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AS LEVEL

Examiners' report

BIOLOGY A

H020

For first teaching in 2015

H020/01 Summer 2023 series

Version 1

Contents

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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 the first of two papers examining AS Level Biology A. As the title suggests it is designed to test a broad range of knowledge from the specification rather than testing knowledge in great depth. Candidates should expect a range of questions testing their knowledge and skills, including mathematical and practical skills.

Candidates who did well in this paper read the questions carefully and were able to recall scientific knowledge and write succinct explanations. Candidates who did less well were unable to interpret the questions successfully and wrote responses that demonstrated knowledge that was not relevant to the question. This is particularly clear in Question 28 (b). Candidates who did well were also able to transfer their knowledge and experience of practical skills to the written paper – this was apparent in Questions 7, 17, 21(b) & (c), 22(b), 23(b) and 26(a). Unfortunately, many candidates were didn't do so well in all these areas and it is important that centres provide sufficient experience in practical tasks.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• recalled names and key concepts accurately • showed mathematical fluency in calculations and interpreted scales on a graph correctly • produced clear and concise responses for questions • had a good practical knowledge, with the ability to understand and apply the information given to the questions being asked • read the question carefully • could interpret information given in diagrams, graphs and tables and use it to answer related questions.	• used biological terminology in the wrong context • found it difficult to answer mathematical based calculations • left responses unfinished or blank • found it difficult to apply what they had learnt to unfamiliar situations, scoring most of their marks on questions involving straightforward recall and understanding • 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 • found it difficult to interpret and use images supplied in the exam paper to answer related questions.

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Section A overview

Many candidates did well in this multiple choice section. When candidates change their mind, some overwrite their initial response making it impossible to read. Candidates should be aware that examiners will mark the response even if it is written outside the box.

Multiple choice responses
If a candidate changes their mind about a response, they should clearly strike out the original response and write their new response beside the answer box.

Question 1

1 Which statement describes a problem that has resulted from the increased use of antibiotics?

A Penicillin can no longer be used to treat infections.

B Rates of MRSA infection have increased.

C Some bacteria and fungi have evolved resistance to antibiotics.

D Viral infections can no longer be treated with antibiotics.

Your answer ☐ **[1]**

The majority of candidates selected the correct response B. The most common incorrect response was C. Some candidates may have been confused by the reference to bacteria and fungi in option C. Fungi are usually treated with antifungal drugs.

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Question 3

3 Simpson's Index of Diversity (D) can be used to estimate the biodiversity of a habitat.

$$D = 1 - \left(\sum\left(\frac{n}{N}\right)^2\right)$$

Scientists calculated D for a grassland habitat. One year later, the scientists calculated D again for the same habitat.

The number of plants recorded from one of the species increased from 100 to 400. All the other values remained the same.

What would be the result of this change?

A Species richness would increase.

B The estimate of biodiversity would increase.

C The value of D would decrease.

D The value of N would decrease.

Your answer [ ] **[1]**

Both B and C were accepted as correct for this question. If the increased species becomes more dominant than the rest of the species within the habitat, then the diversity (D) will decrease (answer C). If the increased species doesn't become dominant within the habitat, then the biodiversity would increase (answer B).

Question 4

4 What is an example of *in situ* conservation?

A A botanical garden

B A breeding programme in a zoo

C A marine conservation zone

D A seed bank

Your answer [ ] **[1]**

The majority of candidates selected the correct response, C. The most common incorrect response was A. Possibly some candidates were confused thinking that a botanical garden was growing plants in one place.

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Question 5

5 The giraffe is a species of mammal with the species name 'camelopardalis' and the genus name 'Giraffa'.

What is the correct format for the binomial name of the giraffe?

A *camelopardalis giraffa*

B Camelopardalis giraffa

C G. camelopardalis

D *Giraffa camelopardalis*

Your answer [ ] **[1]**

Most candidates selected the correct response, D. Some candidates selected answer C, possibly because the abbreviation of the full name is often used in texts. However, candidates should be aware that binomial names should be written in italics.

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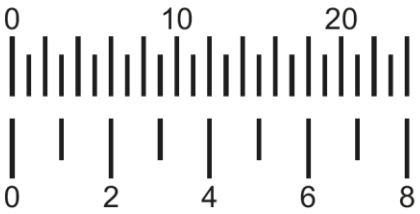
Question 7

7 A student observes xylem tissue under a microscope. The student uses an eyepiece graticule and a stage micrometer to measure the diameter of a xylem vessel.

Eyepiece graticule scale



Stage micrometer scale: 1 division = 10 µm

The xylem vessel has a diameter of 21 units on the eyepiece graticule scale.

What is the actual diameter of the xylem vessel in micrometres?

A 7

B 65

C 70

D 210

Your answer ☐ **[1]**

The question is testing one of the practical skills. Only a few students selected the correct response, C. The most common incorrect response was D presumably because candidates picked up on the 21 units mentioned in the stem of the question and multiplied this by 10.

Assessment for learning

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.

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Question 9

9 What are the roles of the cytoskeleton in a human skin cell?

A Movement of the cell through its environment and providing mechanical strength to the cell

B Movement of the cell through its environment and transport of organelles within the cell

C Providing mechanical strength to the cell and transport of organelles within the cell

D Supporting the cell wall and synthesis of collagen

Your answer [ ] **[1]**

Most candidates selected the correct response, C. The most common incorrect response was A. Movement of cells through their environment is a function of the cytoskeleton but not for skin cells. Candidates are encouraged to identify the key words in the question and think carefully about their responses.

