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Examiners' report

BIOLOGY A

H020
For first teaching in 2015

H020/01 Summer 2019 series

Version 1

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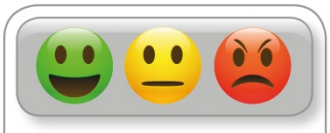
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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

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Paper 1 series overview

This is the Breadth in Biology paper. It assesses content from across all four teaching modules at AS. The aim is to assess the breadth of knowledge and understanding and candidates are expected to answer all the questions. It is split into two sections:

- Section A contains multiple choice questions and is worth 20 marks.
- Section B includes short answer question styles including structured questions, problem solving, calculations and practical – based questions. This section of the paper is worth 50 marks.

To do well on this paper candidates need to have a good understanding of the basic principles of Biology found in teaching modules 1 & 2 and be able to apply those principles within the contexts of the topics found in teaching modules 3 & 4.

Candidates who did well in this paper were able to provide concise detailed answers that kept within the boundaries of the space provided for each response. Those who did less well misread or misinterpreted the question and often gave long responses that were insufficiently focused. Questions 21 (b) (i) & (ii) and 25 (c) (i) & (ii) can be identified as those that gave most problems to candidates who either did not read and interpret the command word correctly or who were unable to apply their knowledge to the specific topic accurately.

A few points need to be reiterated about examination technique:

- Candidates should not try to change a letter in the multiple choice answers. They should just cross out their first response and write it again.
- Candidates should use the additional space provided at the end of the examination paper rather than being given a separate extra answer booklet.
- Candidates should continue responses in the additional space provided at the end of the examination paper rather than attempting to continue their response down the sides of the exam paper or in the space between questions.

Note

From this series students have been provided with a fixed number of answer lines and an additional answer space. The additional answer space will be clearly labelled as additional, and is only to be used when required. Teachers are encouraged to keep reminding students about the importance of conciseness in their answers. Please follow this link to our SIU (https://www.ocr.org.uk/administration/support-and-tools/siu/alevel-science-538595/)

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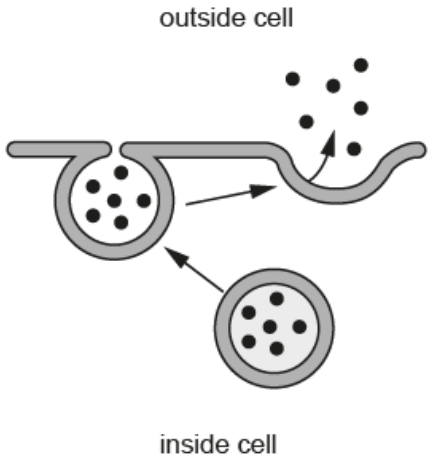
Section A overview

This section is designed to test a wide range of knowledge.. Some questions test basic principles such as Question 3 where a detailed observation of the diagram included provides clues as to the correct response. Other questions test detailed knowledge such as Question 6 where a relatively detailed knowledge of the structure of the carboxylic acid group in an amino acid is required. Some candidates were able to score very well in this section. For those questions that seemed to cause more difficulty it was often not easy to determine which incorrect response was most frequently selected.

A significant number of candidates still superimpose a new answer over an old one making it difficult to decide which answer is the intended one and so potentially losing a mark. Candidates should be reminded to make any correction very clear by crossing out the old response and writing a separate new response nearby.

Question 1

1 The diagram below shows one method of transport across a cell membrane.



Which of the following options, **A** to **D**, is the name of this method of transport?

A cytokinesis

B endocytosis

C exocytosis

D phagocytosis

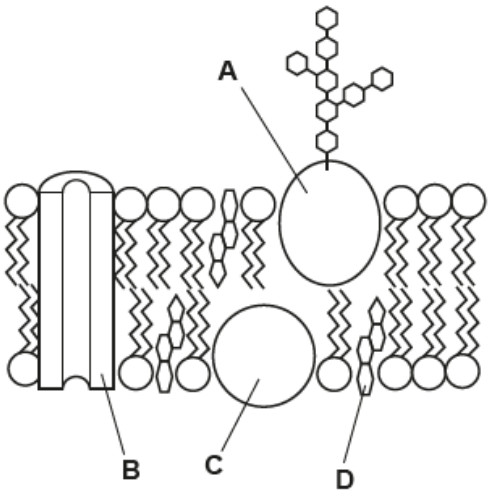
Your answer ☐ **[1]**

The majority of candidates managed to answer this first question correctly as letter C.

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Question 2

2 The diagram below shows the structure of a plasma membrane.



Which label, **A** to **D**, indicates the component of the membrane that can affect its fluidity?

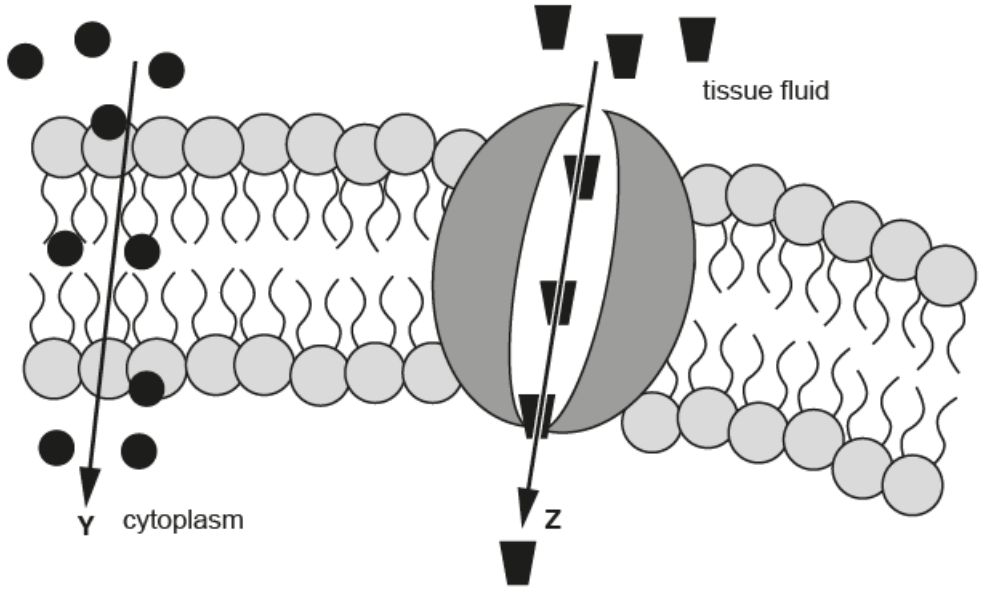
Your answer ☐ **[1]**

The correct response, D, was selected by many candidates. The most common incorrect response was A. Possibly candidates were thinking about how glycoproteins can increase the stability of the membrane through hydrogen bonding to external water molecules.

