>Adenine</b>	<b>Cytosine</b>	<b>Guanine</b>	<b>Thymine</b>	<b>Uracil</b>
<b>A</b>	40	27	13	20	0
<b>B</b>	20	13	27	40	0
<b>C</b>	20	13	27	0	40
<b>D</b>	40	27	13	0	20

Your answer

[1]

- 4 Citrate synthase is an example of an enzyme that undergoes end-product inhibition. The enzyme catalyses the conversion of oxaloacetate into citric acid in the Kerbs cycle.

Which row describes citrate synthase?

	<b>Type of respiration involved in</b>	<b>Location of enzyme</b>	<b>Inhibitor</b>
<b>A</b>	aerobic	mitochondria	citric acid
<b>B</b>	aerobic	mitochondria	oxaloacetate
<b>C</b>	anaerobic	cytoplasm	citric acid
<b>D</b>	anaerobic	cytoplasm	oxaloacetate

Your answer

[1]

- 5 Diffusion, osmosis and mass flow are mechanisms used to move water through plants.

Which row identifies the mechanism used to move water into root cells, up the stem in the xylem and out of leaves?

	<b>Into root cells</b>	<b>Up the stem in the xylem</b>	<b>Out of leaves via stomata</b>
<b>A</b>	diffusion	osmosis	diffusion
<b>B</b>	diffusion	osmosis	osmosis
<b>C</b>	osmosis	mass flow	diffusion
<b>D</b>	osmosis	mass flow	osmosis

Your answer

[1]

- 6** Cells require vitamins and minerals in order to function. These vitamins and minerals need to cross the plasma membrane.

Vitamin A is fat soluble and Vitamin C is water soluble.

Which combination of vitamin and mineral enters a cell by facilitated diffusion?

- A** Vitamin A and calcium atoms
- B** Vitamin A and calcium ions
- C** Vitamin C and calcium atoms
- D** Vitamin C and calcium ions

Your answer

**[1]**

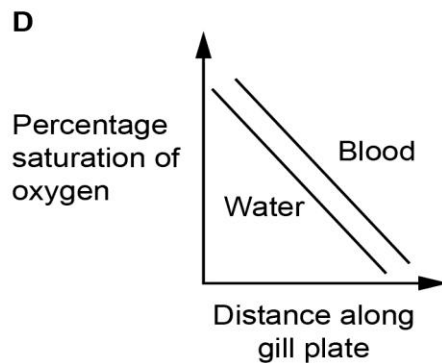
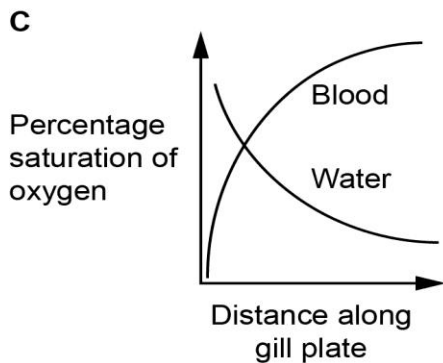
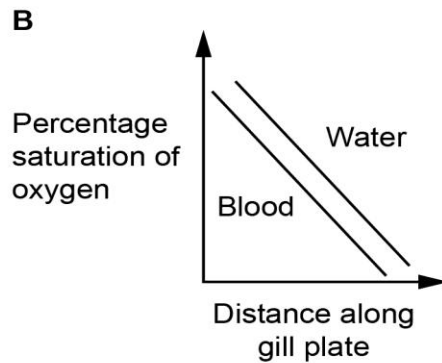
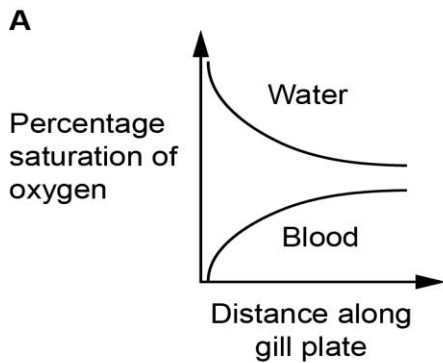
- 7** Which statement explains the significance of mitosis in the development of whole organisms?

- A** Budding in yeast is an example of mitosis, producing new multicellular organisms.
- B** Mitosis can be controlled at certain points in development, which will change body plans.
- C** Mitosis limits the total number of cells in an organism, which will change its shape.
- D** Sex cells are produced by mitosis, which allows new organisms to be produced.

Your answer

**[1]**

8 Which graph represents the counter current exchange system in fish gills?



Your answer

[1]

9 Blood vessels are adapted for their function.

Which of the following statements are true?

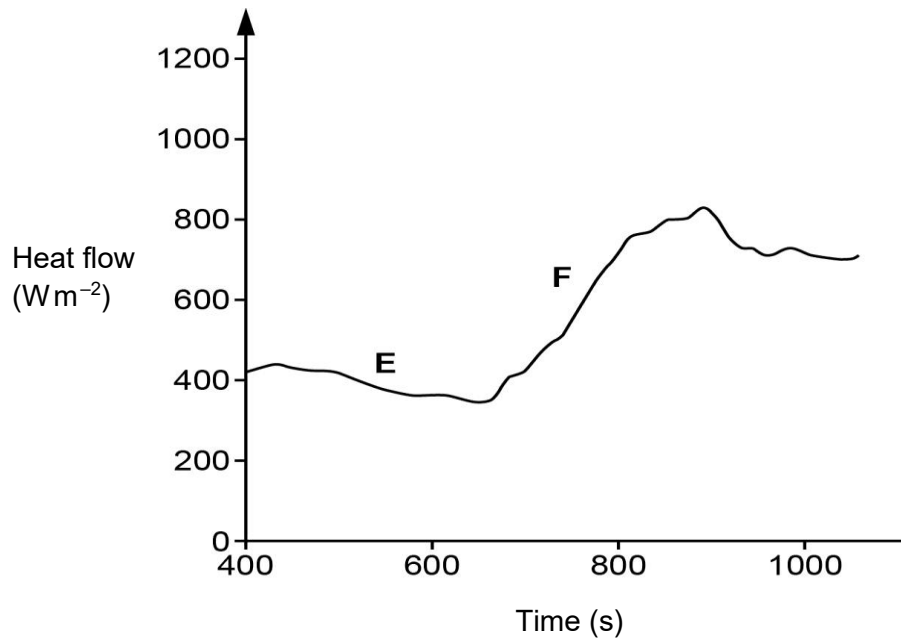
1. The walls of arteries near the heart contain a lot of elastic fibres so that they can stretch and recoil to maintain blood pressure.
2. The walls of the venules contain little muscle.
3. The walls of arteries contain a lot of muscle fibres to contract and generate pressure in the blood.