Question 10

10 Which feature is associated with a prokaryotic cell?

A Cell walls made of chitin

B Extrachromosomal DNA that is circular

C Linear DNA that can form plasmids

D 70S ribosomes present in endoplasmic reticulum

Your answer [ ] **[1]**

Many candidates selected the correct response, B. Answer C was a common error but candidates need to remember that plasmids do not have linear DNA as they do not have terminal ends. Answer D was also another common answer, may be because prokaryotes do have 70S ribosomes but they do not possess endoplasmic reticulum.

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Question 13

13 Which description of the structure of a glucose molecule is correct?

A It contains 5 OH groups and has a C:O ratio of 1:1.

B It contains 6 OH groups and has a C:H ratio of 1:2.

C It contains 6 oxygen atoms and has a C:H ratio of 1:1.

D It contains 12 hydrogen atoms and has a C:O ratio of 1:2.

Your answer ☐ **[1]**

Many candidates selected the correct response, A. Examiners noted that for a number of candidates drawing out the molecule in the space beside the question was a successful strategy.

Question 14

14 Which description of the structure of cellulose is correct?

A Alternate α-glucose monomers rotate 180°

B Branched polymer forms from β-glucose monomers

C Hydrogen bonds form between coiled polymer chains

D Straight chains contain 1,4-glycosidic bonds

Your answer ☐ **[1]**

Many candidates selected the correct response, D. A common incorrect response was B as candidates obviously knew that cellulose contains β-glucose but did not realise that cellulose is not branched.

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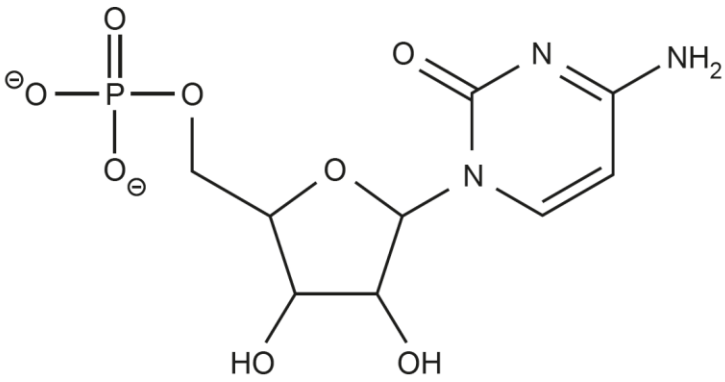
Question 15

15 Which nucleotide is shown in the diagram?



A DNA nucleotide with a purine base

B DNA nucleotide with a pyrimidine base

C RNA nucleotide with a purine base

D RNA nucleotide with a pyrimidine base

Your answer [ ] **[1]**

Many candidates selected the correct response, D. A common error was to select answer C which suggests that although candidates were able to identify the molecule as RNA, they found it challenging to distinguish between purines and pyrimidines.

Assessment for learning

Centres could help candidates recall by encouraging the use of mnemonics or aide memoires to recall certain details. For example, 'Cut the py' can be used to recall that pyramidines have been cut or have a single ring, leaving the purines with a two-ring structure.

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Question 17

A student investigates the effect of pH on the activity of the enzyme catalase.

Oxygen is one of the products of the reaction catalysed by catalase. The student measures the volume of oxygen produced over a 10-minute period. The student uses these data to calculate the rate of oxygen production.

Questions **17** and **18** refer to this method.

17 Which row in the table shows the different types of variables in the student's investigation?

	Control variable	Dependent variable	Independent variable
A	pH	Temperature	Volume of oxygen produced in 10 minutes
B	Volume of oxygen produced in 10 minutes	Catalase concentration	pH
C	Temperature	pH	Volume of oxygen produced in 10 minutes
D	Catalase concentration	Volume of oxygen produced in 10 minutes	pH

Your answer ☐ **[1]**

Most candidates selected the correct response, D, but all other distractors were seen.

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 18

18 The student determines catalase activity by calculating the rate of oxygen production.

Which units of measurement are appropriate to show the rate of oxygen production?

A cm^{-3}

B $cm^3\ s^{-1}$

C $h\,dm^{-3}$

D $mol\,dm^{-3}$

Your answer [ ] **[1]**

Many candidates selected the correct response, B, but all other distracters were seen. Candidates should appreciate that any unit of rate must include a reference to time.

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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.

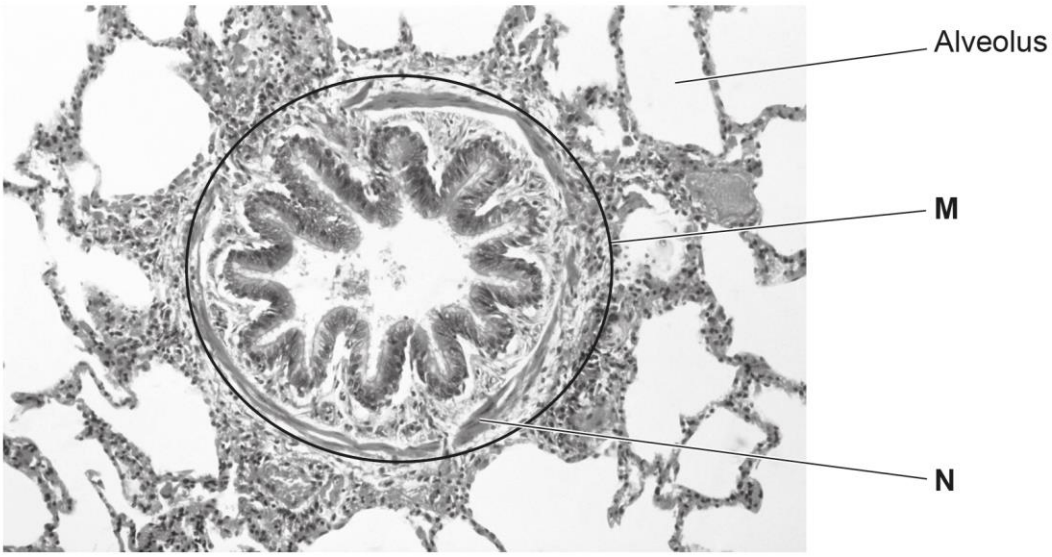
Candidates' performance in this section has highlighted the need to practice at recognising and interpreting photographic images. Responses to both Question 21 and 26 demonstrated that many candidates found it hard to interpret the image in detail.