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Question 3

3 This diagram shows the transport of two molecules across a plasma membrane.



Which row, **A** to **D**, correctly identifies the molecule being transported **and** the mechanism of transport across the plasma membrane?

	Y	Z
A	glucose by active transport	oxygen by diffusion
B	glucose by diffusion	oxygen by active transport
C	oxygen by active transport	glucose by active transport
D	oxygen by diffusion	glucose by diffusion

Your answer ☐ **[1]**

Many candidates selected the correct response, D. A frequent incorrect response was B where candidates possibly felt that the large molecule in the membrane could have been an active transport protein.

?	**Misconception**	This may indicate misconception in candidates about facilitated diffusion and active transport.

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Question 4

4 DNA is made up of two polynucleotide chains.

Which of the bonds, **A** to **D**, forms between two nitrogenous bases holding the two polynucleotide chains together?

A phosphodiester

B ionic

C covalent

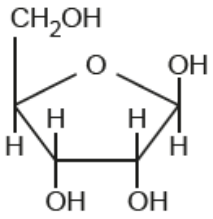
D hydrogen

Your answer ☐ **[1]**

D, the correct response was selected by many candidates. A number of candidates selected A, thinking about the bond between two consecutive nucleotides in a single chain.

Question 5

5 The structure of a biological molecule is shown below.



Which of the following options, **A** to **D**, correctly describes the molecule?

A hexose monosaccharide glucose

B hexose monosaccharide ribose

C pentose monosaccharide glucose

D pentose monosaccharide ribose

Your answer ☐ **[1]**

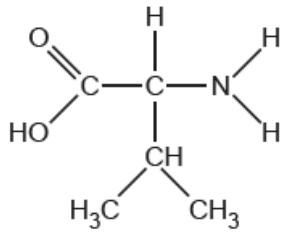
The correct response was D, however, all the other options were selected by different candidates.

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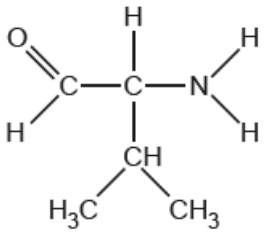
Question 6

6 Which of the following molecules, **A** to **D**, could be a product of breaking a peptide bond during a hydrolysis reaction?

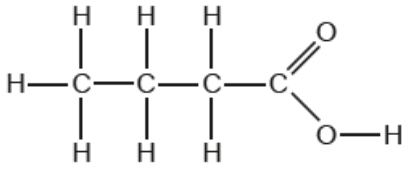
A



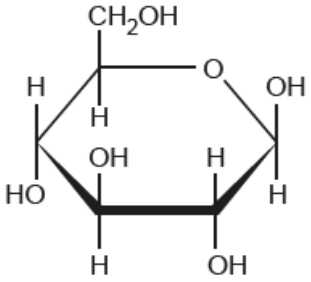
B



C



D



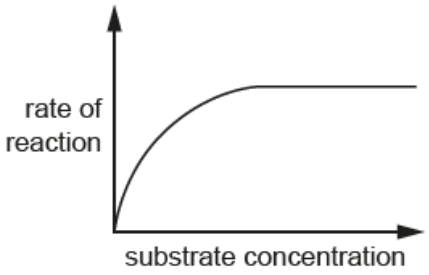
Your answer ☐ **[1]**

The correct response, A, was selected by many. B was the most common incorrect response. C was also selected by some who recognised the carboxylic acid group on the right hand side of the molecule.

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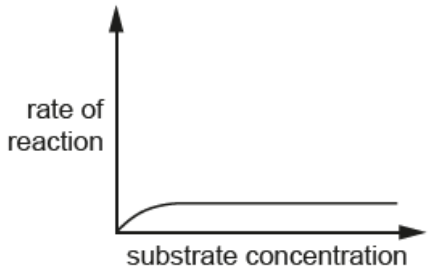
Question 7

7 The diagram below shows the effect of changing substrate concentration on the rate of an enzyme-controlled reaction.

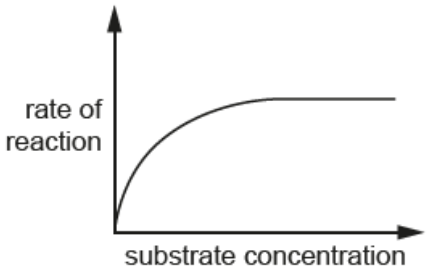


Which of the following graphs, **A** to **D**, shows how a **non-competitive** inhibitor would affect the rate of this reaction?

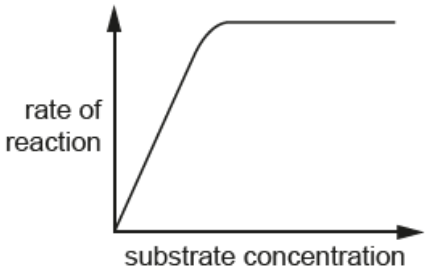
A



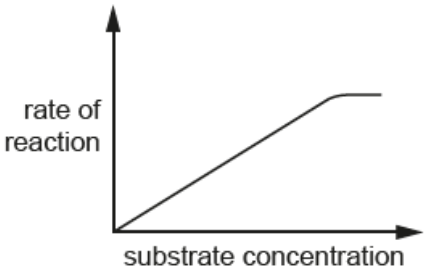
B



C



D



Your answer ☐ **[1]**

Many candidates selected the correct response, A.

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Question 8

8 Which of the following ions, **A** to **D**, is required for the hydrolysis of starch by an enzyme?

A Cl^-

B K^+

C Na^+

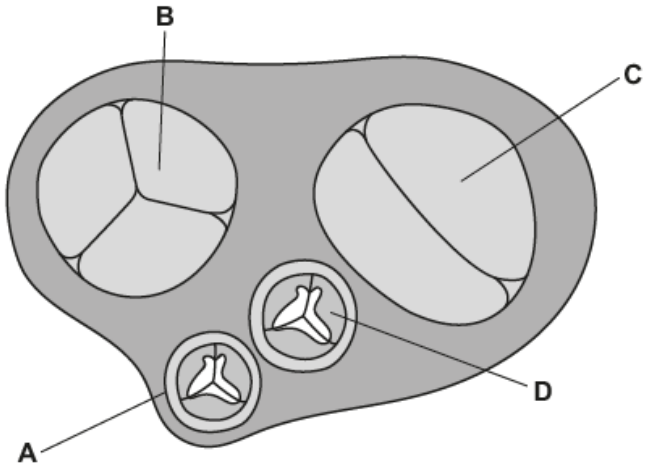
D Zn^{2+}

Your answer ☐ **[1]**

A, the correct response was selected by some All the other options were selected by candidates who perhaps had a lack of knowledge of this detail.