- A** 1, 2 and 3
- B** Only 1 and 2
- C** Only 2 and 3
- D** Only 1

Your answer

[1]

- 10 The graph shows the heat flow through the skin of an athlete during vigorous exercise.



Blood flow can be directed to the parts of the body that have the greatest demands.

What is happening to the blood flow at stages **E** and **F**?

	Stage E	Stage F
<b>A</b>	Blood directed towards the skin to remove heat from the body	Blood directed away from skin to avoid excess heat loss
<b>B</b>	Blood directed away from skin and towards the muscles to supply more oxygen for respiration	Blood directed towards skin to remove heat from the body
<b>C</b>	Blood directed away from skin to avoid excess heat loss	Blood directed towards skin to gain heat from the environment
<b>D</b>	Blood directed away from skin and towards the muscles to supply more oxygen for respiration	Blood directed towards skin to gain heat from the environment

Your answer

[1]

11 Which option is a medical intervention used to regulate high blood glucose levels in diabetic patients?

- A Injection of glycogen
- B Injection of glucagon
- C Injection of insulin
- D Injection of pancreatic beta cells

Your answer

[1]

12 The kidneys of a healthy individual filter  $178 \text{ dm}^3 \text{ day}^{-1}$  of fluid from the glomeruli into the renal capsules. However, only  $1.5 \text{ dm}^3 \text{ day}^{-1}$  of urine is produced.

Which option shows the percentage of the filtrate that is reabsorbed back into the blood?

- A 0.8
- B 11.8
- C 99.2
- D 176.5

Your answer

[1]

13 Which row describes the process that happens during repolarisation of a neurone during an action potential?

	Sodium channels	Potassium channels	Membrane potential
A	closed	open	decreasing
B	closed	open	increasing
C	open	closed	decreasing
D	open	closed	increasing

Your answer

[1]

- 14** Animals receive different stimuli from their environment. Their synapses can manage multiple stimuli, often resulting in one response such as a muscle twitching.

What is this action of the synapse an example of?

- A** All or nothing response
- B** Cell signalling
- C** Spatial summation
- D** Temporal summation

Your answer

**[1]**

- 15** Plant membranes are made of phospholipid bilayers.

Which of the following statements are true?

1. ATP synthase embedded in thylakoid membranes maintains chemiosmotic gradients.
2. Phospholipid bilayers within the chloroplast are impermeable to protons.
3. Thylakoid membranes contain electron transport chain proteins.

- A** 1, 2 and 3
- B** Only 1 and 2
- C** Only 2 and 3
- D** Only 1

Your answer

**[1]**

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Turn over for the next question

**Section B**

16

(a) The electrical activity of the heart can be monitored using an electrocardiogram (ECG).

Figure 16.1 shows the ECG pattern for a single normal heartbeat.

**Figure 16.1**

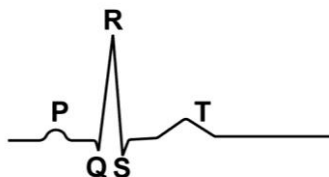
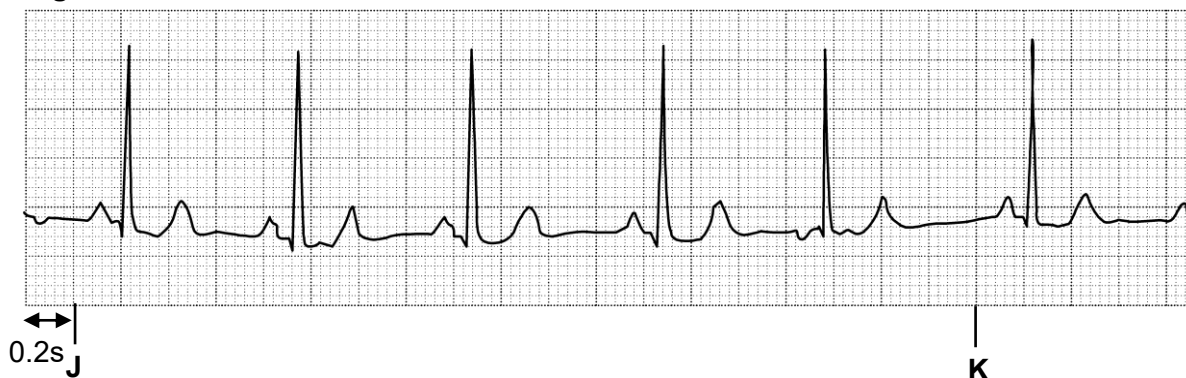
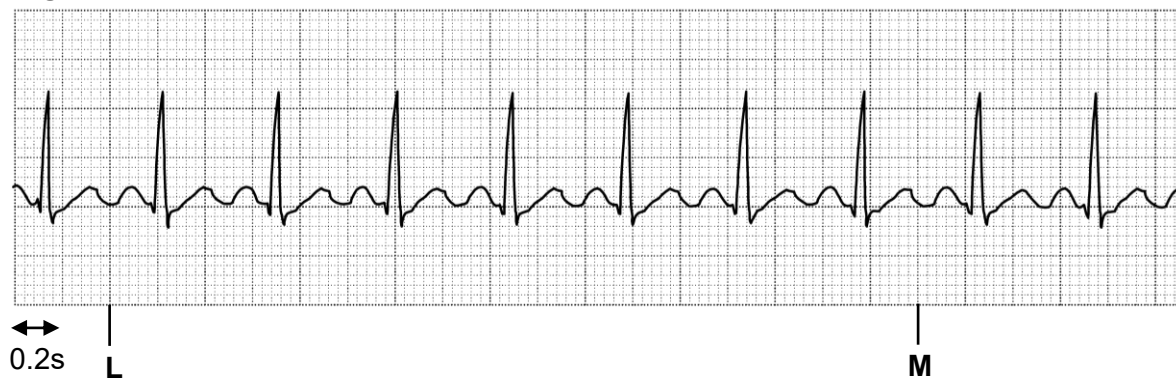


Figure 16.2 shows an ECG trace for a person with normal heart rhythm and Figure 16.3 shows an ECG trace for a person with tachycardia.

**Figure 16.2**



**Figure 16.3**



(i) Calculate the percentage increase in heart rate for the person with tachycardia compared to a normal heart rhythm.