Questions 22 and 24 proved to be very challenging for many candidates while Questions 23, 27 and 28 were usually better performed. A lot of candidates scored better on the recall and understanding of knowledge 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 22 (a) (i) in which candidates are asked to name the model of enzyme action described in the question. Perhaps because this is set in the specific context of a chitinase used in plant defence against the fungal pathogen black sigatoka, many candidates did not name the correct model.

Question 21 (a)

21 The light micrograph shows a transverse section through human lung tissue.



(a) Alveoli provide an efficient gas exchange surface because of their large surface area.

State **one other** feature of alveoli that provides an efficient gas exchange surface.

.....

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

Most candidates achieved a mark here for a simple statement such as 'thin wall'. Common errors were for candidates to state 'thin cell wall' which was not accepted as animals do not have cell walls or to state 'short diffusion pathway' which is not a feature of the exchange surface.

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Question 21 (b)

(b) The human lung is part of the gas exchange system.

Name the component of the gas exchange system in the circle labelled **M** in the light micrograph.

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

Many candidates achieved the mark here for 'bronchiole'. However, many candidates were unable to recognise the folded epithelium and ring of smooth muscle that are important features of a bronchiole. 'Bronchus' was the most common error closely followed by 'trachea' and 'capillary'.

Question 21 (c)

(c) Name the tissue labelled **N** in the light micrograph **and** outline its function in component **M**.

.....

.....

.....

.....

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

Relatively few candidates achieved a mark here as they interpreted tissue N as cartilage or elastic tissue. These candidates often knew the correct function of cartilage or elastic tissue. Only the most able or most well-trained candidates recognised tissue N as smooth muscle which can contract to reduce the diameter of the bronchiole.

Assessment for learning

Use of images and interpretation of those images is an important component of GCE Biology. Centres should appreciate that micrographs of tissues and organs must be part of the teaching and learning. Where access to laboratory space, microscopes or prepared slides may be an issue, centres can easily use images from the internet. Sites such as https://www.sciencephoto.com/ have a wide range of good quality images.

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Question 22 (a) (i)

22 Fungal pathogens such as black sigatoka infect plants.

Many plants produce the enzyme chitinase as a defence against fungal pathogens. Chitinase catalyses the breakdown of chitin in the cell walls of fungi.

(a) Scientists have discovered that when chitin binds to chitinase:

- two amino acids in chitinase move closer together to form a hydrophobic region around the chitin substrate
- other amino acid interactions cause the active site of the enzyme to partially cover the chitin substrate.

(i) Name the hypothesis of enzyme action that is supported by the mechanism observed in chitinase.

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

This is a very straightforward question, but it has proved to be challenging. Less able candidates didn't recognise that the correct hypothesis is the induced fit hypothesis and many stated 'lock and key'. This might be due to the specific context of the question.

Question 22 (a) (ii)

(ii) Explain how the mechanism of enzyme action observed in chitinase increases the rate of chitin breakdown.

.....

.....

.....

.....

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

Some of the candidates who correctly identified the hypothesis as induced fit didn't score well here. A few candidates scored a mark for 'reducing the activation energy' but very few were able to explain how this was achieved. The majority of candidates restated parts of the question stem or described larger numbers of enzyme substrate complexes being formed.

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Question 22 (b) (i)

(b) A student investigates how the concentration of chitinase in plant tissue changes at different stages of fungal infection.

The student prepares a plant extract solution to be able to record the concentration of chitinase present.

(i) The student uses a volumetric flask to measure 250 cm^3 of the solution.

The volumetric flask has an absolute uncertainty of ±0.12 cm^3.

Calculate the percentage error associated with the student's measurement.

Percentage error = ... % **[2]**

This question was well answered with the majority of candidates being able to calculate the correct percentage error. The most common error was to double the absolute uncertainty to 0.24 and end up with a value of 0.096%. Doubling the value of uncertainty is only used when a value is calculated by difference.

OCR support

OCR Maths skills handbook can support with teaching maths skills

Maths for Biology website also has a range of resources for all mathematical skills.