Question 9

9 The diagram below shows an internal view of the mammalian heart with the atria removed so valves can be seen.



Which of the valves, labelled **A** to **D**, is pushed open by oxygenated blood entering a ventricle?

Your answer ☐ **[1]**

The correct answer, C, was selected by many candidates. Many candidates seemed to have difficulty in matching their familiar vertical section of a heart to the cross section even though the bicuspid and tricuspid valves should have been easy to recognise.

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Question 10

10 Which of the following, **A** to **D**, shows the reaction catalysed by carbonic anhydrase?

A $CO_2 + H_2O \longrightarrow H_2CO_3$

B $CO_2 + Hb \longrightarrow HbCO_2$

C $H^+ + Hb \longrightarrow HHb$

D $Hb + 4O_2 \longrightarrow HbO_8$

Your answer ☐ **[1]**

Many candidates selected the correct response, A. The most common incorrect response was B as it contained carbon dioxide.

Question 11

11 The giant water lily, *Victoria amazonica*, grows in the shallow waters of the Amazon river basin.

Which of the following adaptations, **A** to **D**, enables *Victoria amazonica* to survive in its watery environment?

A thick waxy cuticle

B leaves with stomata on upper surface only

C leaves with sunken stomata

D extensive shallow root system

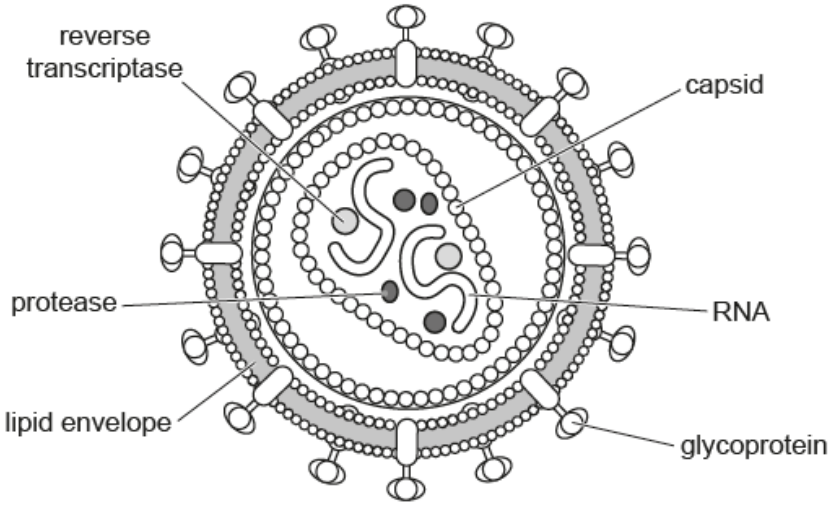
Your answer ☐ **[1]**

Most candidates were able to select the correct response, B.

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Question 12

12 The diagram below shows a pathogen.



Which of the options, **A** to **D**, is the disease caused by this pathogen?

A HIV/AIDS

B potato blight

C ringworm

D tuberculosis

Your answer ☐ **[1]**

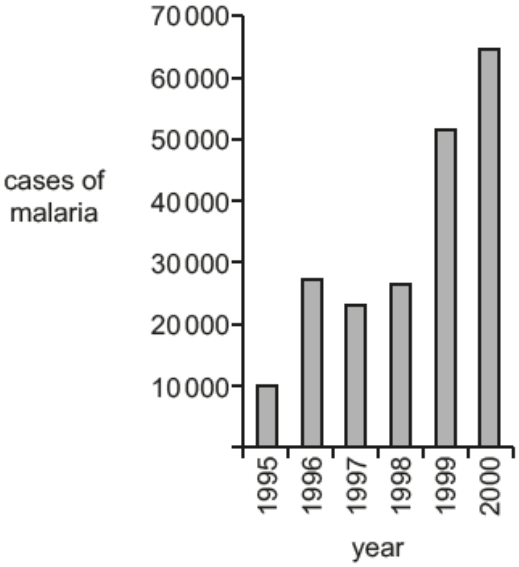
Most candidates were able to select the correct response, A.

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Question 13

The chart shows the number of reported cases of malaria in South Africa between 1995 and 2000.

Questions **13** and **14** refer to this chart.



13 Which of the following, **A** to **D**, is the percentage increase from the number of cases of malaria in 1995 to 2000?

A 85%

B 550%

C 650%

D 55 000%

Your answer ☐ **[1]**

B was the correct response, but many selected C. Candidates do need to interpret the question correctly and the word 'increase' tells them that there must be a subtraction involved before the percentage calculation. Response C was the correct response if the question had been 'calculate the number of cases in the year 2000 as a percentage of the number of cases in 1995'.

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Question 14

14 Which of the following statements, **A** to **D**, could explain the data shown for 1999–2000?

A the malarial parasite had developed resistance to insecticides

B the vector had developed resistance to antibiotics

C the malarial parasite had developed resistance to antiviral drugs

D the vector had developed resistance to insecticides

Your answer ☐ **[1]**

The correct response was D. Many of the candidates who selected the incorrect response selected A thinking that mosquitoes were the malarial parasite.

Question 15

15 The sea marigold, *Calendula maritima*, is a rare species that is critically endangered and has been included in an *ex situ* conservation project.

Which of the following options, **A** to **D**, is a disadvantage of conserving the sea marigold *ex situ*?

A it could reduce genetic diversity in sea marigolds

B sea marigolds are collected from the wild as seeds

C sea marigold seeds are stored in large numbers

D sea marigolds will be at risk from grazing by herbivores

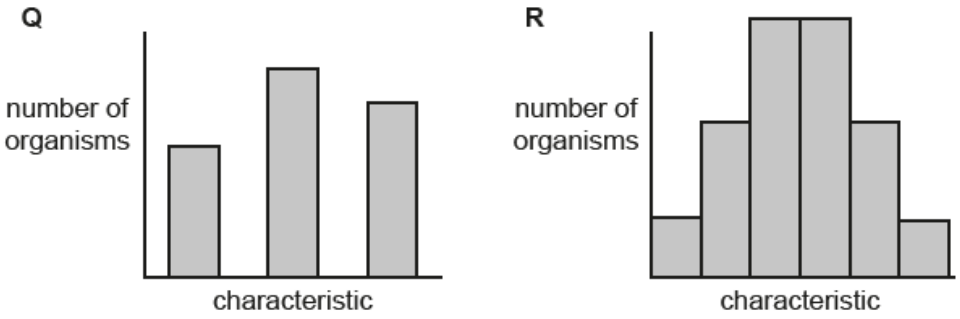
Your answer ☐ **[1]**

The correct response, A, was selected by many candidates. Response D was the most commonly selected incorrect response.