Use the data between points J and K on Figure 16.2 and points L and M on Figure 16.3.

Give your answer to the nearest whole number.

Percentage increase = ..... % [4]

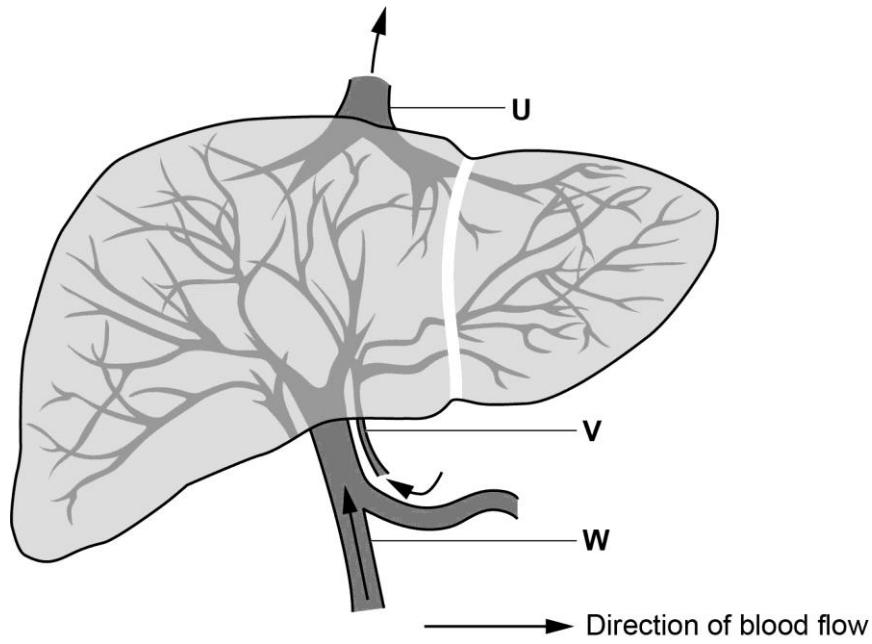


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17

(a) This is a diagram of the external view of a mammalian liver.



Identify the blood vessels labelled **U**, **V** and **W**.

**U** .....

**V** .....

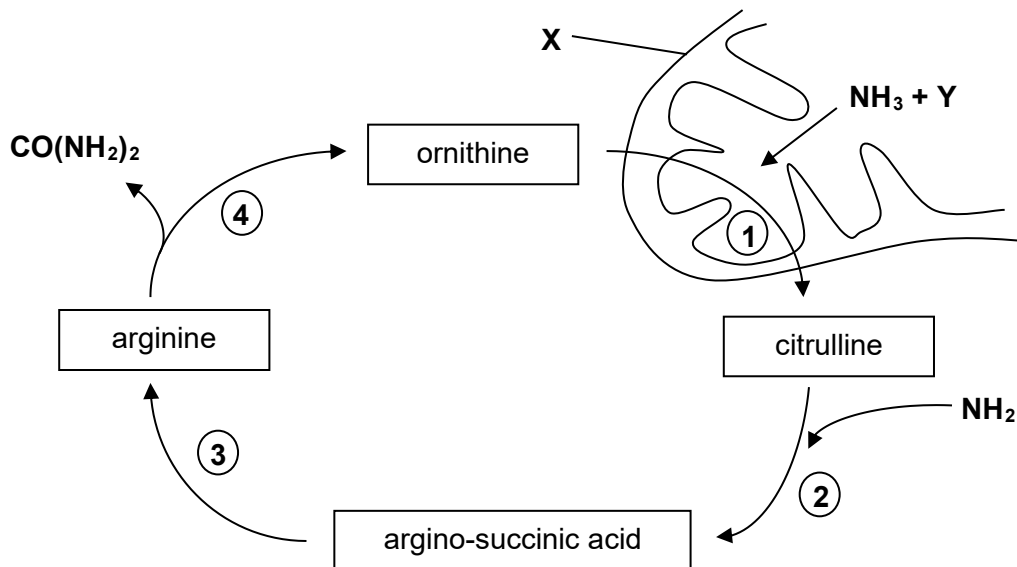
**W** .....

[3]

(b) One of the main functions of liver cells is conversion of ammonia to urea.

The formation of urea occurs rapidly via a series of water-soluble nitrogen-containing intermediate molecules in the ornithine cycle.

This is an outline of the ornithine cycle.



(i) Step 1 of the cycle takes place in the organelle represented by X.

Identify organelle X.

..... [1]

(ii) During the cycle, ornithine moves into organelle X and citrulline moves out of organelle X.

Suggest **one** method by which these molecules move into and out of organelle X during the cycle.

Give reasons for your choice.

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

(iii) State how the ammonia that is used in step 1 has been formed.

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

(iv) Identify the compound labelled Y.

..... [1]

(c) Liver cells have a high metabolic rate. Hydrogen peroxide is a metabolic product produced in large quantities in liver cells. It needs to be removed in order to prevent serious damage to the liver cells.

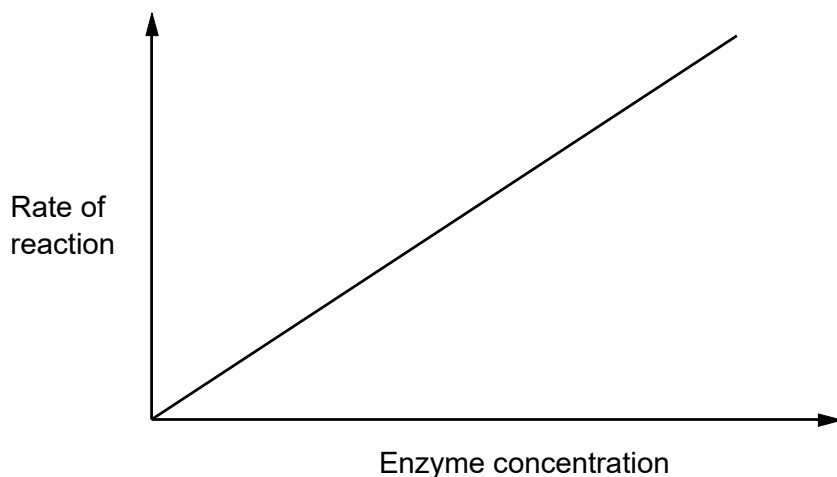
Hydrogen peroxide is detoxified by the enzyme catalase in this reaction:



Catalase has a very high turnover rate. A single catalase molecule can catalyse the breakdown of approximately 6 million hydrogen peroxide molecules every minute. Catalase is found in peroxisomes inside the liver cells. Peroxisomes are organelles surrounded by a single membrane.

