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Examiners' report

BIOLOGY A

H020

For first teaching in 2015

H020/01 Summer 2024 series

Version 1

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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. A selection of candidate answers is also provided. 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 and the mark scheme can be downloaded from OCR.

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Paper 1 series overview

H020/01 Breadth in Biology is one of two examined components of AS Level Biology A. The component tests content from four modules:

Module 1: Development of practical skills in biology

Module 2: Foundations in biology

Module 3: Exchange and transport

Module 4: Biodiversity, evolution, and disease

Candidates should expect a range of questions testing their knowledge and skills, including mathematical and practical skills. To do well in this component, candidates need to have a good level of knowledge and understanding of the basic concepts underlying biology. These include cell biology, biological chemistry, exchange structures, transport systems, biodiversity and evolution.

More successful responses showed that some candidates took the time to read the questions carefully, thinking about what the required response was and decided an appropriate level of detail. They were able to recall scientific knowledge and write concise explanations directly linked to the question they had been asked. It is important that candidates practise working with past paper and exam style questions, discuss the need to read questions carefully, look at how to interpret questions (such as working on the meaning/requirement of command words, e.g. state, describe, and explain) and practise writing in clear concise language. All these points will allow them to improve their exam technique, become more confident in their responses and ultimately should allow them to receive the maximum marks possible for their ability.

In this paper, less successful responses demonstrated that some candidates were unable to interpret questions successfully and wrote responses that demonstrated knowledge that was not relevant to the question. This is particularly clear in Question 24 (c). Here, many candidates were seen to discuss how bacteria can develop antibiotic resistance instead of explaining the consequences of this were not given marks for their responses. It is also important that candidates understand and use scientific terms and language effectively which can be exemplified using past exam questions.

OCR support: Exam builder

Exam builder helps educators to browse, filter and select past paper questions to use with candidates. The filter option allows you to select questions at different assessment objectives, level of demand and practical skills.

This is effective not just as an assessment tool but also can help candidates gain valuable experience with different styles of question and to develop an understanding of the need to read questions carefully picking up on command works such as describe or explain which is vital to achieving as many marks possible on a question.

Candidates should also have experience of carrying out practical work including planning, use of equipment to measure and modelling the processes occurring in living things. Questions 7, 12, 21, 23 (d) and 25 (b) highlight the need for students to be able to transfer knowledge and experience of practical skills to the written paper. Unfortunately, there were many unsuccessful responses in all these areas, and it is important that centres provide sufficient experience in practical tasks to expand candidates learning experience as much as possible.

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OCR support

The OCR website contains a wide range of practical based support materials including the Practical skills handbook as well as Practical Endorsement materials with tried and tested practical activities that can be adapted to a centre's available resources.

The Practice PAG materials can also be useful to help your students ready for the indirect assessment of practical skills.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• attempted to answer all questions • recalled names and key concepts accurately • showed mathematical fluency in calculations • read information from graphs accurately and were able to draw tangents correctly • produced clear and concise responses for questions • had a good practical knowledge, with a range of practical situations • read the question stem carefully, using it to support and guide their response, for example knowing the difference between a 'describe' and an 'explain' question • could interpret and/or extract information given in diagrams, graphs and tables, and use it to answer related questions • understood the need for comparative statements using terms like 'higher', 'much more' and 'greater' when answering questions where this was needed.	• left responses unfinished or blank • did not use enough biological terminology and/or used it in the wrong context • found it difficult to answer mathematical based calculations • found it difficult to apply what they had learnt to unfamiliar situations, scoring most of their marks on questions involving straightforward recall and understanding • did not have a good understanding of practical situations, apparatus and procedures • produced responses which lacked depth, particularly to biochemistry or practical based questions • produced responses which were often peripheral to what had been asked, sometimes simply repeating information provided in the stem of the question • were not able to understand how to approach task questions that required the response in a specific format.

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Section A overview

There were many successful responses in this multiple-choice section. There were some clear discriminators which few candidates got right, but overall responses were positive and very few questions were seen with no response showing that candidates knew to complete all questions as they have a chance of guessing the correct response.

Overall, candidates seemed to be aware that if they change their mind for a Multiple Choice Question (MCQ) they should not overwrite their initial response. This can make it impossible to read or produce a hybrid letter which cannot be given marks.

Multiple-choice responses

Candidates should be aware that examiners will mark the response even if it is written outside the box, so they do not need to squash a second response into the box if it will make their answer unclear. Instead, they should clearly cross out any responses they no longer want, and leave **only one response** outside the box, if needed.

Candidates' performance in this section has highlighted the need to practice recognising and interpreting photographic images. Responses to Question 12 and 16 demonstrated that many candidates found it hard to interpret and link the images provided to the related biological content.

Candidates who performed well were also able to read data/information from graphs or tables accurately and were able to process and/or interpret it if needed, in the correct way. This was apparent in Questions 4, 7, 16, and 18.

Question 1

1 Which process occurs during ventilation in bony fish?

A During expiration, the operculum opens

B During expiration, the volume in the buccal cavity increases and the pressure decreases

C During inspiration, the mouth opens causing the operculum to open

D During inspiration, the volume in the buccal cavity decreases and the pressure decreases

Your answer [ ] **[1]**

Some candidates correctly identified A as the correct response. All distractors were seen, indicating that some were unclear of the stages involved with ventilation in bony fish and the correct sequence. Many candidates were able to identify the incorrect references to pressure in the distractors, as C was the most commonly seen wrong response.

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Question 2

2 Which change in the mammalian gas exchange system takes place only during forced expiration?

A Abdominal muscles relax

B Diaphragm contracts to become dome-shaped

C External intercostal muscles contract

D Internal intercostal muscles contract

Your answer ☐ **[1]**

There was a clear split of knowledge in this question with some candidates correctly identifying D as the correct response. Many candidates were clear on the mechanisms involved with forced expiration and the role the different muscles play and were able to link their contraction/relaxation to the different stages of breathing.

Question 3

3 The blue whale can grow up to 30 m long and can weigh up to 200 000 kg.

Whales have specialised surfaces for gas exchange.

Which option is **not** a reason why blue whales need a specialised surface for gas exchange?

A Transport of gases by diffusion is too slow

B Whales are multicellular organisms

C Whales have a high metabolic demand

D Whales have a large surface area to volume ratio

Your answer ☐ **[1]**

Many candidates were given the mark for this question and gave D as the correct response. Candidates often confuse large and small surface area: volume ratios as a concept. This could be further clarified by worked examples with a variety of sized animals as well as comparing the SA:V ration of single celled and multicellular organisms.