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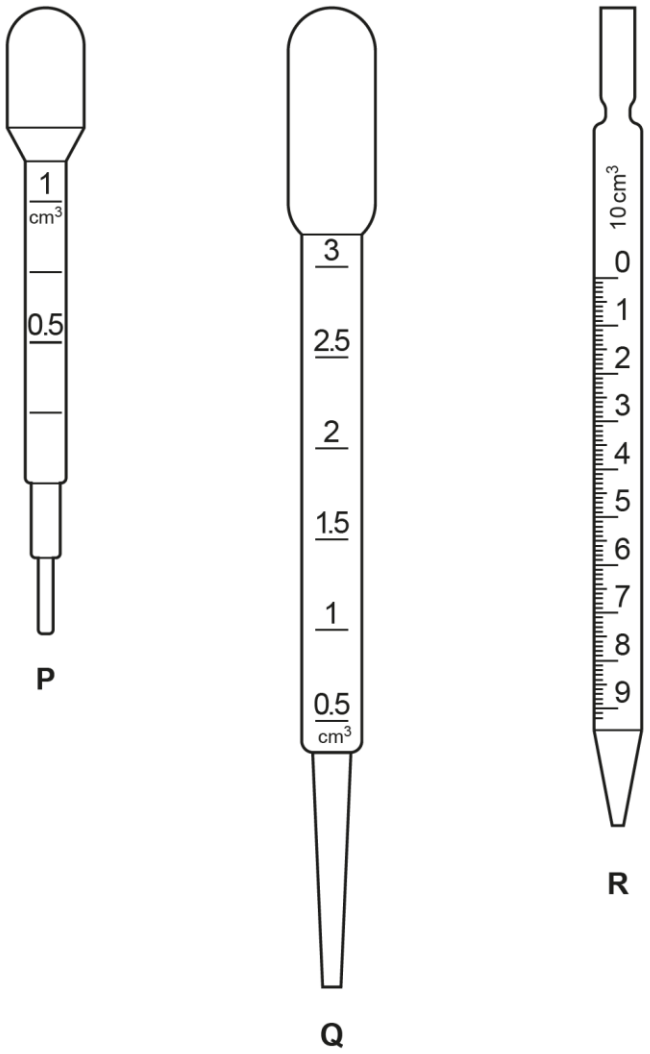
Question 22 (b) (ii)

(ii) Using a pipette, the student transfers several 5 cm^3 samples of the plant extract solution during their investigation.

The diagram shows three different pipettes, **P**, **Q** and **R**.



Explain which pipette, **P**, **Q** or **R**, would reduce the uncertainty when transferring the plant extract solution.

.....

.....

.....

.....

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

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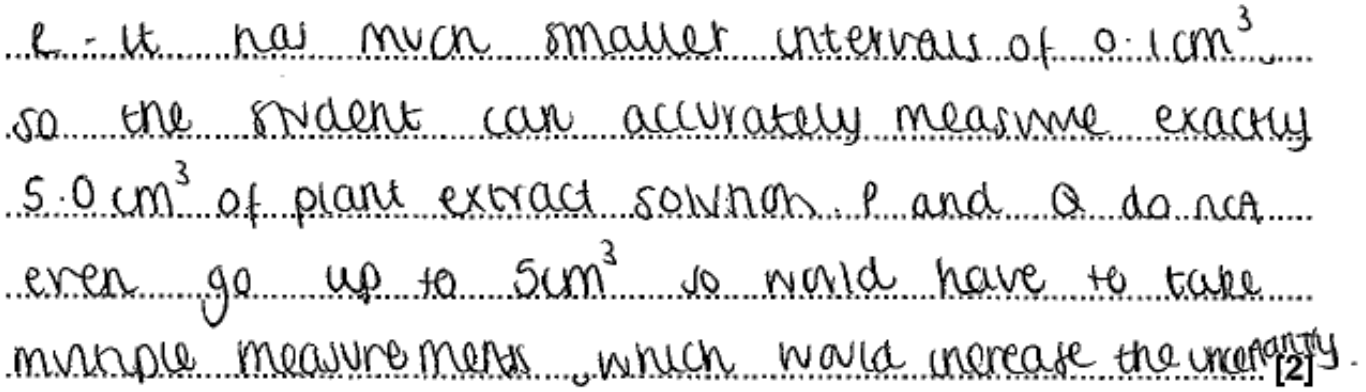
This question was not well answered and all alternatives were regularly seen in responses. Once a choice had been made most candidates were unable to explain the reasons for their choice coherently. Vague statements about ease of use or precision or accuracy were common.

However, these terms were rarely used in the correct context to explain that having the smallest increments in its scale and containing a large enough volume meant that pipette R would reduce uncertainty the most. Highest resolution refers to the equipment with the smallest scale divisions (i.e., smallest division for P=0.25cm^3, Q=0.5 cm^3, R=0.1 cm^3).

Exemplar 1



In this exemplar we see a fairly good response which scored one mark. The candidate has correctly identified pipette R as the best pipette to use. This correct identification did not gain a mark as the marks are given for the explanation. Mark point 1 was not given as the candidate has described the intervals on the scale as 'smaller' rather than the 'smallest' of the three. Mark point 5 was given as using P or Q multiple times is the reverse argument of pipette R needing to be used fewer times or only once.

OCR support

Many candidates appear to find the language of measurement very demanding. Support on uncertainty and the effect it has on measurements is available at:

Language of measurement in context - Biology

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Question 23 (a)

23 Thin layer chromatography (TLC) can be used to separate and identify amino acids.

(a) Name **and** describe the reaction that produces amino acids from polypeptides.