Scientists investigate the activity of catalase using chopped liver tissue and dilute hydrogen peroxide. When chopped liver is added to the hydrogen peroxide bubbles of oxygen are produced.

The graph shows the effect of increasing enzyme concentration on the rate of the reaction.



(i) Identify **two** variables that need to be controlled in this investigation.

1 .....

2 .....

[1]

(ii) Describe how you could control **one** of the variables that you identified in part (i).

.....

..... [1]



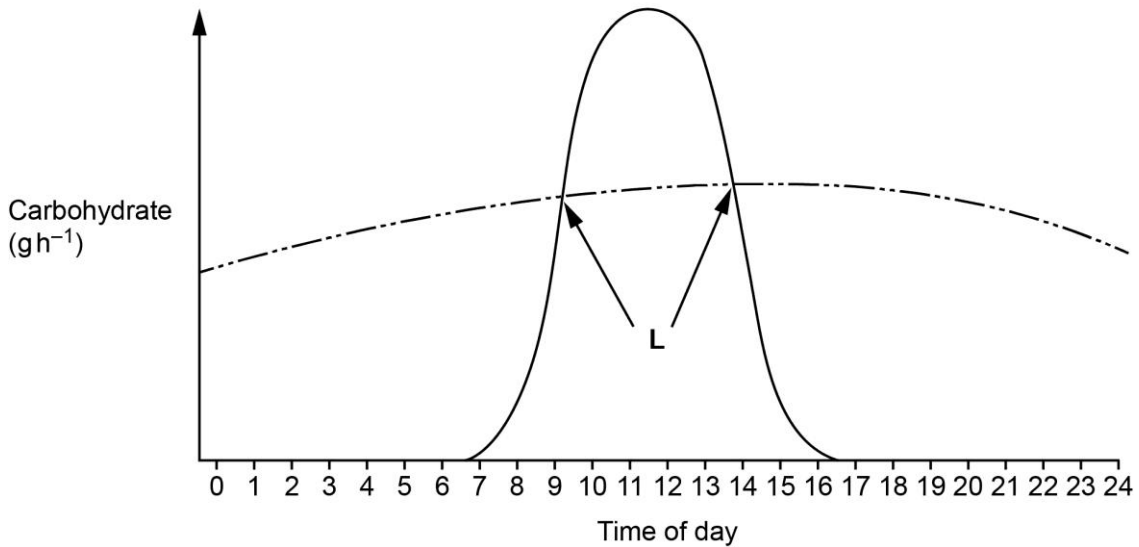
18

(a) Plants photosynthesise and respire.

The graph shows the rate of production of carbohydrate in photosynthesis and the rate of use of carbohydrate by respiration.

**Key**

- Rate of photosynthesis
- - - - - Rate of plant respiration



(i) Explain the shape of the curve for the rate of photosynthesis.

.....

.....

.....

..... [2]

(ii) Explain the shape of the curve for the rate of plant respiration.

.....

.....

.....

..... [2]

(iii) Identify what is happening at the points indicated by the letter L.

.....

..... [1]



- (ii) Calculate the values for the mean assimilation of carbon dioxide by C3 plants and C4 plants at 20°C.

C3 plants mean = ..... CO<sub>2</sub>kg ha<sup>-1</sup>h<sup>-1</sup>

C4 plants mean = ..... CO<sub>2</sub>kg ha<sup>-1</sup>h<sup>-1</sup>

[2]

- (iii) Suggest **one** conclusion that could be drawn from the mean values you calculated in part (ii).

.....

..... [1]

- (iv) Suggest which curve on the graph corresponds to each of the following crops:

Sugar cane, which grows in warm climates.

.....

Barley, which grows in cool climates.

.....

[2]



- (ii) Suggest **two** ways in which the ultrastructure of the chloroplast is changed in high temperatures. For each suggestion, explain the effect that it will have on photosynthesis.

Suggestion .....

.....

Explanation .....

.....

Suggestion .....

.....

Explanation .....

.....

[4]

**19** Assimilates are transported throughout the plant by translocation in phloem.

**(a)** Phloem sap mainly consists of carbohydrate in the form of sucrose, but also contains other solutes.

**(i)** Suggest why it is beneficial to the plant for the carbohydrate to be transferred throughout the plant in the form of sucrose rather than as an alternative carbohydrate.

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

**(ii)** State **one** similarity **and one** difference between transport of substances in phloem and xylem.

Similarity .....

.....

Difference .....

.....

[2]

**(b)** Assimilates are loaded into the phloem at the source and then transported to the sink.

**(i)** Explain how some parts of the plant can act as both a source and a sink.

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..... [2]

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Turn over for the next question



Extra answer space if required.

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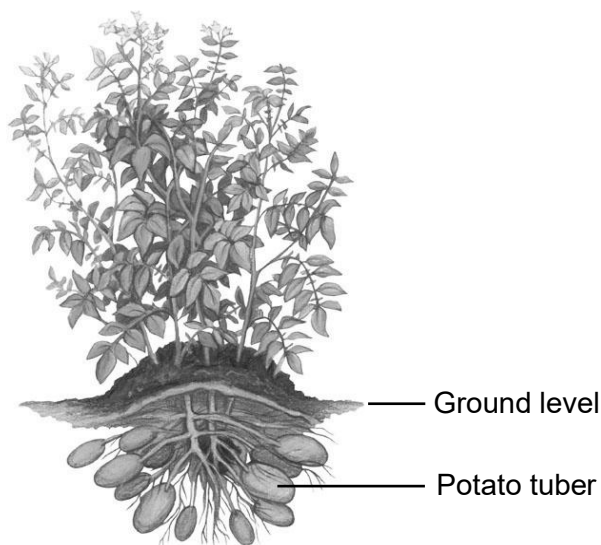
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(c) This is an image of a potato plant.



Potatoes are tubers. Tubers are underground storage organs.

Actively growing tissues have a high demand for carbohydrates. Phloem sap is directed to these tissues and sucrose is unloaded in large amounts.

Scientists modified potato plants by inserting a gene for invertase into their DNA so that the gene would be expressed in the tubers.

Invertase is responsible for catalysing the hydrolysis of the disaccharide sucrose.

The scientists investigated the properties of the modified and non-modified plants.

The results are shown in the table.