Misconception

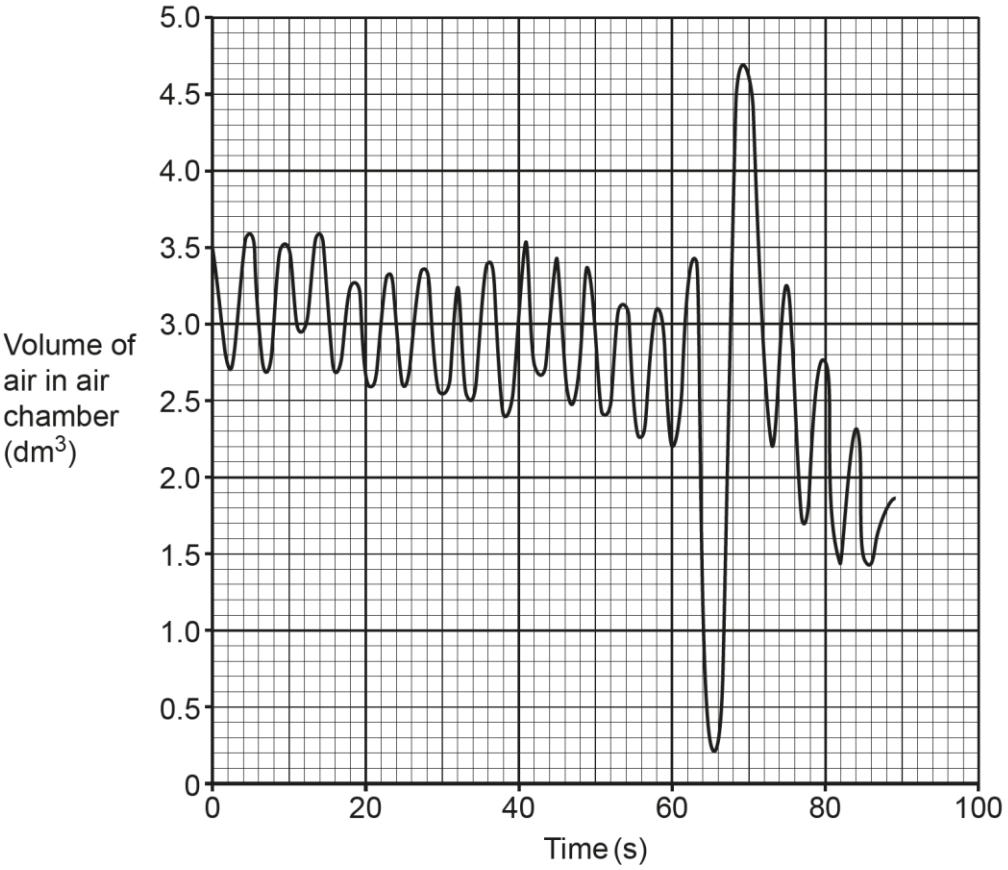
? A common misconception seen was that being multicellular organisms was not a reason for a specialised surface for gas exchange, which could be reinforced through examples.

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Question 4

4 The graph shows a trace recorded by a spirometer.

The trace shows a period of normal breathing whilst at rest, followed by a maximum inhalation and maximum exhalation.



What is the value for vital capacity?

A 0.70 dm^3

B 0.90 dm^3

C 3.15 dm^3

D 4.50 dm^3

Your answer [ ] **[1]**

Vital capacity is the maximum air that can be expelled after a maximum inhalation. Most candidates correctly identified D as correct, with a number annotating the graph at the highest and lowest peak, (4.7dm^3- 0.2dm^3 = 4.5 dm^3). This highlights the importance of being able to extract data from graphs accurately as well as knowing key definitions of breathing volumes. C was a common incorrect response, indicating that candidates were confusing maximal inhalation with vital capacity.

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Question 5

5 During exercise the cardiac output of an athlete is 28 $dm^3 min^{-1}$ and their stroke volume is 160 cm^3.

How many heart beats occur when the athlete exercises for five minutes? Assume the cardiac output and stroke volume stay constant during the exercise time.

A 22

B 175

C 875

D 4480

Your answer [ ] **[1]**

The was a well-answered question which showed that many candidates were able to carry out the needed calculation. They recognised that they needed to convert the dm^3 of the cardiac output into cm^3 to make it the same units as the stroke volume, before multiplying the value by 5 as answer is for five minutes to get C as the correct answer.

Calculation:

Rearrange equation: Cardiac output = stroke volume x heart rate

Heart rate = cardiac output / stroke volume

Convert dm^3 to cm^3 = 28 x 1000 = 28,000cm^3

Heart rate per min = 28,000 / 160 = 175

Heart rate for 5 mins = 175 x 5 = 875

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Question 6

6 Which option is a feature of tissue fluid?

A Tissue fluid carries oxygen away from muscle cells

B Tissue fluid does not contain erythrocytes

C Tissue fluid forms when net hydrostatic pressure < net oncotic pressure

D Tissue fluid forms when net hydrostatic pressure = oncotic pressure

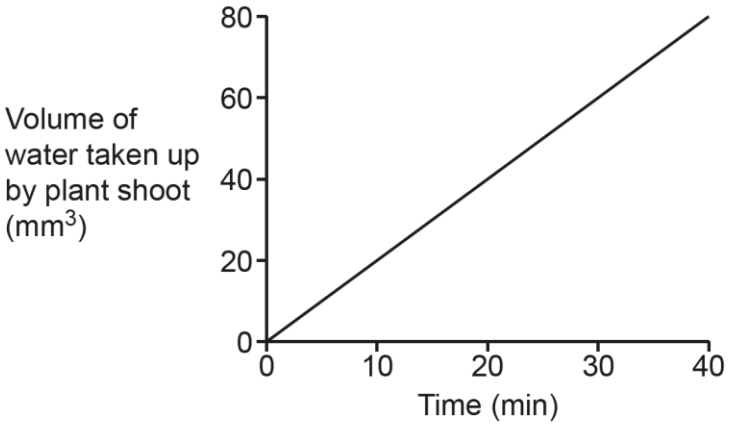
Your answer [ ] **[1]**

Many candidates were able to identify an absence of erythrocytes in tissue fluid as the correct response (B). Some gave A as the correct response possibly because tissue fluid carries oxygen towards muscle cells, so some oxygen may be carried away this would not be a specific feature of tissue fluid but a side consequence of excess oxygen in the blood or possibly low metabolic activity of muscle cells. The most common incorrect responses were C and D, where the formation of tissue fluid was poorly understood.

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Question 7

7 A potometer was used to estimate the rate of transpiration. The graph below shows the results from the experiment.



What is the estimated rate of transpiration?

A $0.5\,mm^3\,min^{-1}$

B $1.0\,mm^3\,min^{-1}$

C $2.0\,mm^3\,min^{-1}$

D $4.0\,mm^3\,min^{-1}$

Your answer [ ] **[1]**

Most candidates were able to get the correct response C by using the line of best fit to estimate the rate (difference in y/difference in x), and a number were seen to annotate the graph to help them do this which is good practice.

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Question 8

8 *Bacillus thuringiensis* (Bt) is a species of bacterium that lives in soil. Bt makes proteins that are toxic to some insects when eaten.

Which process does **not** occur in Bt?

A Bt modifies and packages toxic proteins in the Golgi apparatus

B Bt reproduces by asexual reproduction to pass on the gene for the toxic protein

C Bt transcribes the gene for the toxic protein using RNA polymerase

D mRNA is translated to make the toxic protein

Your answer ☐ **[1]**

Some candidates were able to make the link between 'bacterium' in the stem of the questions and the fact that bacteria are prokaryotic cells. They knew that the cells do not have membrane bound organelles such as Golgi apparatus, so they were able to identify A as the correct response.