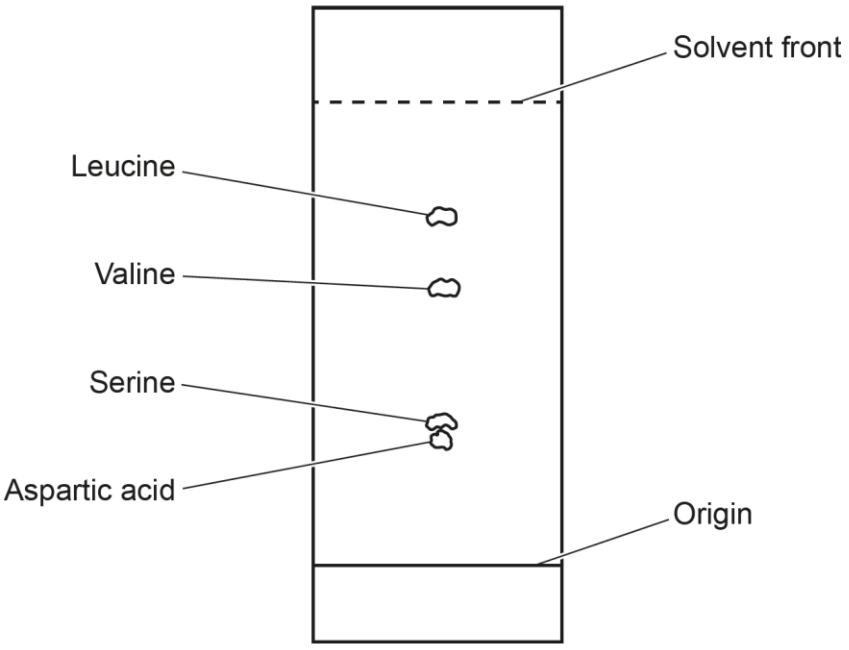
.....

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

Many candidates knew that the reaction was called 'hydrolysis'. A few candidates, however, did not describe the breaking of 'peptide bonds'. Common errors were to call the reaction 'condensation' or to call the bond broken a 'polypeptide bond' or a 'glycosidic bond'.

Question 23 (b) (i)

(b) The diagram shows the chromatogram that was produced when using TLC to separate a mixture of amino acids.



(i) Use the chromatogram to calculate the Rf value of valine.

Rf = ... **[2]**

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This was very well answered in the majority of cases. Candidates were able to measure the correct distances from the examination paper and then knew what to do with the figures. A few candidates lost credit as they did not round to a suitable number of decimal places. In some cases candidates calculated the Rf value for Leucine rather than Valine.

Question 23 (b) (ii)

(ii) Serine and leucine have different R groups.

With reference to the chromatogram, suggest what can be concluded about the chemical properties of the R groups in serine and leucine.

.....

.....

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

Only a few candidates gained a mark in this question. Many candidates simply described differences in size or solubility and a lot described one amino acid as being more or less hydrophilic than the other. Candidates should appreciate that separation of amino acids in thin layer chromatography uses organic solvents and the distance travelled depends on relative interactions with the mobile phase and the stationary phase.

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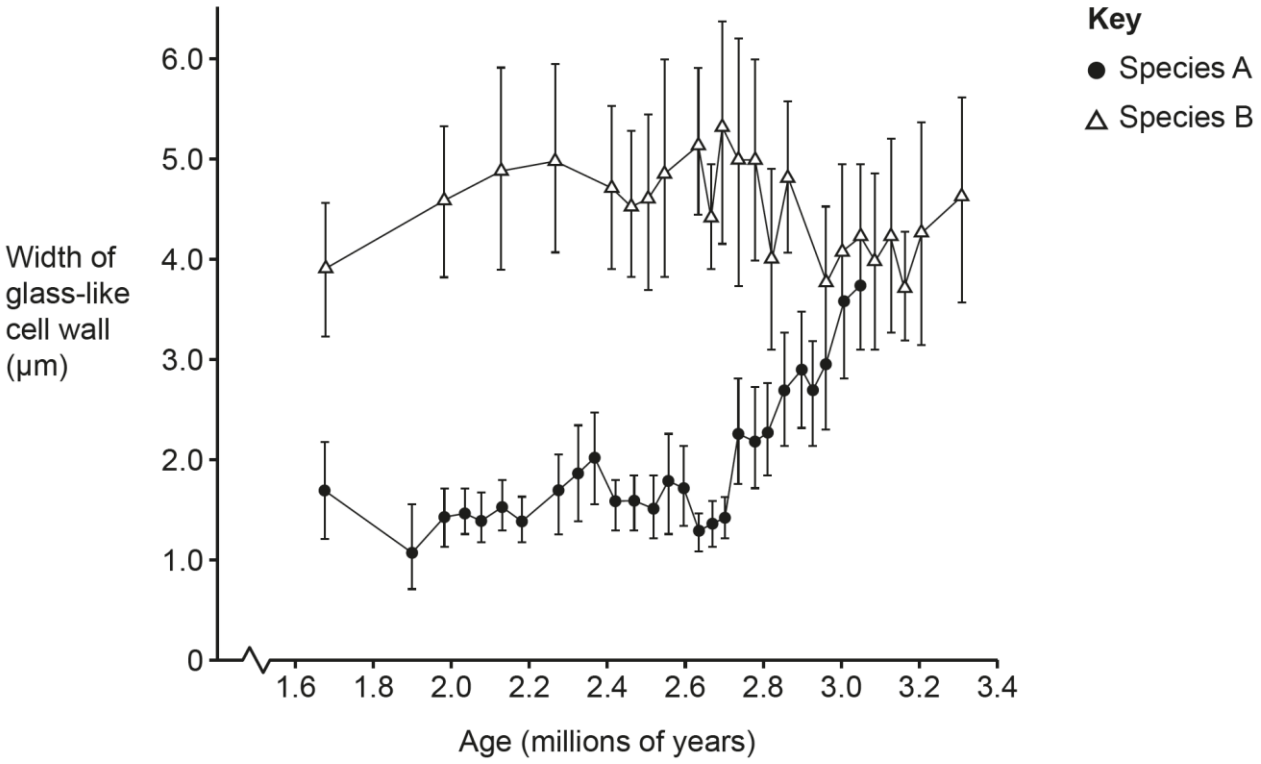
Question 24 (a)

24 The age of a fossil can be calculated based on its position in rock layers in the ground. Fossils of different ages can be compared to provide evidence of evolution and to help construct phylogenies.