	Mean number of tubers (per plant)	Mean mass of one tuber (g)	Mean sucrose concentration ( $\text{mg g}^{-1}$ tuber)	Mean glucose concentration ( $\text{mg g}^{-1}$ tuber)	Invertase activity (arbitrary units)
<b>Modified</b>	2.2	49.7	1.4	$36.3 \pm 3.5$	62.1
<b>Non-modified</b>	5.3	16.8	13.7	$1.9 \pm 0.3$	1.1

(i) Name the bond that is hydrolysed by invertase.

..... [1]

(ii) The potato tubers contain monosaccharides.

Compare the concentration of monosaccharides in the modified tubers with those that were not modified.

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

(iii) In the modified plants, the unloading of sucrose is increased in the tubers compared with those that were not modified.

The transport of sucrose to the tubers is also increased in the modified plants.

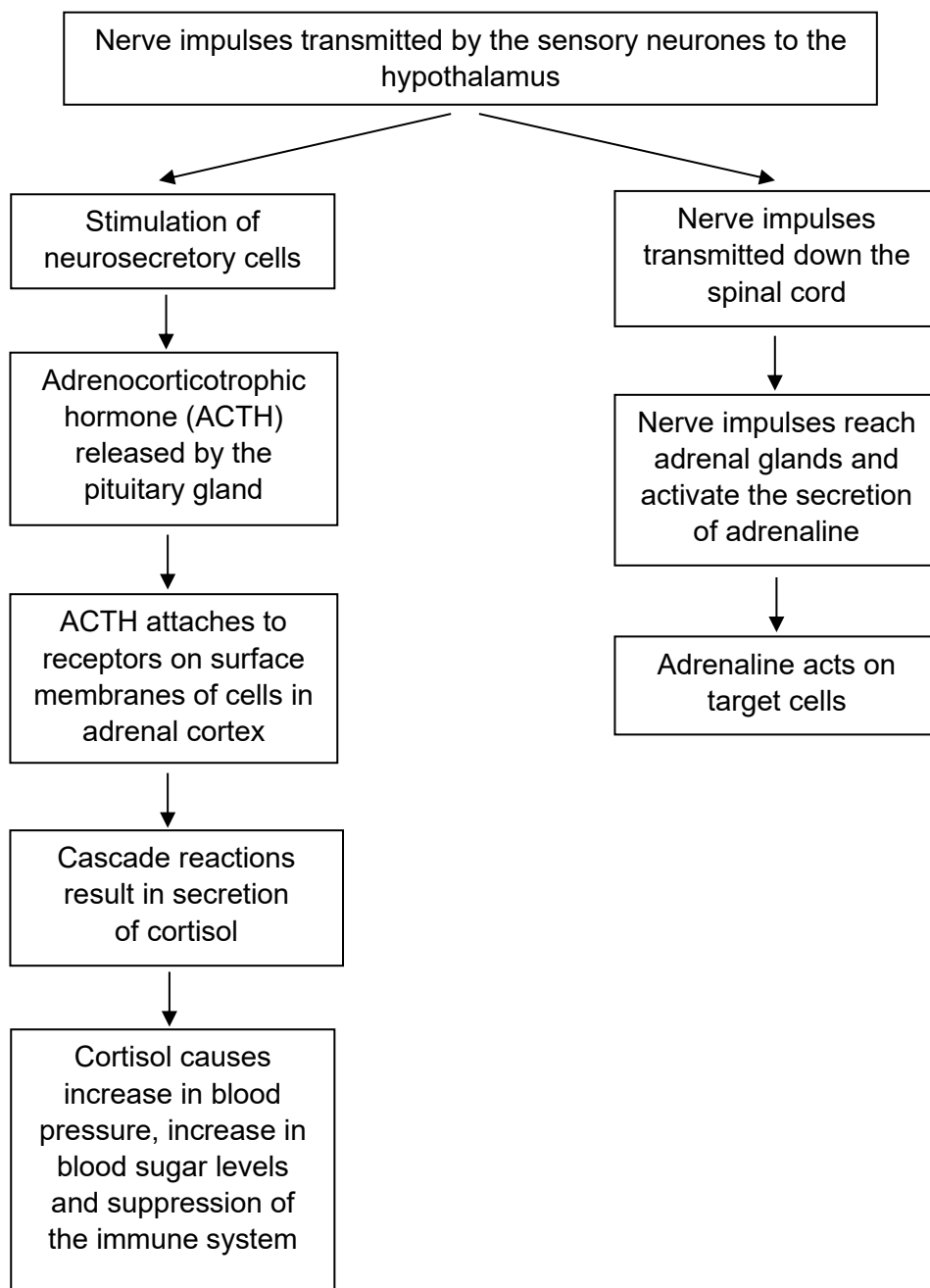
Using the data and the information given, explain a possible mechanism that causes the increased unloading **and** the transport of sucrose in the modified plants.

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



20

- (a) The flow diagram shows the sequence of events in the body once a threat is detected. The response is often described as the 'fight or flight' response as it prepares the body to respond physically to a threat.



- (i) Identify **two** signalling molecules named in the diagram.

1 .....

2 .....

[1]

- (ii) Adrenaline acts on different cell types and produces different responses. Complete the table by stating the effects of stimulating each target cell.

Target cell	Response	Role in the 'fight or flight' response
Smooth muscle in bronchioles		
Sino-atrial node		
Liver cell		

[6]

- (iii) Describe the sequence of actions that occur in the target liver cells once adenylyl cyclase is activated.

.....

.....

.....

.....

..... [2]

- (iv) The response described in the flow diagram also occurs when a person is subjected to stress. However, the body does not need to respond physically to the stimulus. Suggest the long term adverse effects on body function of continued exposure to stress.

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

- (b) Muscle cells require a supply of oxygen for respiration. If not enough oxygen is available, the cells respire anaerobically.

The diagram shows the process of anaerobic respiration in muscle cells.



- (i) Identify the compounds labelled **D** and **E**.

**D** .....  
**E** ..... [2]

- (ii) Identify the role of compound **D** in anaerobic respiration.

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

(iii) Explain why it is important that compound **G** is formed during the reaction in which compound **D** is converted into compound **E** in anaerobic respiration.

.....

.....

.....

.....

..... [2]

(iv) Compound **E** is toxic and is removed from muscle cells. It is transported to an organ in the body. Name the organ compound **E** is transported to **and** state how compound **E** reaches that organ.

.....