Question 9

9 Lactose is a carbohydrate.

Which feature describes the structure of lactose?

A Lactose contains glycosidic bonds that are broken by a condensation reaction

B Lactose is made up of fructose and glucose

C The molecular formula of lactose is $C_{12}H_{22}O_{11}$

D The molecular formula of lactose is $C_{12}H_{24}O_{12}$

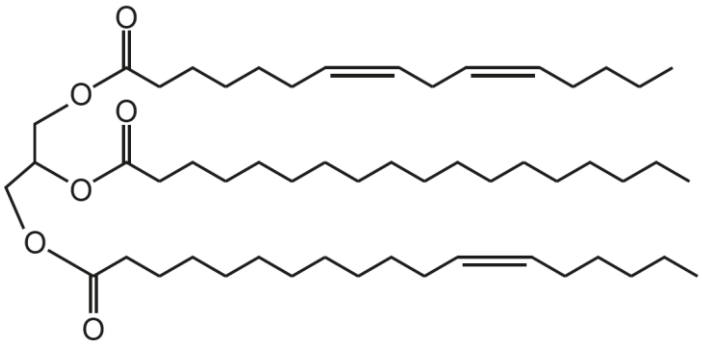
Your answer ☐ **[1]**

Some candidates were able to identify C as the correct response and they were either familiar with the formula of lactose or that it was a disaccharide and were also able to take into account the loss of a water molecule in the formation of it to find the correct formula.

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Question 10

10 The diagram shows a triglyceride molecule found in sunflower oil.



Which option describes the structure of this triglyceride molecule?

A Contains phosphodiester bonds

B Monounsaturated

C Polyunsaturated

D Saturated

Your answer [ ] **[1]**

Most candidates were able to pick out the link between 'poly' and the 3 double bonds shown on the image and selected the correct response C.

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Question 11

11 Chloramphenicol is an antibiotic that works by binding to bacterial ribosomes.

What process stops when chloramphenicol is present?

A Cytokinesis

B Endocytosis

C Transcription

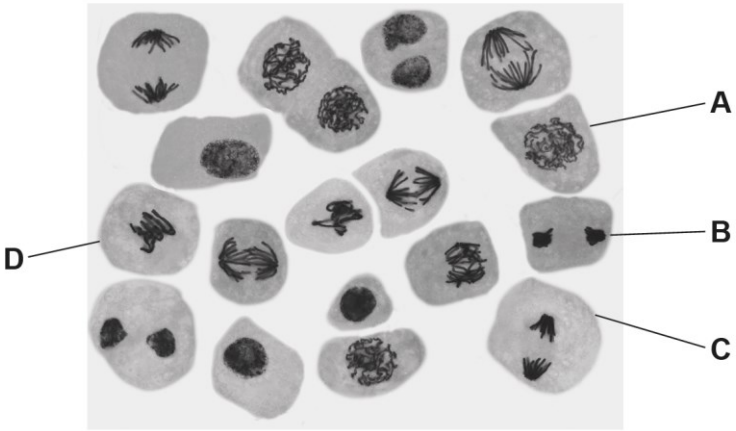
D Translation

Your answer ☐ **[1]**

Many candidates were able to identify that although all other processes would be stopped eventually and ultimately the cells would die, the immediate effect of the Chloramphenicol is to stop the function of ribosomes. Therefore, they were able to identify D as the correct response as translation occurs at the ribosomes. This showed a good knowledge of the organelles involved with protein synthesis and the function of different organelles.

Question 12

12 The photomicrograph shows a group of cells prepared from an onion root tip squash.



Which of the label lines shows a cell that is in metaphase?

Your answer ☐ **[1]**

Most candidates correctly answered D and were able to make links between the features of the different stages of mitosis and the photomicrograph, and/or were familiar with images of the different stages of mitosis.

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Question 13

13 Ring rot is an infection that can kill potato plants.

Which kingdom does the organism that causes ring rot belong to?

A Fungi

B Prokaryotae

C Protoctista

D Viruses

Your answer ☐ **[1]**

Only a few candidates were able to identify the correct organism as a prokaryote and select B as the right response. The additional guidance provided in the specification should be used to make sure that all key examples of specific organisms are covered in teaching. Specification point 4.1.1 (a) lists ring rot as an example of bacterial pathogen. The most common incorrect response was A.

Question 14

14 What is an example of a disease transmitted by a vector?

A Hepatitis C from sharing needles

B Herpes simplex virus from sharing lipstick

C HIV from unprotected sex

D Malaria from mosquitoes

Your answer ☐ **[1]**

Most candidates got this question right with only a few not selecting D.

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Question 15

15 Plant defences can be described as chemical or physical.

Which of the following results in a **physical** defence against a pathogen?

A Plants produce hormones, which alert nearby plants of their own infection

B Plants synthesise callose, which they use to block plasmodesmata

C Plants synthesise enzymes called chitinases to break down fungal cell walls

D Plants synthesise proteins called defensins, which disrupt metabolism to cause cell death of the pathogen

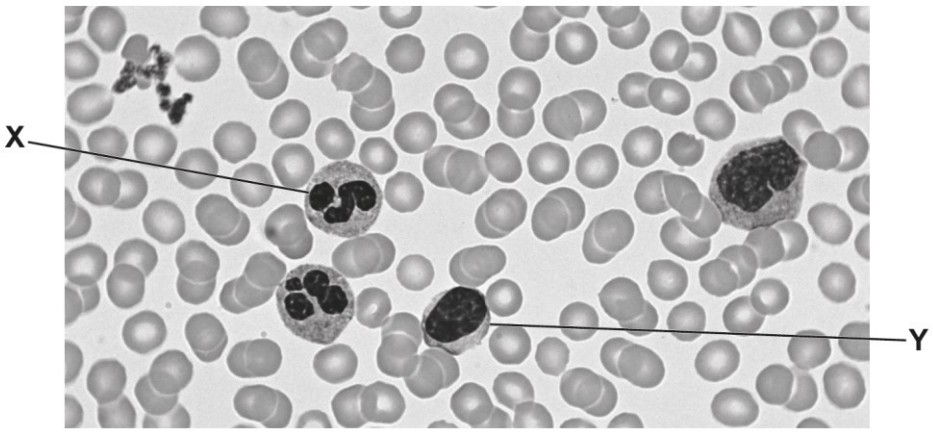
Your answer [ ] **[1]**

This question was well answered with most candidates making the link between callose and a physical defence and selecting B as the correct answer.

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Question 16

16 The image shows a photomicrograph of a blood smear.



Which row in the table below correctly identifies cell **X** and cell **Y**?

	X	Y
A	neutrophil	erythrocyte
B	neutrophil	lymphocyte
C	lymphocyte	neutrophil
D	platelet	neutrophil

Your answer ☐ **[1]**

Many candidates were able to identify the correct cells in the image provided and selected B as the correct response. Examination of microscope images/micrographs and drawing skill activities linked to the different types of leucocytes can reinforce the key features of the different types.

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Question 17

17 Which statement describes species evenness?

A The number of different species

B The number of organisms in a community

C The number of organisms of a particular species

D The relative number of individuals of each species in an ecosystem

Your answer [ ] **[1]**

The question was answered very well, showing that most candidates were clear on the different definitions in this specific topic selecting D as the correct response.