(a) Diatoms are single-celled organisms that have glass-like cell walls, which can be preserved as fossils.

The graph shows the fossil record for two species of diatom.



Explain whether the data in this graph show evidence for evolution by natural selection.

.....

.....

.....

.....

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

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Relatively few candidates read and interpreted the graph correctly. The vast majority of candidates who recognised that the thickness of wall in species A changed over time described at as increasing in thickness. However, the horizontal axis reads with increasing time into the past and the wall actually decreased in thickness over time.

Very few candidates separated the concepts of evolution and natural selection and many started their response by stating 'the graph does/does not show evidence for evolution by natural selection....'. Some candidates appreciated that there was a change in the cell wall thickness in species A but did not realise that the graph did not give any evidence about what caused the change. While the thickness of wall changing over time is evidence of evolution the graph does not provide evidence of natural selection as there is no information about whether the changes were beneficial or not.

Less able candidates often gave an account of natural selection or suggested that species A became extinct or even converged and combined with species B.

Misconception

Evolution and natural selection are not the same thing. Evolution is the concept that species change over time rather than remaining constant. Natural selection is the mechanism by which evolution is believed to occur.

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Question 24 (b)

(b) A student analyses the estimated ages of 16 species of diatom. The estimated ages show how long ago the species evolved from an ancestor. The student compares estimated ages from two different sources:

- the position of each species in the fossil record
- molecular and genetic data, which has been used to construct the current phylogenetic tree of diatom species.

The student tests whether a positive correlation exists between the two sets of data for the 16 diatom species using Spearman's rank correlation coefficient.

The student's null hypothesis is:

'There is no correlation between the estimated ages of diatom species based on the fossil record and the estimated ages based on molecular and genetic data.'

The calculated r_s is 0.979.

The student compares the r_s of 0.979 to the critical values in the table.

n	Probability (p)	
	0.05	**0.01**
14	0.4637	0.6264
15	0.4464	0.6063
16	0.4294	0.5824
17	0.4142	0.5662
18	0.4014	0.5501

Explain what the student can conclude based on their r_s value of 0.979.

.....

.....

.....

.....

.....

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

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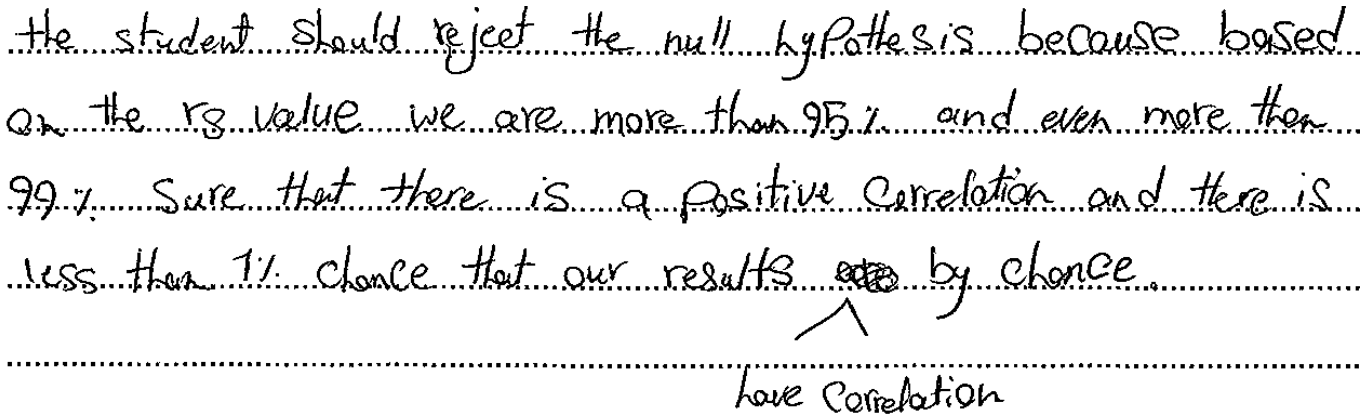
Many candidates were able to gain credit here for stating that the calculated value of r_s (0.979) was greater than the critical value for n=16 (0.4294) or for stating that the null hypothesis can be rejected.

Few candidates were able to give clear concise responses that explained in full what could be concluded. In particular, candidates do not seem to understand the concept of significance. If the calculated value (0.979) is greater than the relevant critical value (0.4292 or 0.5824) then there is a significant correlation at that level of probability and the correlation is not due to chance.

Less able candidates used the critical values for n = 15 or simply stated that the calculated value was higher than all the values in the table. Candidates should be aware that there are two types of tables, for identifying the critical value for Spearman's correlation. Sometimes the tables are given with the 'number of items' (*n*) and other versions have the entries listed by 'degrees of freedom' (df). Either can be assessed in the exams and candidates need to be careful when reading the heading in the tables.

Many thought that if the calculated value was higher, it meant you should accept the null hypothesis.

Exemplar 2



In this exemplar the candidate scored 2 marks. The candidate has correctly stated that the null hypothesis should be rejected and clearly understands that there is a 95% probability that the correlation is not due to chance. The candidate unfortunately missed the easy mark (scored by many less able candidates) by not comparing the calculated r_s value to the selected critical value. Also, the candidate did not state that the correlation is (statistically) significant which was a common omission. Very few candidates were able to state their explanations as clearly as this.

OCR support

Many candidates appear to find reporting conclusions from statistical tests very demanding. Support on the use of statistical tests and on probability and chance is available at:

Maths for Biology website: Probability and chance

Statistics for Biologists

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Question 24 (c)

(c) Diatoms are members of the domain Eukarya.