..... [1]

(c) Athletic sprinters require large amounts of energy in short periods of time. Many elite sprinters can run 100m races in under 10s.

Under normal conditions, exercise requires an increased rate of breathing. It has been observed that some of the best sprinters only take one breath at the start of the race and do not inhale again until the end of the race.

Suggest how these sprinters can release so much energy without needing to carry out aerobic respiration.

.....

.....

.....

.....

..... [2]

**END OF QUESTION PAPER**

**EXTRA ANSWER SPACE**

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.

This section of the page is a large, empty area for writing answers. It consists of 25 horizontal dotted lines spaced evenly down the page. A solid vertical line runs down the left side of this area, creating a margin. The lines are intended for students to write their answers to questions, with the instruction to write question numbers clearly in the margin.

**EXTRA ANSWER SPACE**

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.

A large area of lined paper for writing answers. It features a vertical margin line on the left side and horizontal dotted lines for writing. The lines are evenly spaced and extend across the width of the page.

**EXTRA ANSWER SPACE**

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.

A large area of the page is filled with horizontal dotted lines for writing, with a solid vertical line on the left side defining a margin.

**EXTRA ANSWER SPACE**

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.

A large area of lined paper for writing answers. It features a vertical solid line on the left side, creating a margin. The rest of the page is filled with horizontal dotted lines, providing space for writing.



**CAMBRIDGE**  
**OCR**

**Sample Assessment Material**

A Level Biology A

H420/01 Biological processes

**MARK SCHEME**

**MAXIMUM MARK    100**

**Duration: 2 hours 15 minutes**

**Version – 3.0**

**Last updated: February 2026**

**This document consists of 19 pages**

## MARKING INSTRUCTIONS

### Preparation For Marking

#### 1. RM Assessor

- Access and complete the on-screen marking training packages: OCR Examiner Training (RMA3).
- Read the mark scheme and question paper for this component or unit.
- The mark scheme and question paper are available in RM Assessor or on your Component Page if you use the Training Platform for standardisation.
- Log in to RM Assessor and mark the **required number** of practice scripts and the **required number** of standardisation scripts.

### Marking

#### 2. General Guidance

- Mark strictly to the mark scheme.
- Marks awarded must relate directly to the marking criteria.
- If you are in any doubt about applying the mark scheme, consult your Team Leader by phone, email or via the RM Assessor messaging system.
- It is **essential** that you meet the RM Assessor 50% and 100% batch deadlines. For traditional marking this will be 40% and 100%. If you experience problems, contact your Team Leader without delay.
- Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add the annotation '**SEEN**' to confirm that the work has been seen and mark any responses using the annotations.
- The RM Assessor comments box is used by your Team Leader to explain the marking of the practice responses. Use these comments when checking your practice responses. Do not use the comments box for any other reason.
- Before the end of the marking period send a brief report on the performance of candidates to your Team Leader via email. The report should contain notes on strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

### 3. No Response and Crossed-out Answers

Using the No Response (NR) option. Only mark as NR if:

- the answer space is blank
- there is only a comment not related to the question (e.g., 'can't do', 'don't know')
- there is only a mark (e.g., a dash, a question mark) which is not an attempt at the question.

Note: Enter 0 marks for an attempt that earns no credit (including copying out the question). Do **not** use NR.

#### Crossed-out answers

If a candidate has crossed out an answer and written a clear alternative, do **not** mark the crossed-out answer.

If a candidate has crossed out an answer and **not** written a clear alternative, mark the crossed-out answer if it is readable.

### 4. Responses with more answers than needed

#### • Multiple-choice question answers

When a multiple-choice question has only **one** correct answer and a candidate has written two or more answers (even if one of these answers is correct), do **not** award a mark.

When a multiple-choice question asks candidates to select **more than** one option the marking guidance from your Principal Examiner will ensure consistency of approach.

#### • Contradictory answers in points-based questions

Do **not** award any marks, even if one of the answers is correct.

#### • Rubric error answers – optional questions

Where candidates have a choice of question/s and they provide more answers than required, all responses are marked and entered into RM Assessor. The highest mark allowable within the rubric will automatically be selected.

- **Questions that ask for a set number (including 1) of short answers or points**

Mark only the **first set number** of answers/points. (e.g. **two** reasons for something)

**First** mark the answers/points against printed numbers on the answer lines. Mark the first answer/point against each printed number. **Second**, if candidates have not followed the printed numbers, mark the answers/points from left to right on each line. **Third**, mark line by line until the set number of answers/points have been marked. Do **not** mark any remaining answers/points.

Examiners should use their own judgement to decide if a 'second answer' on the same line is adding more detail to the first answer, or if it is a completely separate answer.

- **Short Answer Questions (requiring a more developed response, worth two or more marks)**

If the candidates are required to provide a description of, for example, three items and four items are provided, mark line by line until the set number of descriptions have been marked (it is unlikely a candidate will provide more than one response on each line in this scenario).

- **Longer Answer Questions (requiring a developed response)**

If a candidate has written two or more answers to a question that only requires one (developed) answer, only mark the first answer (which has not been crossed out).

## 5. Questions using levels of response (LOR):

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

**The higher mark** should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

**The lower mark** should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.
















**In summary:**

**The skills and science content determines the level.**

**The communication statement determines the mark within a level.**

Level of response questions on this paper are **17(c)(iii)** and **19(b)(ii)**.

## 6. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore
	Blank page

**7. Abbreviations, annotations and conventions used in the mark scheme (including subject-specific conventions).**

<b>Abbreviation / Annotation</b>	<b>Meaning</b>
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
<b>DO NOT ALLOW</b>	Answers which are not worthy of credit
<b>IGNORE</b>	Statements which are irrelevant
<b>ALLOW</b>	Answers that can be accepted
( )	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
<b>ECF</b>	Error carried forward
<b>AW</b>	Alternative wording
<b>ORA</b>	Or reverse argument

## 8. Subject-specific Marking Instructions

### Introduction

Your first task is to familiarise yourself with:

- the specification, especially the assessment objectives
- the question paper and any inserts or resource booklets
- the mark scheme, including annotation requirements
- the administrative procedures related to the marking process.

The administrative procedures are set out in the OCR booklet **Instructions for Examiners**.