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Question 18

18 Students carried out fieldwork in two different woodlands. They marked out an area measuring 10 m by 10 m in each woodland. For each plant species present they recorded the number of individuals of each species.

The table shows their results.

Species	Number of Individuals	
	Area 1	Area 2
Greater celandine	5	25
Lesser celandine	7	10
Herb robert	2	5
Wild strawberry	8	0
Dog's mercury	4	0
Violet	4	0
Snowdrop	0	2

The students made some conclusions about their data.

Which of these conclusions is supported by their data?

A Area 1 has a lower value of Simpson's index of diversity

B Area 1 is a more stable habitat

C Area 2 has a greater species evenness

D Both area 1 and area 2 have the same species richness

Your answer ☐ **[1]**

B was identified by most candidates as the correct response showing a good understanding of the definitions of species evenness and species richness, and their roles in the stability of a habitat. Although some candidates showed working out suggesting they calculated Simpsons Index of diversity, this was not required to answer the question as the data provided showed a clear increase in species evenness for Area 1 resulting in a more stable habitat.

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Question 19

19 *In situ* and *ex situ* conservation methods maintain biodiversity.

Which example describes an *ex situ* conservation method?

A Collecting and storing seeds of clover glycine after an Australian forest fire

B Estimating the number of mountain hares in the Peak District National Park

C Protecting ancient oak trees by restricting access to their location

D Protecting the nesting grounds of leatherback sea turtles in the Great Barrier Reef

Your answer ☐ **[1]**

This question was a good discriminator with most successful responses choosing the right response of A.

Question 20

20 Bats are mammals that hunt insects while flying. Dolphins are mammals that hunt fish while swimming. Some bats and all dolphins use a technique known as echolocation to hunt their prey. They emit sound waves which reflect back to them to show the location of prey.

What explains why bats and dolphins show the same adaptation of having echolocation?

A Bats and dolphins are in the same family

B Both had different environmental conditions

C Both had the same selection pressure

D The environment caused both to have the same mutation

Your answer ☐ **[1]**

Many candidates correctly identified C as correct, that echolocation had developed due to having the same selection pressures. Other candidates incorrectly selected D, believing that environment caused the same mutation. Candidates should be clear that all mutations are random spontaneous events and therefore are not driven by the environment.

Assessment for learning

Examples of convergent evolution and evolutionary niches could be used in teaching to reinforce this concept, such as the placental mole compared to the marsupial mole.

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Section B overview

Candidates demonstrated a wide range of knowledge and ability in this section. Many candidates were able to access all questions with a greater or lesser degree of success. There were relatively few candidates who did not respond to some questions.

Candidates' performance in this section highlighted the need to practice recognising and interpreting photographic images. Responses to Question 22 (b) demonstrated that many candidates found it hard to interpret the image provided in detail.

Questions 21, 23 and 25 proved to be the most challenging for many candidates while better performance was seen in Questions 22 and 24. A lot of candidates were given more marks on the recall and understanding of knowledge questions than on the questions that required interpretation and extension of that knowledge. Many candidates seem to find it challenging when given an unexpected or unusual contexts for simple questions. An example of this would be Question 23 (c) about the cell cycle, checkpoints and mitosis.

Practical-based questions such as Questions 21, 23 (d) and 25 (b) show the need for candidates to be well experienced with a range of practical activities and while many were able to achieve good marks on these questions, some candidates were disadvantaged possibly by the lack of practical experience. Additionally, Questions 21 (a), 21 (b), and 21 (d) highlight the need for analysis and discussion of practical results to include identifying anomalies, describing and explaining trends and the interpretation of data from tables and graphs. Question 23 (d) highlights the need for discussion about the theory behind the stages involved in practical activities and investigations. For example very few candidates understood the role of salt in DNA extraction.

Accurately extracting data from graphs is a core skill and it was essential for Question 23 (a). Candidates who performed well here had experience of drawing tangents before and knew how to use them.

Responses which used comparative language were successful in Questions 21 (a), 21 (d), 24 (c) and 25 (c). Here, using terminology like 'much more', 'very high', 'higher', 'lower', 'much lower' and 'lower than expected' were vital to gaining full marks.

Task-based questions

Less successful responses would benefit from practising task-based questions such as Question 24 (a), as some candidates did not understand what they had to do and lost the chance of getting marks by writing 'once', 'more than once' or 'not at all' into the boxes. Candidates need to carefully read the instructions for task-based questions like this and be clear that they know how to write their responses.

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Question 21 (a)

21 A group of students are investigating osmosis in plant cells.

This is the method they use:

- Use a cork borer to cut cylinders of sweet potato to 30 mm in length.
- Dry each cylinder using a paper towel and record its mass.
- Prepare 5 cm^3 of sucrose concentrations of 0.0, 0.1, 0.2, 0.4 and 0.8 mol dm^{-3} in test tubes.
- Place one cylinder into each test tube.
- Leave test tubes at room temperature for 48 hours.
- Remove each cylinder, dry using a paper towel and record its mass.
- Repeat the experiment three times at each sucrose concentration.
- Calculate the percentage change in mass for each cylinder.

The table shows the processed results obtained by the students.

Sucrose concentration / (mol dm^{-3})	Percentage change in mass				Mean percentage change in mass
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	
0.0	+30.3	+25.5	+28.8	+29.2	+28.5
0.1	+23.3	+25.5	+10.3	+22.2	+20.3
0.2	+12.7	+14.4	+14.8	+12.3	+13.6
0.4	+2.7	+4.3	+4.4	+2.9	+3.6
0.8	–13.9	–10.9	–12.5	–12.8	–12.5

(a) Explain the difference between the mean results obtained at the 0.0 mol dm^{-3} and 0.8 mol dm^{-3} sucrose concentrations.

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

Many candidates gave a correct reference to water moving inwards or outwards by osmosis for 1 mark. A few students were given 2 marks here and these candidates were able to provide a correct description of water potential and included specific details about locations such as 'the potato cell' rather than more general statements about 'cylinders'. Candidates who were given marks were able to identify the need to 'explain' the results rather than 'describe' them from the stem of the question and did not waste valuable exam time describing the data in the table.

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Question 21 (b)

(b) The students suggested that there was an anomaly in their results.

Identify the anomalous result **and** explain how the anomalous result affects the **precision** of the data obtained.

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

The anomaly was well identified so most candidates were able to achieve 1 mark, however only a few candidates were able to 'explain' its effect on precision to be awarded 2 or 3 marks. Most stated it made the results less precise because it lowered the mean value, or it increased the spread of results – without linking this to the mean. Some more successful responses correctly stated it increased the standard deviation. Very few candidates tried to link repeatability into their response.

OCR support

OCR has a resource available to support candidates with the practical investigation and 'Language of measurement'.

Language of measurement in context - Biology

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Question 21 (c)

(c) The students prepared the sucrose concentrations using a serial dilution technique. The students were provided with 10 cm^3 of a 0.8 mol dm^{-3} sucrose concentration.