Complete the sentences about domains using the most appropriate terms.

The process of sorting of organisms into taxonomic groups is called ..... .

Domains represent the highest taxonomic level; they are the groups that contain the largest number of species. The number of kingdoms in each domain is different. The domain Eukarya contains ..... different kingdoms. The domains Bacteria and ..... both contain species from only the kingdom Prokaryotae.

[3]

Many candidates achieved one mark for 'classification' but only the most able candidates scored more than this. Candidates could be encouraged to read the whole paragraph first before trying to insert terms as they read through.

Question 25 (a)

25 Cell surface membranes are composed of many different components, including cholesterol.

(a) Describe **two** roles of a cell surface membrane.

1 .....

.....

2 .....

.....

[2]

Almost all candidates scored at least one mark here – usually for the idea that the cell surface membrane controls what substances enter and leave the cell. Many candidates were able to provide a second correct response. Those that did not score well wrote vague statements such as 'allows substances in and out of the cell' or described functions of internal cell membranes such as compartmentalisation. Perhaps the most common misconception was that the cell surface membrane provides support/protection to the cell.

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Question 25 (b)

(b) The presence of cholesterol is one of several factors that affect membrane fluidity.

A student examined two different cell surface membranes. One membrane had a higher concentration of cholesterol than the other membrane.

The student concluded that 'the membrane with the higher concentration of cholesterol would have less fluidity than the other membrane'.

Discuss whether the student's conclusion can be supported.

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

Most candidates appreciated that cholesterol is found in the cell membrane. However, many described the position of cholesterol between the phospholipid tails or discussed the disruption of the bilayer structure rather than relating their responses to the question. Very few candidates appreciated that the effect of cholesterol on the fluidity was dependent on temperature although they did realise that temperature itself can affect fluidity of the membrane.

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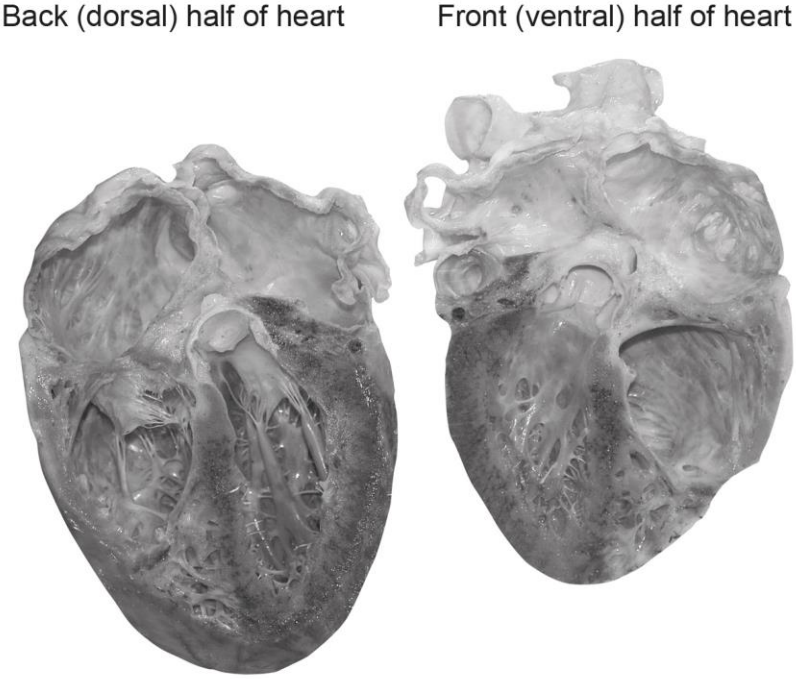
Question 26 (a)

26 (a) **Fig. 26.1** shows a dissected human heart.

Fig. 26.1



Draw a simple diagram of the front half of the heart shown in **Fig. 26.1** in the space below.

On your diagram, label the left ventricle.

[3]

Many candidates achieved one mark. This was usually for the size of the diagram covering more than half the available space. The quality of the diagrams did not usually follow the guideline for biological drawings (i.e., lines were not drawn with sufficient care and most diagrams showed overlapping lines or incomplete lines). On the positive side very few diagrams had been shaded. Candidates did find the interpretation of the images to be demanding and many labelled the left ventricle on the right-hand side of their diagram as would be expected in the normal textbook view of a heart. Of those that did correctly identify the left ventricle some lost the mark because they did not use a ruler for their label line or added an arrowhead.

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OCR support

Guidance on biological drawings is available in the drawing skills handbook at:

Drawing skills handbook: Biology

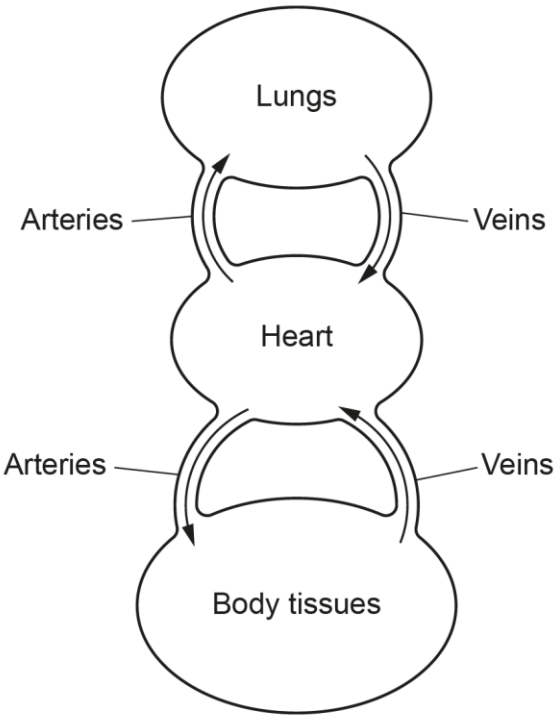
Learner checklist: Graphs, Tables and drawings

Question 26 (b) (i)

(b) Birds have hearts with a similar structure to mammalian hearts.