If you are examining for the first time, please read **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

All relevant training materials are accessed from the Training Platform.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

**Section A**

<b>Question</b>	<b>Answer</b>	<b>Marks</b>	<b>Guidance</b>
<b>1</b>	D	<b>1</b>	
<b>2</b>	D	<b>1</b>	
<b>3</b>	A	<b>1</b>	
<b>4</b>	A	<b>1</b>	
<b>5</b>	C	<b>1</b>	
<b>6</b>	D	<b>1</b>	
<b>7</b>	B	<b>1</b>	
<b>8</b>	B	<b>1</b>	
<b>9</b>	B	<b>1</b>	
<b>10</b>	B	<b>1</b>	
<b>11</b>	C	<b>1</b>	
<b>12</b>	C	<b>1</b>	
<b>13</b>	A	<b>1</b>	
<b>14</b>	C	<b>1</b>	
<b>15</b>	C	<b>1</b>	
	<b>Total</b>	<b>15</b>	

Question			Answer	Marks	Guidance
16	(a)	(i)	<p><b>FIRST CHECK ANSWER ON ANSWER LINE</b>  <b>If answer = 58 (%) award 4 marks</b></p> <p><i>normal rate</i>  <math>(60 * 1) / 0.7</math>            78.9 bpm ✓</p> <p><i>rate for tachycardia</i>  <math>(60 * 1) / 0.5</math>            125 bpm ✓</p> <p><i>percentage increase</i>            58 (%) ✓✓</p>	4	<p><b>ALLOW</b> 1.3 bps</p> <p><b>ALLOW</b> 2.1 bps</p> <p><b>ALLOW 2 marks</b>            for percentage increase correctly calculated using candidate's figures for rates and answer given to nearest whole number.</p> <p><b>ALLOW 1 mark</b>            for correct working <math>[(120 - 78.9) \div 78.9 \times 100</math> or correct use of candidate's figures for rates]</p> <p><b>or</b>            a correctly calculated but unrounded answer</p> <p><b>DO NOT ALLOW</b> answers that divide by the rate for tachycardia as a percentage <b>increase</b> is asked for</p>
		(ii)	<p>lower (Q)R(S) peak ✓            P and T equal in height ✓            width of T wave greater ✓</p>	max 2	
	(b)		<p>no distinct, P curve / atrial depolarisation ✓            irregular / weak, atrial contraction ✓            insufficient blood forced into ventricles ✓            although ventricles contract there is less blood forced from the heart ✓</p>	max 3	
			<b>Total</b>	<b>9</b>	

Question		Answer	Marks	Guidance
17	(a)	<p><b>U</b> hepatic vein ✓  <b>V</b> hepatic artery ✓  <b>W</b> hepatic portal vein ✓</p>	3	
	(b)	(i)	1	<b>ALLOW</b> mitochondria.
		(ii)	2	
		(iii)	1	
		(iv)	1	
	(c)	(i)	1	<p><b>Two answers required for 1 mark</b></p> <p><b>DO NOT ALLOW</b> an answer that includes mass of liver/enzyme concentration</p>
		(ii)	max 1	<b>ALLOW</b> use of buffer solutions

Question	Answer	Marks	Guidance
	<p><i>temperature</i> use liver tissue and hydrogen peroxide at room temperature/same temperature for all enzyme concentrations tested ✓</p> <p><i>substrate concentration</i> use same concentration and volume of hydrogen peroxide for all enzyme concentrations tested ✓</p>		
	<p><b>(iii)</b> *</p> <p><b>Level 3 (5–6 marks)</b> Explanation includes coherent interpretation of the evidence, clearly linking all ideas to explain why and how activity is regulated.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b> Explanation includes clear use of some evidence to support conclusion but ideas may not be clearly linked for both how and why.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b> A simple explanation about how or why based on a limited interpretation of the evidence.</p>	6	<p><b>Indicative scientific content:</b></p> <p><i>Why</i></p> <ul style="list-style-type: none"> <li>• large quantities of hydrogen peroxide and high turnover number of catalase would mean vigorous reaction and lots of oxygen produced very quickly.</li> </ul> <p><i>How</i></p> <ul style="list-style-type: none"> <li>• isolation of catalase in peroxisomes</li> <li>• released in small quantities</li> <li>• cells can limit expression of catalase</li> <li>• this effectively limits enzyme concentration and therefore reduces reaction rate</li> <li>• cells have no control over temperature or substrate concentration so enzyme concentration is the only method of control.</li> </ul>

Question			Answer	Marks	Guidance
			<p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b> No response or no response worthy of credit</p>		
			<b>Total</b>	<b>16</b>	

Question			Answer	Marks	Guidance
<b>18</b>	<b>(a)</b>	<b>(i)</b>	<p>increased photosynthetic activity during daylight ✓ as light intensity increases there is increased activity of the light dependent reaction ✓</p>	<b>2</b>	No marks available for describing the shape of the curve
		<b>(ii)</b>	<p>daytime temperatures generally higher than night time ✓ rate of respiration increases with increased temperature as its enzymes are temperature-dependent ✓</p>	<b>2</b>	No marks available for describing the shape of the curve
		<b>(iii)</b>	<p>compensation point(s) / carbohydrate produced by photosynthesis equal to carbohydrate used in respiration ✓</p>	<b>1</b>	
	<b>(b)</b>	<b>(i)</b>	<p><i>for all crops</i> initial increase in assimilation with increasing temperature ✓ at higher temperatures the assimilation decreases ✓</p>	<b>2</b>	<b>DO NOT ALLOW</b> accounts that describe the curve for each crop individually

Question		Answer	Marks	Guidance
	(ii)	<p><b>FIRST CHECK ANSWER ON ANSWER LINES</b>  <b>If answer = C3 34.5 and C4 73.5 award 2 marks</b></p> <p>C3:  <math>(27+42)/2</math>            34.5 ✓</p> <p>C4:  <math>(87+60)/2</math>            73.5 ✓</p>	2	<p><b>ALLOW</b> 35 if used <math>(27+43)/2</math></p> <p><b>ALLOW</b> 73 if used <math>(86+60)/2</math></p>
	(iii)	C3 plants assimilate less carbon dioxide than C4 plants ✓ <b>ora</b>	1	<b>ALLOW</b> a conclusion cannot be drawn because there is not enough data on each type of plant
	(iv)	Sugar cane - C4 crop 2 ✓ Barley - C3 crop 1 ✓	2	
(c)	(i)	deactivation of RuBisCO will reduce, carbon dioxide fixation / light independent reaction ✓ the light dependent reaction will reduce when the supply of NADP is reduced ✓ reduction in stomatal aperture will reduce carbon dioxide available for fixation ✓	3	
	(ii)	<p>damage to chlorophyll / reduction in pigment ✓            which will reduce the light dependent stage ✓</p> <p>damage to membranes in chloroplast / reduction in sites for light capture ✓            which will reduce the light dependent stage ✓</p> <p>damage to membranes in chloroplast / reduction in reaction sites for electron transfer ✓</p>	max 4	<b>Award 1 mark for the alteration of the ultrastructure (max 2) and 1 further mark for details of its effect on photosynthesis (max 2)</b>