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Question 16

16 The two histograms represent the frequency distribution for the two different types of variation.



Which of the statements, **A** to **D**, about characteristic **Q** is correct?

A controlled by many genes and unaffected by the environment

B controlled by one or two genes and unaffected by the environment

C controlled by many genes and influenced by the environment

D controlled by one or two genes and influenced by the environment

Your answer ☐ **[1]**

The differences between continuous and discontinuous variation can be difficult to spot for lower ability candidates. However, many candidates selected the correct response, B.

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Question 17

17 Some of the taxonomic groups for the beach sunflower, *Helianthus debilis*, are shown in the table below.

Kingdom	Plantae
Phylum	Magnoliophyta
W	Magnoliopsida
Order	Asterales
X	Asteraceae
Y	Helianthus

Which of the following rows, **A** to **D**, correctly identifies the missing taxonomic groups from the classification of *Helianthus debilis*?

	W	**X**	**Y**
A	class	genus	species
B	class	family	genus
C	family	genus	species
D	family	class	genus

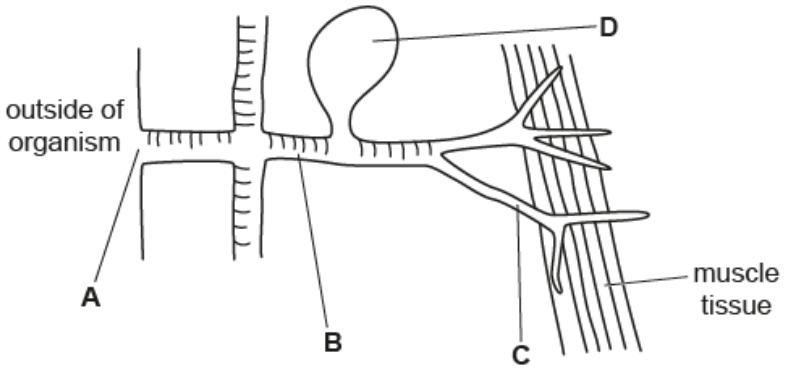
Your answer ☐ **[1]**

Response B was correct. Using some form of acronym or rhyme can help candidates recall the correct sequence of taxonomic groups.

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Question 19

19 The diagram shows part of the gas exchange system of an insect.



Which of the labels, **A** to **D**, indicates the trachea?

Your answer ☐ **[1]**

The correct response was B, but many candidates selected A or C.

i	**OCR support**	The topic exploration pack on 'Mechanisms of ventilation and gaseous exchange', provides ideas on teaching ventilation in insects: https://www.ocr.org.uk/Images/209191-mechanisms-of-ventilation-and-gaseous-exchange.pdf

Question 20

20 The table below shows the stages of the cell cycle.

Which row, **A** to **D**, shows the correct order of the different stages?

	Cytokinesis	G_1	G_2	Mitosis	S
A	four	two	three	one	five
B	five	one	three	two	four
C	three	four	one	two	five
D	four	two	five	one	three

Your answer ☐ **[1]**

Many candidates selected the correct response, C.

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Section B overview

This section uses short structured questions to test both principles and detailed knowledge. Most of the questions required only short responses

Question 21 (a)

21 A student investigated the effects of different solutions on pieces of potato tissue. Six potato rods were prepared with a cork borer. The student trimmed them to a length of exactly 5 cm.

After treatment, the six rods were placed in test tubes and submerged in either sucrose solution or distilled water.

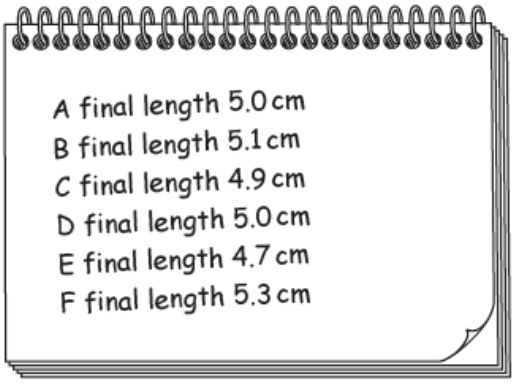
The treatment and liquid added to each potato rod is shown in Table 21 below.

Potato rod	Treatment	Liquid added
A	boiled in water for 5 minutes	1 mol dm^{-3} sucrose solution
B	boiled in water for 5 minutes	distilled water
C	soaked in ethanol for 5 minutes	1 mol dm^{-3} sucrose solution
D	soaked in ethanol for 5 minutes	distilled water
E	untreated	1 mol dm^{-3} sucrose solution
F	untreated	distilled water

Table 21

After 30 minutes, the rods were removed from the tubes and their lengths measured.

The student recorded the results on a piece of scrap paper, shown below.



(a) In the space below, present the student's results in an appropriate format.

[3]

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This question may have confused some candidates who felt that the results had already been recorded in an appropriate format. Most candidates displayed the results in an acceptable table format, correctly placing the independent variable (potato rod) in the left hand column and dependent variable (final length) in the right hand column. A few drew row tables and hybrid row/column tables were seen. Common errors included not recording the results to the correct number of decimal points and recording processed results (change in length) rather than the original results. Results should be recorded in a table according to the guidelines found in the Practical skills handbook. Some candidates used a graphical presentation but this approach was not considered adequate.

	**OCR support**	OCR support includes the Practical skills handbook and the student guidance sheet 'Graphs, tables and drawings: student checklist'. https://www.ocr.org.uk/Images/346170-graphs-tables-and-drawings-student-checklists.doc https://ocr.org.uk/Images/294468-biology-practical-skills-handbook.pdf

Question 21 (b) (i)

(b) (i) Explain how the treatment results in the difference in the final lengths of rod **A** and rod **E**.

.....

.....

.....

.....

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

Question 21 (b) (ii)

(ii) Explain how the treatment results in the difference in the final lengths of rod **D** and rod **F**.

.....

.....

.....

.....