Describe how the students produced 0.4, 0.2 and 0.1 mol dm^{-3} sucrose concentrations each with a volume of 10 cm^3.

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

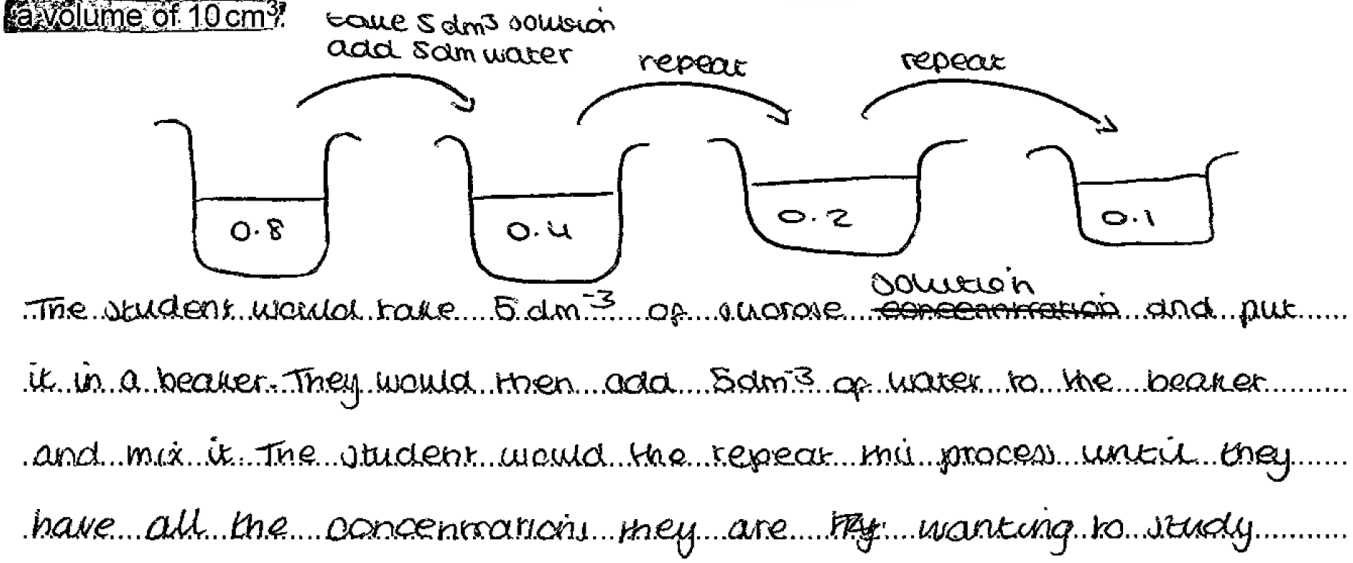
Many candidates were given 2 marks for correctly suggesting taking 5 cm^3 of sucrose and adding it to 5 cm^3 of water and then giving the process of serial dilution. They described (or used an annotated diagram) that for each new solution the previous solution is diluted further, rather than simply stating that the process was 'repeated', which was not given in the mark scheme. Few got the idea of mixing or stirring the contents.

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Exemplar 1

The students prepared the sucrose concentrations using a serial dilution technique. The students were provided with 10 cm^3 of a 0.8 mol dm^{-3} sucrose concentration.

Describe how the students produced 0.4, 0.2 and 0.1 mol dm^{-3} sucrose concentrations each with a volume of 10 cm^3.



The students would take 5 dm^{-3} of sucrose solution concentration and put it in a beaker. They would then add 5 dm^{-3} of water to the beaker and mix it. The student would the repeat this process until they have all the concentrations they are trying wanting to study

The candidate uses a clear annotated diagram to support their written description of the procedure. They use correct volumes and include the need to mix the solution at each stage of the process. Their written description alone would not be enough for them to be given a mark. In their description, they just state repeat this process' for the mark point for the idea of 'taking contents from previous tube and add to the next', but their diagram shows us clearly that this is what they know should happen in a serial dilution so they could be given the mark.

OCR support

Practical skills are an important component of GCE Biology. Centres should appreciate that even at AS Level practical skills must be part of the teaching and will be tested in the written examination papers.
Practical skills handbook / PAG practicals

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Question 21 (d)

(d) The students carried out a similar experiment with carrot tissue.

Explain how the students could use their data to estimate whether sweet potato tissue or carrot tissue had a higher sucrose concentration in its cells.

.....

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.....

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

A few candidates knew to plot a graph and use the x axis intercept to predict the sucrose concentration of the cells. Some suggested plotting a graph but were then unable to explain how to use it and/or did not mention drawing a line of best fit for both plant tissues. The most common mark given was for a correct reference to a qualitative interpretation of data, e.g. higher mass increase is due to a higher concentration of sucrose in the cells, so candidates were aware of the concept but unable to describe a qualitative method to achieve this.

Question 22 (a)

22 Living organisms are organised into tissues, organs, and organ systems.

(a) State the difference between a tissue and an organ.

.....

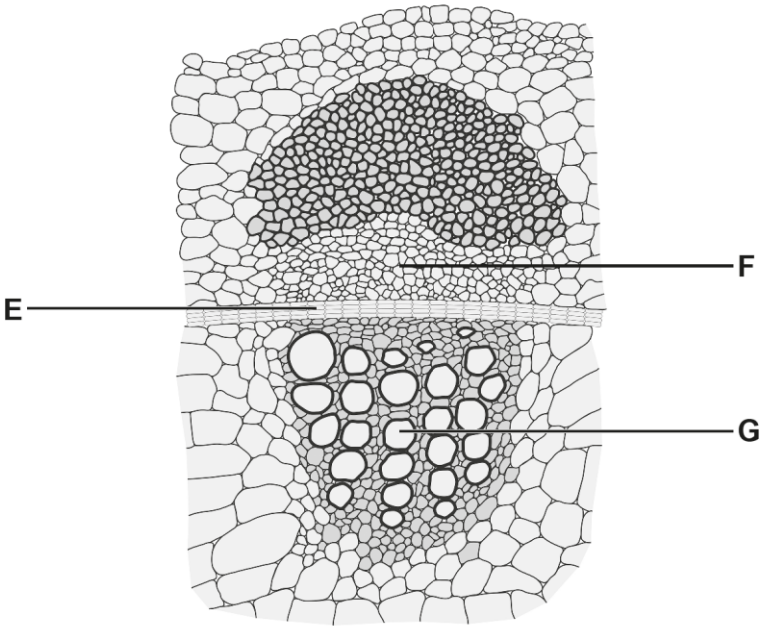
..... **[1]**

Generally, candidates were able to define both terms well so many were given the mark.

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Question 22 (b) (i)

(b) A light microscope image from a transverse-section through the stem of a plant was used to produce the drawing shown below.



(i) Identify tissues **E** and **F**.

Tissue **E** .....

Tissue **F** .....

[2]

Candidates who were familiar with microscopic images of plant tissues and their histology were given both marks. Many knew that the first label was meristem/cambium, but many thought that the second one was xylem. Some candidates could not label either correctly, although candidates did generally attempt to put a form of plant tissue as a response which showed that they knew the content but were unable to apply it to an unfamiliar image.