Question			Answer	Marks	Guidance
			<p>which will reduce, photophosphorylation / ATP production in the light dependent stage ✓</p> <p>damage to membrane around chloroplast / release of enzymes ✓</p> <p>which will reduce, light independent stage / Calvin cycle ✓</p>		
			<b>Total</b>	<b>19</b>	

Question			Answer	Marks	Guidance
19	(a)	(i)	<p>sucrose is soluble so can be transported in sap ✓</p> <p>but metabolically (relatively) inactive so no, used / removed, during transport ✓</p>	2	
		(ii)	<p><i>similarity – one of</i></p> <p>solute carried in solution in both ✓</p> <p>both carry mineral salts ✓</p> <p>both use, mass flow / generated hydrostatic pressure ✓</p> <p><i>difference – one of</i></p> <p>transport in phloem can take place in different directions</p> <p><b>and</b> transport in xylem only takes place up the plant ✓</p> <p>phloem carries carbohydrates <b>and</b> xylem does not ✓</p> <p>phloem transport uses living cells <b>and</b> xylem does not ✓</p> <p>xylem uses, capillary action / cohesion and adhesion, <b>and</b> phloem does not ✓</p>	max 2	

Question		Answer	Marks	Guidance
	(b) (i)	certain parts can store and then release carbohydrates when needed ✓ suitable examples include root or leaf, which can act as sink or source at different times of year ✓	2	
	(ii)*	<p><b>Level 3 (5–6 marks)</b> A thorough explanation, showing a good understanding of the principles of loading into phloem, incorporating use of the diagram.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b> A partial explanation showing some understanding of the principles of loading into phloem.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b> An attempt including some correct principles, but likely to be confused, showing limited understanding of the principles of loading into phloem.</p> <p><i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p><b>0 marks</b> No response or no response worthy of credit.</p>	6	<p><b>Indicative scientific content:</b></p> <ul style="list-style-type: none"> <li>• <b>B</b> / sucrose, pumped from companion cell into phloem sieve tube</li> <li>• by active transport</li> <li>• H<sup>+</sup> / proton, co-transport of sucrose</li> <li>• reduces water potential of sieve tube</li> <li>• <b>A</b> / water, enters sieve tube from companion cell</li> <li>• <b>C</b> / water, enters sieve tube from xylem</li> <li>• increased pressure forces flow of sap down phloem</li> <li>• through the pores in the sieve plates.</li> </ul>

Question		Answer	Marks	Guidance
(c)	(i)	glycosidic ✓	1	
	(ii)	19 × greater in modified ✓ 1811% increase in modified compared with unmodified ✓ standard deviation indicates greater spread of data for modified ✓	max 2	
	(iii)	sucrose unloaded at sinks and invertase converts sucrose into, glucose / monosaccharide ✓ increases sucrose concentration gradient between phloem and sink ✓ causes increased unloading of sucrose from phloem ✓ <i>two from</i> increases solute gradient between source and sink ✓ removal of water from phloem increases pressure gradient between source and sink ✓ contributes to increased movement in phloem ✓	max 4	
	(iv)	modified produce fewer <b>and</b> larger tubers ✓ <b>ora</b> modified produce greater mass of tuber ✓ <b>ora</b> 109.34 g for modified <b>and</b> 89.04 g for not modified ✓	3	
		<b>Total</b>	<b>22</b>	

Question			Answer	Marks	Guidance												
20	(a)	(i)	two of: ACTH cortisol adrenaline ✓	1	Two answers required for 1 mark												
		(ii)	<table border="1"> <thead> <tr> <th>Target cell</th> <th>Response</th> <th>Role in the 'fight or flight' response</th> </tr> </thead> <tbody> <tr> <td>Smooth muscle in bronchioles</td> <td>muscle relaxes ✓</td> <td>bronchioles dilate and allow more oxygen to reach blood ✓</td> </tr> <tr> <td>Sino-atrial node</td> <td>increases rate of firing impulses ✓</td> <td>increased heart rate circulates blood more quickly ✓</td> </tr> <tr> <td>Liver cell</td> <td>increases glycogenolysis ✓</td> <td>makes more glucose available for respiration ✓</td> </tr> </tbody> </table>	Target cell	Response	Role in the 'fight or flight' response	Smooth muscle in bronchioles	muscle relaxes ✓	bronchioles dilate and allow more oxygen to reach blood ✓	Sino-atrial node	increases rate of firing impulses ✓	increased heart rate circulates blood more quickly ✓	Liver cell	increases glycogenolysis ✓	makes more glucose available for respiration ✓	6	
Target cell	Response	Role in the 'fight or flight' response															
Smooth muscle in bronchioles	muscle relaxes ✓	bronchioles dilate and allow more oxygen to reach blood ✓															
Sino-atrial node	increases rate of firing impulses ✓	increased heart rate circulates blood more quickly ✓															
Liver cell	increases glycogenolysis ✓	makes more glucose available for respiration ✓															
		(iii)	catalyses synthesis of cyclic AMP from ATP ✓ cyclic AMP activates enzymes responsible for conversion of glycogen to glucose ✓	2													

Question		Answer	Marks	Guidance
	(iv)	prolonged high blood pressure can lead to cardiovascular problems ✓ prolonged high blood sugar can lead to, problems with blood sugar regulation / diabetes ✓ suppression of the immune system can lead to susceptibility to, disease / infection ✓	max 2	
(b)	(i)	D pyruvate ✓ E lactate ✓	2	
	(ii)	is a hydrogen acceptor / removes hydrogen from reduced NAD ✓	1	
	(iii)	for glycolysis to take place, NAD / <b>G</b> , is needed ✓ there is a limited amount of NAD in the cell ✓ formation of, NAD / <b>G</b> , allows, glycolysis to continue / some ATP to be formed ✓	max 2	
	(iv)	liver <b>and</b> in the blood ✓	1	
(c)		cells are able to tolerate, high levels of lactate / acidity / low pH ✓ have high phosphocreatine stores ✓ use of stored ATP ✓	max 2	
<b>Total</b>			<b>19</b>	

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