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

Questions 21 (b) (i) & (ii) were, the least well answered questions in the examination. It appeared that few candidates had carried out this experiment or similar experiments investigating the effect of temperature on cell surface membranes. Lower ability candidates simply repeated the treatments or described the results with little or no attempt at an explanation. Those who did attempt an explanation often believed that water moved in one direction during the boiling process or while being soaked in ethanol only to reverse that direction of movement when placed in sucrose solution or distilled water. Few candidates discussed the effect of temperature or ethanol on membrane structure and the explanation was often incorrect; did not include the correct direction of water movement.

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Exemplar 1

AS rod D was soaked in ethanol for 5 minutes, its solute concentration increased so and so its length would have decreased and so when it was added in dimilled water, water diffused into the rod via osmosis and it remained the same length 4.5 cm. Rod F also gained water via osmosis from the higher water potential in the rod thus increasing its mass and length to 5.3 cm. [2]

e how the student could reduce the uncertainty of their data.

This is a typical response for Q 21 (b) (ii) in which no attempt has been made to explain what has happened to the cell surface membrane and the reasons why one potato piece changed in length and the other did not are confused but show some basic knowledge of water potentials.

Exemplar 2

The ethanol that rod D was soaked in, would have dissolved the ~~ster~~ fatty acid chains of the phospholipids in the plasma membrane, so no water could pass through out of the membrane. Rod F however was untreated, so water molecules could ~~more~~ diffuse into the cells, causing the potato to swell. [2]

This was one of the better responses to Q 21 (b) (ii) in which the candidate correctly states how the ethanol has damaged the plasma membrane. The candidate goes on to explain the difference in the final length of the potato rods stating that water does not move into rod D but can still move into rod F increasing its length. The explanation is not entirely correct but enough correct information was provided to allow the marks to be given.

i	**OCR support**	Practical work should be an integral part of the study of Biology. The practicals provided by OCR to support the practical endorsement include Practical Activity Group (PAG) 5 in which the first practical investigates membrane permeability. PAG 5 investigates aspects of osmosis and membrane permeability. These practicals include extension questions that can be used to help prepare students for questions of this type in the examination. PAG activities are available on OCR interchange: https://interchange.ocr.org.uk/Modules/ControlledMaterials/ControlledMaterialsGCEFrom2015.aspx

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Question 21 (c)

(c) State how the student could reduce the uncertainty of their data.

.....

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

This question was not well answered as many candidates did not understand the word 'uncertainty'. Few candidates knew that to reduce uncertainty, you needed to use more precise or accurate apparatus. The most frequent answer referred to carrying out repeats and working out a mean, which gained no credit. Others suggested measuring mass instead of length or improving the accuracy of measuring volumes. Improving resolution and using statistics were also suggested by some candidates.

i	**OCR support**	The definitions of terms used in measurement can be found in the OCR practical skills handbook, Appendix 4: https://ocr.org.uk/Images/294468-biology-practical-skills-handbook.pdf

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Question 22 (a)

22 Practical apparatus is often used in biological investigations.

(a) Table 22 is a list of practical apparatus used in biological investigations. Each piece of apparatus has been assigned a letter.

Letter	Apparatus
A	calorimeter
B	gridded quadrat
C	biosensor
D	potometer
E	chromatography tank
F	spirometer
G	colorimeter

Table 22

The table below gives five examples of biological investigations.

Using Table 22, write the letter of the correct piece of apparatus that would be used in each investigation.

Biological investigation	Letter of piece of apparatus that would be used
Determining blood glucose concentration over a short time period following a meal	
Determining the distribution of dandelions on a playing field	
Estimating the concentration of pigment that has escaped from plant tissue that had been placed in water baths of different temperatures	
Measuring the vital capacity of a student	
Estimating the rate of transpiration in a plant shoot	

[3]

Q 22 (a) was generally well answered with most candidates scoring 2 or 3 marks. The most common errors were:

(i) to use a calorimeter (A) to determine blood glucose concentration rather than a biosensor (C)

(ii) to use a calorimeter (A) or chromatography tank (E) rather than a colorimeter (G) to estimate the concentration of pigment escaping from plant tissue.

Candidates who appeared to have had greater experience of practical work during their course faired better than those who seemed to have had little practice.

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Question 22 (b) (i)

(b) Before taking readings with a colorimeter it is important to calibrate the apparatus.

(i) Describe how a colorimeter is calibrated.

.....

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

Q 22 (b) (i) also tended to show the difference between those who had had practical experience using a colorimeter and those who had not. Only a few candidates referred to the use of a blank or filled with distilled water to calibrate a colorimeter. Instead they suggested using a clear liquid or a sample that was free of pigment. Many candidates who correctly used water in the colorimeter did not mention that it should be set to zero absorbance. Many candidates described putting in the water and taking a reading or pressing a control button of some kind with no clear reference to setting to zero.

Question 22 (b) (ii)

(ii) Why is it important to calibrate a colorimeter?

.....

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

Many candidates correctly stated that the purpose of calibrating a colorimeter was to make sure that the values would be accurate or valid. A few lost credit by also saying it made the results more precise or reliable.

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Question 23 (a) (i)

23 The photomicrographs shown in Fig. 23 below are taken from an animal cell undergoing mitosis.



Fig. 23

(a) (i) Write the letters of the images, **P** to **S**, in the correct mitotic sequence.

.... **[1]**

Most candidates answered this very well using the letters provided. The most common incorrect answer was putting Q first, followed by S, P, R – an understandable error if you thought that R was one of the two daughter cells.

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Question 23 (a) (ii)

(ii) Describe in detail what is happening in image **Q**.

.....

.....

.....

.....

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

Q 23 (a) (ii) was generally well answered, candidates often gained both marks where they correctly identified the phase as metaphase. However, a frequent error was to identify the stage as prophase and give a description of chromosomes condensing and the nuclear membrane breaking down.

Question 23 (b)

(b) In the space below produce a **labelled** diagram of the cell in image **S** from Fig. 23.