Assessment for learning

Picture quizzes are a fun and quick way to recap and explore different images of key parts of the course. They can be done within a topic or built up over the course to include various images such as specialised cells, biological molecule structures, plant transport tissues, root structure, different blood cells, different blood vessels, different ECG traces, etc. The images can also be linked to different types of microscopes and used as talking points to recap and revise content.

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Question 22 (b) (ii)

(ii) Explain **two** ways tissue **G** is adapted for its function.

.....

.....

.....

.....

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

This question discriminated well with more successful responses being given 2 marks. These candidates were able to correctly identify xylem, but then were also able to use good biological terminology to explain the adaptations stated. Those who were not given any marks often just stated the adaptations without explaining their function, suggesting they had not picked up on the 'explain' in the stem of the question or that their content knowledge was lacking. Few candidates stated that the cell walls were lignified showing good understanding of the structure of xylem as a tissue not a cell. Candidates who did not score well also referred to water storage features such as succulent/fleshy leaves and/or water collection methods like deep roots so not interpreting the question correctly or not knowing xylem's function.

Question 22 (c)

(c) The sentences are about the transport of water through a plant.

Complete the sentences using the most appropriate terms.

In the apoplast pathway, water moves through the ..... of plant cells. When water reaches the endodermis, its movement is blocked by an impermeable barrier called the ..... .

Water is then forced into the symplast pathway. It moves between cells through channels called ..... .

[3]

Many candidates were given 3 marks here, but there were some who could not fill in the gaps at all. The most commonly known missing term was 'cell wall', although some lost this by giving 'spaces between cell walls'. Many variations of the spelling of 'casparian' and 'plasmodesmata' were seen and phonetic spelling was accepted.

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Question 22 (d)

(d) Xerophytes are plants that are adapted to living in dry environments.

Explain **two** ways that xerophytes are adapted to prevent water loss in dry environments.

1 .....

.....

2 .....

.....

[2]

Most candidates were not given any marks for this question. Some were given 1 mark, but very few were given 2. Candidates who were given 2 marks were aware of the need to 'explain' the water loss, so picked up on the command word in the stem and were also aware of the need to use proper terminology linking adaptations to water 'vapour' loss and/or 'reduced transpiration' which was key for a number of the marking points. Many candidates referred to 'small leaves' but did not mention 'surface area'. Likewise, 'thick' was often missing from marking point (MP) 2. MP3 was seen, but many candidates were vague in their responses and did not receive marks. MP4 and 5 were commonly described. MP6 and 7 were rarely seen. Quite often, information from the stem of the question (prevents water loss) was used rather than an explanation of how the adaptation prevented the water loss. Candidates who did not interpret the question well also discussed xerophyte having long roots and water storage features.

Misconception

Many candidates referenced stomata on the underside of the leaf and did not recognise that this also applies to non-xerophytic plants too. This was also seen where candidates noted that the waxy cuticle reduced evaporation of water from leaves without pointing out that xerophytes have 'thick(er)' waxy cuticles, as all plants have a waxy cuticle.

Exemplar 2

1 Thick waxy cuticle to prevent water loss through ~~the~~ transpiration.

2 Sunken stomata to slow the rate of evaporation.

Exemplar 2 clearly states the adaptation and how this links to reducing water loss in a concise way using the correct terminology and they are given 2 marks. They do not need to state water 'vapour' loss as they have used other correct terminology to make this point apparent.

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Question 23 (a)

23 DNA has a double helix structure made from polynucleotides.

(a) Describe how a polynucleotide is formed from its monomers.

.....

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

This question discriminated well and some candidates were given the mark. The main common error seen was no mention of nucleotides – candidates often just used monomers from the stem of the question, but bonds between bases and amino acids were also seen. Hydrogen bonds, peptide bonds, glycosidic and ester bonds were also seen in responses where candidates were not given marks, suggesting they were mixing up the different biological molecules.

Question 23 (b) (i)

(b) DNA is replicated during interphase of the eukaryotic cell cycle.

(i) The enzyme helicase is active during DNA replication.

Describe the action of helicase.

.....

.....

.....

.....

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

Some candidates were given 2 marks and some were given 1, suggesting the action of helicase is well known. Unzipping/unwinding was nearly always seen, but the most common mistake was not making it clear that there were two strands being separated and/or linking this to the DNA double helix. Many candidates missed out the breaking of Hydrogen bonds for the second mark.

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Question 23 (b) (ii)

(ii) DNA replication conserves genetic information with accuracy.

Explain how errors may occur during DNA replication.

.....

.....

.....

.....

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

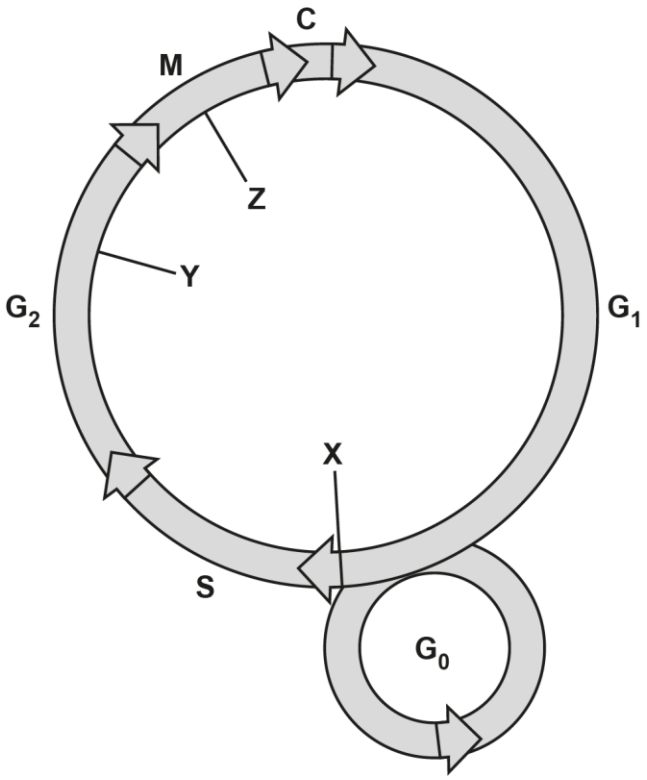
Most candidates were given 1 mark for correctly identifying mutations as a key term. Many candidates focused on incorrect complimentary base pairing but did not link this to the resulting DNA base sequence being different (i.e. suggesting that the base pairing was wrong but then not explaining that this leads to a different sequence of bases). A few candidates lost a mark by referring to transcription and RNA, possible due to not recognising the need to refer to DNA replication stated in the stem of the question.

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Question 23 (c)

(c) An outline of the eukaryotic cell cycle is shown below.

X, **Y** and **Z** represent checkpoints in the regulation of the cell cycle.



A cell that had completed the cell cycle had more chromosomes than its normal diploid number.

Identify which cell cycle checkpoint, **X**, **Y** or **Z**, had failed to work in this cell. Give a reason for your choice.

.....

.....

.....

.....

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

Only a few candidates were able to correctly identify checkpoint Z, and even less could be given an extra mark for explaining why. Many identified Y or X incorrectly, believing that the DNA had over-replicated so too many chromosomes entered mitosis, which is not possible as if this was the case the other checkpoints would have stopped the cell cycle moving forward. More successful responses were able to make links to chromatids not being separated/chromosomes not attaching correctly to spindle fibres.