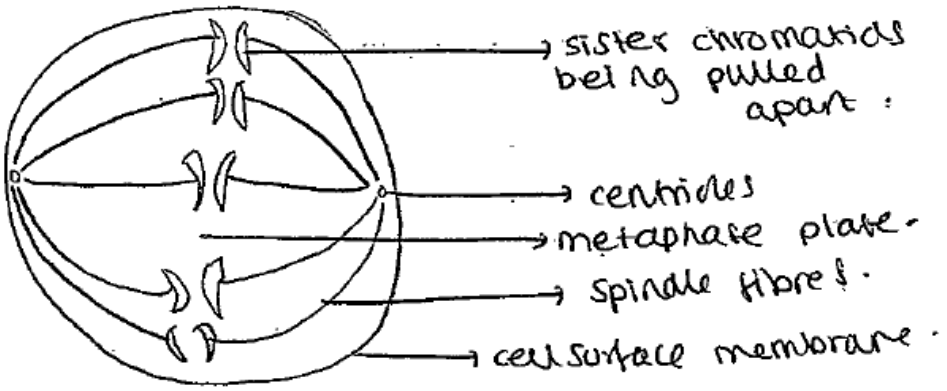
[3]

Q 23 (b) was generally tackled well and many candidates gained 2 or 3 marks. There was a wide variety in both style and standard of diagram. The most common mistake was not drawing at least 5 chromosomes, but many that did this did go on to gain full credit. Other errors included not using a ruler for drawing the label lines and the label line not touching the structure. A few candidates drew vertical chromosomes that bore no resemblance to the photograph, or drew chromosomes being pulled apart at right angles to those in the photograph. Some drew the chromosomes at metaphase rather than anaphase.

i	**OCR support**	OCR provides guidance in the 'Biological drawing booklet' available at: https://www.ocr.org.uk/Images/251799-biology-drawing-skills-handbook.pdf Centres should take guidance from the PAG activity 1.1 in which an example of how to draw a cell during mitosis is provided: https://interchange.ocr.org.uk/Modules/ControlledMaterials/ControlledMaterialsGCEFrom2015.aspx

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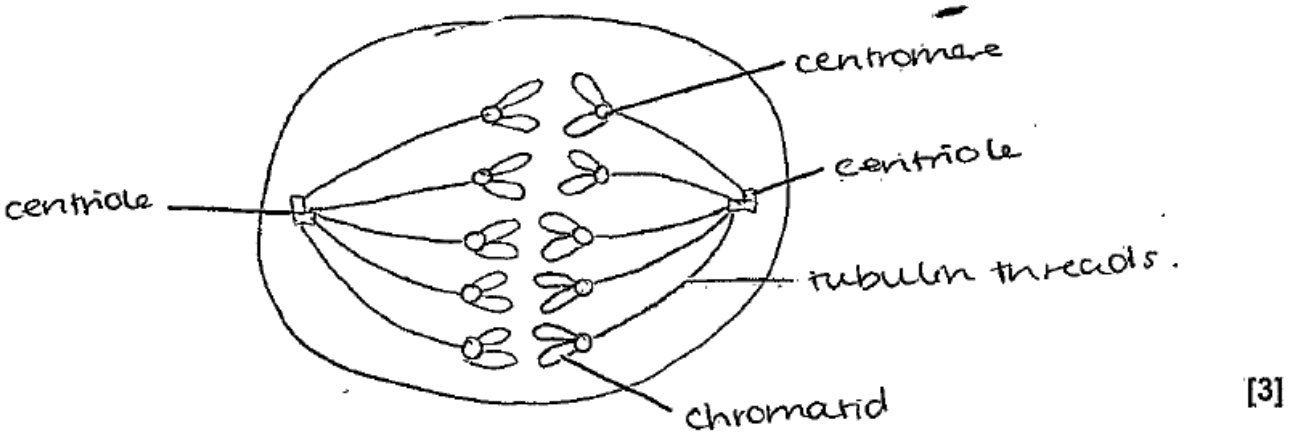
Exemplar 3



[3]

This was a well-drawn diagram. The candidate recognised that there were at least five pairs of chromosomes; these were not drawn in a suitable V-shape. The label lines were drawn with a ruler and touched the appropriate part of the diagram; they shouldn't have arrow heads on the label lines.

Exemplar 4



[3]

This was a well-drawn diagram. The chromosomes are clear, the label lines are drawn with a ruler and the labels are correct. The only criticism would be that the candidate has drawn centromeres which were not visible in the image provided.

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Question 23 (c)

(c) A student observed a prepared slide of an onion root tip under a microscope.
The total number of cells in the field of view was 265.

The number of cells at the different stages of the cell cycle are shown in Table 23.

Stage of cell cycle	Number of cells
interphase	207
prophase	42
metaphase	4
anaphase	6
telophase	6

Table 23

The cell cycle takes 20 hours. The number of cells visible at each stage is proportional to how long each stage of the cell cycle lasts.

Calculate the time taken for prophase to occur.

Give your answer in minutes to the nearest whole number.

time taken = ... min **[2]**

Q 23 (c) was well answered by most candidates, calculating the answer correctly at 190 minutes. A very few candidates gained one mark only, for incorrect rounding of the final answer. In general, if the working out was correct, the answer was correct.

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Question 24 (a)

24 Plants need water to survive.

(a) Water enters plants through the roots. Most roots are covered in root hairs.

The number of root hairs per mm^2 of root surface is described as the density of root hairs. The density of root hairs can vary between and within species.

A scientist examined a plant root. The plant root had a diameter of 2 mm. In 1 mm of root **length** the scientist counted 440 root hairs.

Calculate the density of root hairs on the root the scientist examined.

Use the formula: Surface area of cylinder = $2\pi r(r+l)$

Give your answer to **2** significant figures.

density = ... **[3]**

Most candidates demonstrated good mathematical skills in this part of the question. Using the formula provided to calculate the surface area of a cylinder produced an answer of 35 root hairs mm^{-2}. Many candidates achieved this answer. These candidates were given full marks. However, the formula provided includes the circular surfaces at the top and bottom of the cylinder which would not contain hairs. The higher ability candidates realised this and correctly calculated the density of root hairs over the length of the root as 70 mm^{-2}. The correct unit is mm^{-2} rather than $/mm^2$ or per mm^2, not many candidates were able to give the correct unit.

i	**OCR support**	The Maths for Biology website provides support on calculating surface area and use of units: https://www.ocr.org.uk/subjects/biology/maths-for-biology/index.aspx?id=biology-a-h020-h420-from-2015

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Question 24 (b) (i)

(b) A scientist investigated the effect of different mineral solutions on root hair density on cress plants.

Cress plants were grown for seven days in two different mineral solutions, **A** and **B**.

The results are shown in the table below.

Cress plant	Root hair density (hairs mm^{-2})	
	Mineral solution A	Mineral solution B
1	42	25
2	53	41
3	60	32
4	52	34
5	38	58
6	48	27
Mean	48.8	
Standard deviation	8.0	

(i) Calculate the standard deviation of root hair density for cress grown in mineral solution **B**.

Use the formula: $s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$

[Write your answer in the table] **[3]**

Most candidates gained 1 mark for correctly calculating the mean at 36.2. Many were also able to use the formula to calculate the standard deviation correctly although a significant number of candidates gave up after calculating the mean. In common with other calculations on this examination paper the most frequent reason for loss of marks was incorrect rounding. Candidates should be reminded to round their final answer rather than rounding earlier in the calculation. All processed data is recorded to up to one significant figure more than the raw data.

i	**OCR support**	The maths skills handbook is provided on the OCR website: https://www.ocr.org.uk/Images/294471-biology-mathematical-skills-handbook.pdf

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Question 24 (b) (ii)

(ii) The scientist thought that mineral solution **B** might cause a reduction in root hair density.

Suggest an appropriate statistical test that the scientist could carry out in order to confirm their hypothesis.

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

Judging by the number of crossed-out alternatives seen on scripts, candidates were unprepared for selecting appropriate statistical tests. Only a few candidates gave the correct response. The most common incorrect answers were chi-squared or Spearman's rank correlation and some candidates referred to 'calculate a mean'.

i	**OCR support**	The Mathematical skills statistics booklet is provided on the OCR website: https://www.ocr.org.uk/Images/338621-mathematical-skills-statistics-booklet.doc

Question 24 (c) (i)

(c) Fig. 24 is a section through xylem tissue from a **stem** of a dicotyledonous plant.

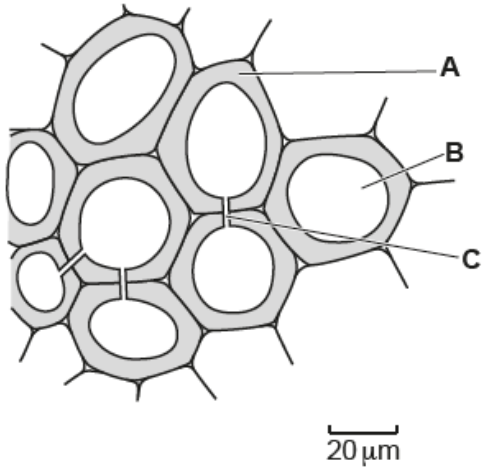


Fig. 24

(i) Identify **A**, **B** and **C** on Fig. 24.

A .....

B .....

C .....

[3]

Knowledge of xylem structure was poor. Responses gaining even 1 mark were rare and this was almost always for 'bordered pits'. Incorrect responses seen most frequently included:

For A: using the term 'cell wall' rather than 'vessel wall'.

For B: 'hollow tube', 'phloem' and 'xylem vessel' in place of 'lumen'.

For C: 'plasmodesmata' was often used in place of 'pits'.

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Question 24 (c) (ii)

(ii) Some plants, such as mosses, do not have xylem. Mosses are small plants that rarely grow more than a few cm in height.

Suggest why mosses do not need structures such as roots or xylem to survive.

.....

.....

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

Many candidates understood that a large SA:V ratio was important here and a few managed to link this to a short distance over which water needed to be transported. However, many candidates concentrated on the support role of xylem tissue and pointed out that little support was needed for a small plant. Some candidates only mentioned that mosses live in damp places.

Question 25 (a) (i)

25 Fig. 25.1 represents the tertiary structure of the enzyme lysozyme.

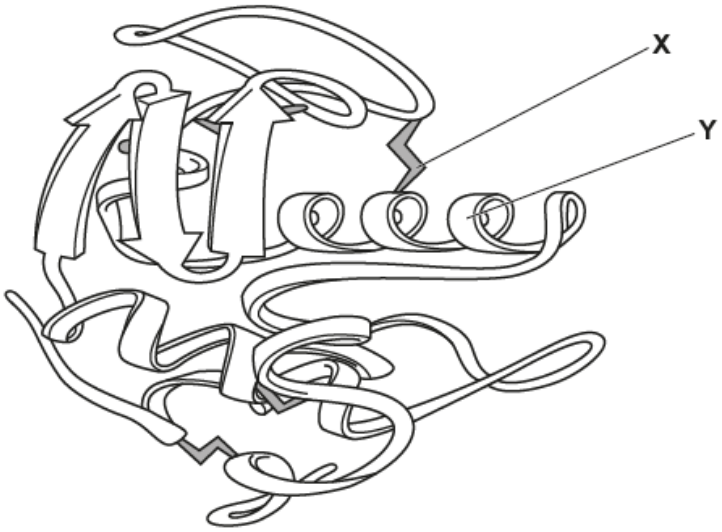


Fig. 25.1

(a) (i) Name the covalent chemical bond labelled **X** which links two cysteine amino acids.

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

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Question 25 (a) (iii)

(iii) Lysozyme consists of a single polypeptide chain of 129 amino acids.

State which level of protein structure is **not** shown by lysozyme.

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

Knowledge of protein structure was generally good, and most candidates achieved full marks. Marks were lost where candidates had not read the question carefully. In Q25 (a) (i) some candidates wrote 'peptide' as they had not looked at the diagram to see that bond X is not between two adjacent amino acids in the chain. In Q25 (a) (iii) some candidates wrote 'primary' as they had looked at the diagram and could not see the sequence of amino acids.

Question 25 (b) (i)

(b) The function of lysozyme is to break down the cell walls of bacteria.

(i) Name the molecule that is found in the cell walls of bacterial cells.

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

(ii) Name the structure labelled **Y** which forms part of the secondary structure of lysozyme.

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

The correct response was seen in many scripts although the spelling was often inaccurate. Common incorrect responses included 'chitin' and 'cellulose'.

Question 25 (b) (ii)

(ii) Lysozyme is also known as a glycoside hydrolase.

Suggest the type of chemical bond that lysozyme breaks and name the molecule other than the substrate that is needed for this reaction.

Type of bond .....

Other molecule needed for this reaction .....

[2]

This question was generally answered correctly. Some candidates gave incorrect answers including 'hydrogen', 'ionic' and 'peptide' for the type of bond. A common error was to use the formula for water rather than to give the name.

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Question 25 (c) (i)

(c) Enzymes are affected by temperature. Fig. 25.2 shows the time course of a mammalian enzyme reaction at different temperatures.