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Question 23 (d)

(d) Students use this method to extract DNA from the fruit of a strawberry plant:

- Take a fruit from a strawberry plant and crush it using a mortar and pestle.
- Add salt to the crushed strawberry fruit mixture.
- Add an enzyme to the mixture.
- Add ethanol to the mixture.

Evaluate whether the method used by the students would successfully extract DNA.

.....

.....

.....

.....

.....

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

This question discriminated well, with only able responses gaining 3 or 4 marks. Candidates mostly knew the reason for crushing, adding ethanol, enzyme and pointed out the need for detergent. However, marks were lost for imprecise use of terms such as cell membrane or phospholipid bilayer for marking point (MP) 4 and 5. Very little reference was made to the purpose of adding salt, suggesting that candidates were unfamiliar with the reason for this stage in the procedure. Responses from candidates that gained marks reflected that they had had experience with this practical in some form, but possibly had not delved in to the detail of the purpose of each stage. Very few got MP2, and salt was often linked to every other process, or it was stated that it was not required, or to the breaking of Hydrogen bonds in DNA rather than between DNA and water to reduce solubility. MP3 was often seen, although quite a few thought that the ethanol would only work if ice cold. A number of candidates spend valuable time discussing the viability of the practical although this was not part of the question so were not given any marks. Some students rightly stated that a protease would break down the histone proteins, but this was just a statement and it was not linked to the evaluation that the method did not state which enzyme should be added.

Misconception



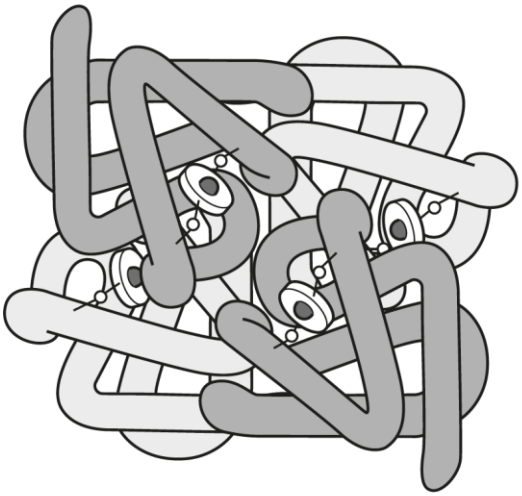
Many candidates thought that crushing the strawberry broke open the plasma membrane. This stage was to break down the cell walls and would not have affected the cell membranes.

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Question 24 (a) (i)

24 Haemoglobin is a conjugated protein with quaternary structure.

(a) The image shows the quaternary structure of a haemoglobin molecule.



(i) In addition to having a quaternary structure, haemoglobin also has primary, secondary and tertiary structures.

The table below contains statements about the structure of haemoglobin.

Complete the table to show the level of protein structure described in each statement.

You can choose each level of protein structure **once**, **more than once** or **not at all**.

Statement	Level of Protein Structure
Disulfide bonds are formed when two cysteine amino acids in an α-globin chain come together after the alpha helix folds	
Haemoglobin is made up of two α-globin chains and two β-globin chains	
Each α-globin and β-globin chain is folded into a spherical shape	
The β-globin chain has 147 amino acids in a specific sequence	

[3]

Most candidates were given 1 or 2 marks here. Some candidates lost all marks as they misunderstood the question and wrote 'once', 'more than once' or 'not at all' in the boxes, taking these from the question stem. Some thought that all the structures needed to be used, and so mistakenly identified secondary for one of the statements. Both of these points indicate that some candidates need more practice with this style of question and/or need to take more time to understand the task outlined and should be advised not to rush into this style of question.

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Question 24 (a) (ii)

(ii) Name the enzyme in an erythrocyte that allows haemoglobinic acid to be formed.

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

When attempted, this was well answered and many candidates were given the mark. When attempted correctly, spelling was generally good with only a small number not spelling the enzyme correctly, although clear phonetic spelling was given the mark. Those who were not given the mark either gave other enzymes or did not give a response.

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Question 24 (b)

(b) The bacterium, *Pseudomonas aeruginosa*, does not have haemoglobin.

P. aeruginosa is found in natural water sources.

Infection by *P. aeruginosa* can cause the disease, hospital-acquired pneumonia (HAP).

One hospital assessed the frequency of people admitted to the intensive care unit (ICU) with HAP in 2013.

The results were:

- 346 people were admitted to the ICU and HAP was diagnosed in 25.4% of these people.
- 14.6% of people diagnosed with HAP died due to infection by *P. aeruginosa*.
- This number was 35% higher than in 2012.

Calculate the **number** of people who died due to infection by *P. aeruginosa* in **2012**.

Give your answer to the **nearest whole number**.

Number of people = ... **[2]**

Many candidates were given 1 mark here by providing working which showed they were able to correctly calculate that 87.884 patients were diagnosed with HAP and/or 12.83 had died. However, only a few candidates were given 2 marks for then being able to calculate 35% higher.

Calculation:

People diagnosed with HAP in ICU = 346 x 25.4% = 87.884

People died with HAP = 87.884 x 14.6% = 12.83

The number of people died in 2012 = 12.831 x 135 % = 9.504….

Nearest whole number = 10

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Question 24 (c)

(c) The treatment for people in hospitals that have HAP due to *P. aeruginosa* is to give antibiotics. Some populations of *P. aeruginosa* have become resistant to specific antibiotics.

Suggest **and** explain the potential implications of antibiotic resistance for hospitals.

.....

.....

.....

.....

.....

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

Successful responses to this question explained the consequences for the hospital of antibiotic resistance (as the question asked). Less successful responses explained how antibiotic resistance happens/comes about, showing that many misunderstood the question or did not recognise the command words in the stem. These candidates discussed natural selection causing, antibiotic resistance to increase, or how the bacteria wouldn't be able to be treated and talked about contributing issues such as staff shortages. More successful responses used comparative words/statements: 'more costly' rather than 'costly', 'more deaths' rather than 'deaths', and 'spread more easily' rather than 'would spread'. 'New antibiotics', 'more deaths' and 'more people hospitalised' were the most common correct responses.

Question 24 (d)

(d) Scientists have suggested that personalised medicine may be used to help with the problem of antibiotic resistance.

State what is meant by personalised medicine.

.....

.....

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

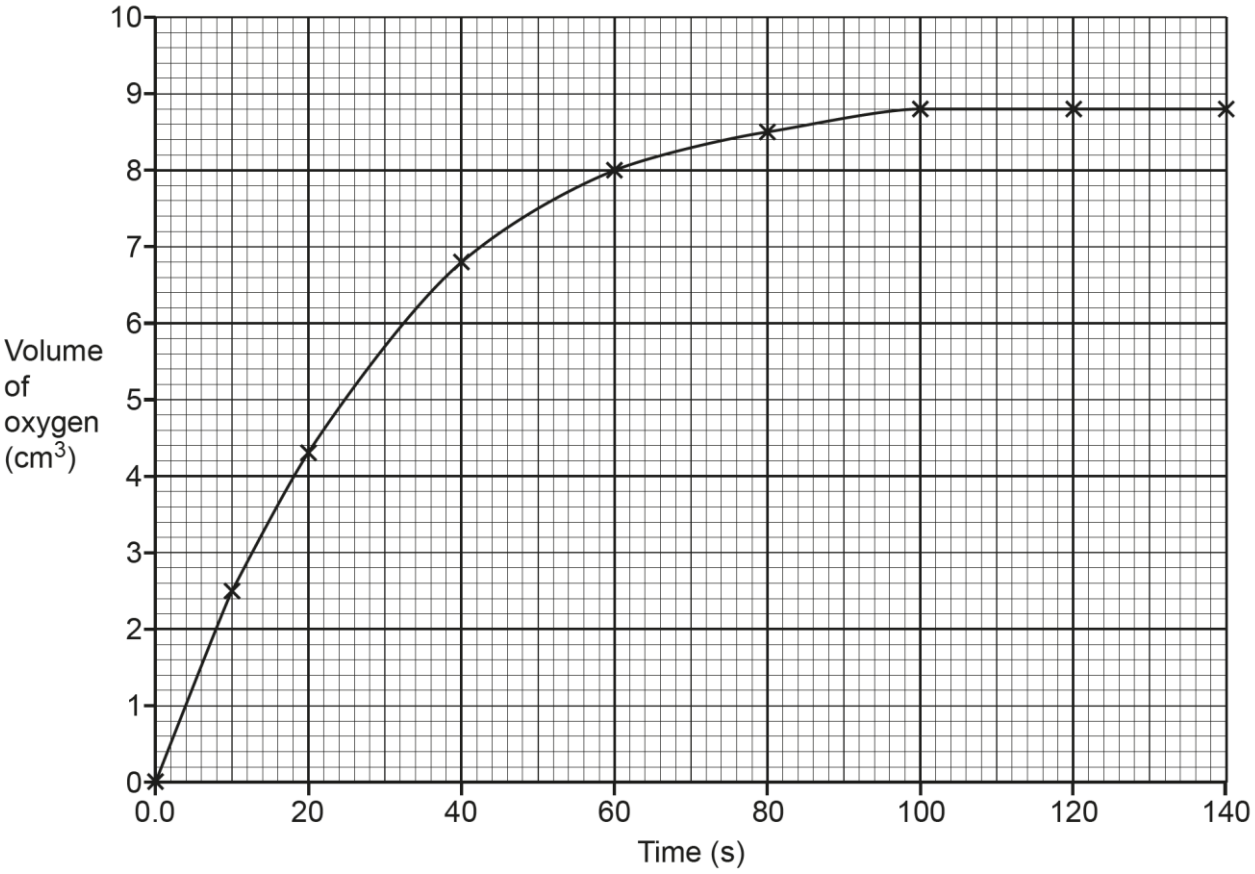
Many candidates were able to correctly link personalised treatment to an individual's genome. Those giving the idea of matching the bacterial infection to a specific antibiotic sometimes were not given the mark because they did not link it to a specific person's needs, i.e. the specific infection they had. Most responses were just generalisations about the drug being specific to the individual, which was not given the mark. A common incorrect response was to state 'based on their immune system' rather than a link to a person's individual 'genome'.

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Question 25 (a)

25 A student investigates the rate of catalase activity as it breaks down hydrogen peroxide into oxygen and water.

The volume of oxygen released was recorded over a period of 140 seconds. The results are shown in the graph.



(a) Use the graph to calculate the rate of reaction at **50** seconds.

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

Rate = ... $cm^3 s^{-1}$ **[2]**

Some candidates were able to accurately draw a tangent and use it to calculate the rate of reaction at a point. More were given 1 mark for drawing a tangent and knowing how to use it. Some were not awarded marks by falling outside the tolerance range and drawing an inaccurate tangent line, but it was good to see so many showing their working out and annotating the graph as they still achieved 1 mark for this.

Candidates who were not given any marks often merely read the graph as an interpolation or were able to draw a tangent but then did not use it, instead just using interpolation.

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Tangent should be 'even on both sides of the line of best fit', i.e. the entire curve should be visible. While aligning the ruler, make sure that in the vicinity of the point none of the line of the curve is covered by the ruler. The aim is to have the entire curve visible as the line is drawn, otherwise the tangent will not be accurate.

Taken from the OCR AS and A Level Mathematical Skills Handbook.

Question 25 (b)

(b) Hydroxylamine inhibits catalase.

Describe how the student could show that hydroxylamine is a competitive inhibitor.

.....

.....

.....

.....

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

Candidates that were given 2 marks described the practical procedure and knew the expected results with competitive inhibitors. They described carrying out the experiment at different concentrations of substrate. The most common response that was given marks was where students understood the need to do an experiment 'with and without' the inhibitor to be able to see its effects. Many candidates did not realise that the original experiment did not do this, so they just stated that the experiment should be repeated. Most candidates described what a competitive inhibitor was and/or how they affect the rate of reaction and so were given no marks.

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Question 25 (c)

(c) Phagocytes engulf pathogens during phagocytosis and digest them using enzymes.

These enzymes can be found in lysosomes.

Explain how the enzymes inside lysosomes come into contact with pathogens that have been engulfed.

.....

.....

.....

.....

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

This question was a good discriminator, with more successful responses given 2 marks. The most common errors was that the pathogen is engulfed inside the phagocyte cytoplasm and that the lysosome fuses directly with the pathogen. Many candidates correctly used the term phagolysosome and were given the marks.

Misconception

? Although candidates were using key terminology, they did not fully understand the sequence of events and often confused this response with the action of antibodies on pathogens.

Exemplar 3

~~engulfs the pathogen~~ as the psuedopodia fuse together to form the ~~pa~~ phagosome. the phagsome engulfs the pathogen. lysosomes combines with phagosomes forming phagolysosomes. the hydrolic enzymes then digest the pathogen. **[2]**

Exemplar 3 shows a clear and concise response with the key terminology used in the correct order. The candidate was given 2 marks although there are 3 mark points within the response.

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Question 26 (a)

26 Several factors can have a negative effect on biodiversity.

(a) Explain how agriculture can have a negative effect on biodiversity.

.....

.....

.....

.....

.....

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

Overall, candidates attempted this question well with a full range of marks being given. Candidates who were given 3 marks were able to link different agricultural practices such as 'monoculture' with their consequences like 'habitat destruction' and 'reduction in genetic biodiversity' – these being the most common marking points seen. Candidates who did not score as well discussed species richness and evenness but could not clearly link these to agriculture to gain marks and/or talked too generally about loss of biodiversity without linking to a specific type, i.e. 'species', 'habitat' and/or 'genetic' biodiversity.

Misconception



Many candidates knew that the use of fertiliser could be harmful to aquatic environments but were not given the relevant marking points as they didn't adequately explain (or name) the process of 'eutrophication'.

Question 26 (b)

(b) State **one** factor other than agriculture that can have a negative effect on biodiversity.

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

This question was very well answered with most candidates given the mark here. The most common responses were 'climate change', 'global warming' and 'deforestation', but the full range of possible responses were seen.

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