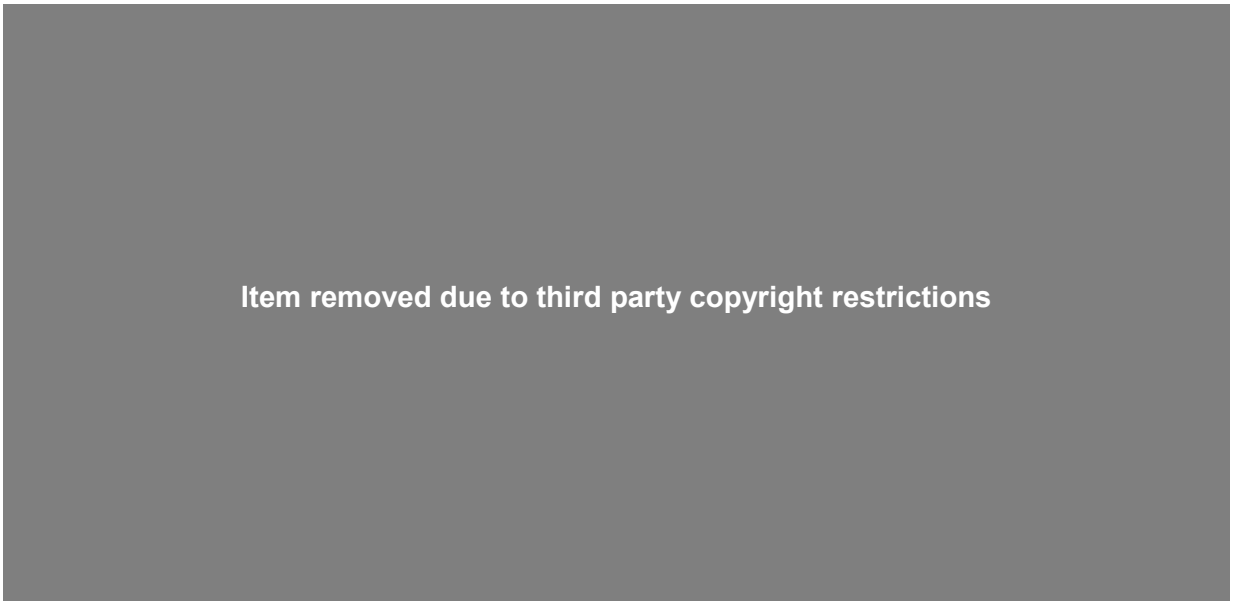


Fig. 25.2

(i) Explain why there is a difference in the shapes of the curves at 37 °C and 60 °C.

.....

.....

.....

.....

.....

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

This question required careful interpretation of the graphs as well as an understanding of enzyme function. A small number of candidates were able to give clear, logical, explanations to account for the shapes of the curves.

In general, it seems that students did not apply a systematic approach to graph analysis. Many *described* the shape of the curves rather than attempting to *explain*.

In Q25 (c) part (i) the majority of students gave GCSE responses about 37^{O}C being the optimum temperature and this being the temperature that enzymes "work best at". They ignored the evidence in the graph showing a faster rate of reaction at 60 ^{O}C for the first part of the time period. There were not a lot of direct references to the graph.

i	**OCR support**	The Mathematical skills handbook is provided on the OCR website: https://www.ocr.org.uk/Images/294471-biology-mathematical-skills-handbook.pdf

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Exemplar 5

At 37°C the enzymes are working at their optimum temperature and so produce the highest yield with the enzyme-substrate complexes being formed. However at 60°C the temperature is higher than 37°C so at first there is a steep rise in product formation due to the increased number of enzyme-substrate complexes. However at 60° the Vmax is lower than 37° as the temperature is too high so enzymes tertiary structure is impacted and so enzymes denature [2]

This response to Q25(c)(i) is typical of many candidates. The candidate has referenced formation of enzyme substrate complexes but has not related this to increased kinetic energy. The candidate has also referenced the denaturing of enzymes at the higher temperature but has not clearly related the effect that this has had.

Question 25 (c) (ii)

(ii) Explain why there is a difference in the shapes of the curves at 25 °C and 37 °C.

.....

.....

.....

.....

.....

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

As in Q25 (c) (i) candidates concentrated almost exclusively on the 37^{O}C line. Here, the most common reason given for the plateau was that the enzymes had become denatured – despite the fact that this had been described as the optimum temperature in the previous response. Often the 25^{O}C curve was almost completely ignored. It seems that most candidates have not had the opportunity to carry out a range of practicals to investigate other factors that affect enzyme activity.

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Exemplar 6

Rate of reaction at 25°C was much lower than that at 37°C, having not completed the reaction within the hour is evidence of this. Reasons can include lower kinetic energy of substrate and enzyme at 25°C meant there were fewer successful collisions per second, thus a slow rate of reaction. [2]

This response to Q 25(c)(ii) gained full credit for a clear and concise explanation of the difference in the shapes of the curves at 25 ^{O}C and 37 ^{O}C. The candidate has clearly stated that 25 ^{O}C has the lower rate of reaction explaining this by relating it to collision theory. The candidate has also stated that the reaction had not been completed within the one-hour time frame. This candidate has clearly understood the graph well.

Question 26 (a)

26 The specific immune system is based on white blood cells called lymphocytes.

(a) Complete the following passage by using the most appropriate terms from the list. You may use terms once, more than once or not at all.

memory **plasma** **killer T cell** **antigens** **antibodies**

interleukins **phagocyte** **meiosis** **mitosis** **hormones**

When a pathogen enters the body it is recognised due to specific molecules on the surface of its cells called ..... . A phagocyte will engulf the pathogen and process these molecules by displaying them on the surface of the phagocyte. This cell will now interact with a special type of T lymphocyte called a T helper cell. The T helper cells produce ..... that will activate the B lymphocytes. They start to divide by ..... . These cells now differentiate into ..... cells, which synthesise and release ..... .

[5]

The majority of candidates gained full marks here. The most common incorrect response was to write 'memory' or 'killer T cell' rather than 'plasma' in the fourth space. Many wrote 'hormones', rather than 'interleukins' in the second space. Some candidates still confuse antigens and antibodies.

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Question 26 (b)

(b) A student wrote the following passage in an essay on the immune system.

Immunisation programmes involve injecting individuals with a small amount of the safe antibody, known as a vaccine. In the UK, babies are given routine vaccinations against a range of infectious diseases including diphtheria and measles. These injections provide a form of natural passive immunity that may last a year, a few years or a lifetime.

State **three** errors that the student has made in this passage.

.....

.....

.....

.....

.....

..... **[3]**

Candidates were asked to 'state three errors'. Many candidates also wanted to correct the errors and it was sometimes difficult to ascertain whether the responses written were the errors or corrections for those errors. In this situation it may be beneficial for candidates to be creative in their response and use a small table in which the column headings are 'error' and 'correction'. Candidates could use tables and bullet points in their responses if these would help to make the response clearer. Most candidates achieved full marks here. There was some confusion over what vaccinations are routinely provided. Many candidates referred to dead or weakened pathogens being injected rather than antigenic material.

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Section A, Q13-14

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