Fig. 26.2 shows a diagram of the circulatory system of a bird.

Fig. 26.2



(i) Describe the type of circulatory system shown in **Fig. 26.2**.

.....

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

Most candidates recognised this as a double or a closed circulatory system but only the more able candidates identified both aspects.

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Question 26 (b) (ii)

(ii) Explain why larger organisms, such as a bird, need a circulatory system but some smaller organisms do not need a circulatory system.

.....

.....

.....

.....

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

The majority of candidates gained credit for the idea that a larger organism would have a smaller surface area to volume ratio, but few could develop the idea much further. Some candidates gained credit for understanding that oxygen has to be delivered to all the tissues. Less able candidates discussed the idea of gas exchange rather than transport. Only a few more able candidates linked in the idea of higher metabolic demand in larger organisms.

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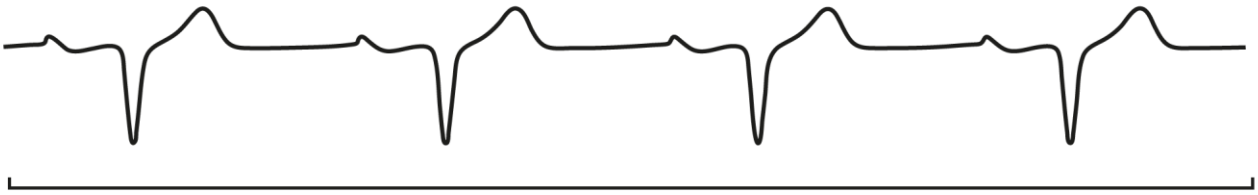
Question 26 (c)

(c) An electrocardiogram (ECG) trace from a bird and an ECG trace from a human have many differences.

The ECG trace below is from a bird.



Time = 1 second

Describe how the ECG trace from a bird is different from a normal ECG trace from a human.

.....

.....

.....

.....

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

The majority of candidates recognised that the heart rate was higher than in a human. However, very few candidates could describe the trace accurately referring to the letters P, Q, R, S and T. Many recognised that part of the trace (the R peak in humans) went down rather than up. Sometimes the attempted descriptions were too vague such as 'the peak is upside down' or 'the trace is upside down'. The least able candidates related the trace to breathing movements as if it were a spirometer trace.

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Question 27 (a) (i)

27 Enzymes that catalyse the removal of CH_3 groups from cytosine bases in DNA are called TET enzymes. The rate of transcription increases when CH_3 groups are removed from DNA.

During embryo development, TET enzymes remove CH_3 from a large number of genes. This TET activity is essential for the development of embryos.

(a) (i) Suggest how the activity of TET enzymes affects metabolism at both the cellular and whole organism level.

.....

.....

.....

.....

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

Many candidates correctly linked the activity of the TET enzyme to a change in protein production usually suggesting that protein production increased. However, few then linked the change in protein production to an increase in energy needs or an increase in respiration rate to provide that extra energy. Very few described the secretion of proteins from the cell that could then affect growth of the whole embryo or development. Less able candidates tended to rely on rephrasing or simply copying out parts of the question stem.

Question 27 (a) (ii)

(ii) Vitamin C binds to TET enzymes and increases their catalytic activity.

State the role of vitamin C when it binds to a TET enzyme.

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

Many candidates knew that Vitamin C acted as a cofactor or coenzyme. Less able candidates called it a prosthetic group.

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Question 27 (a) (iii)

(iii) Intracellular and extracellular reactions are catalysed by enzymes.

The table lists three enzymes, including TET.

Complete the table to indicate whether the enzyme catalyses an intracellular reaction or an extracellular reaction.

Tick (✓) **one** box in each row.

Enzyme	Type of reaction catalysed	
	Intracellular	Extracellular
TET		
Catalase		
Trypsin		

[1]

Many candidates scored well in this question. A few seemed that they didn't understand the terms intracellular and extracellular. The most common error was thinking that catalase was an extracellular enzyme – possibly because it is often used in laboratory experiments investigating enzyme action.

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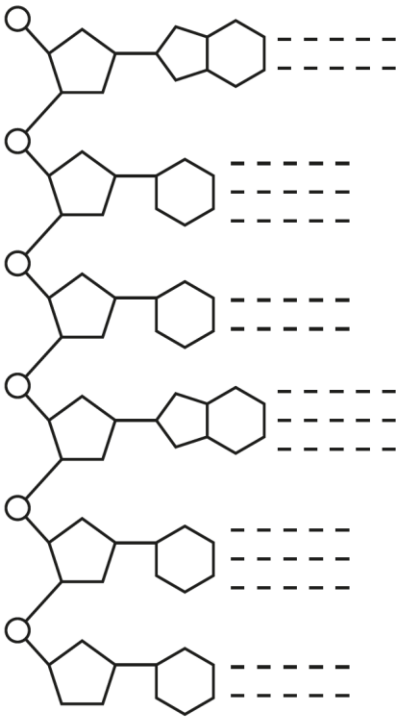
Question 27 (b) (i)

(b) The diagram shows a section of one strand of DNA.



Key

– – – = hydrogen bonds formed with base in the other strand

(i) Label a phosphodiester bond **in the diagram above** with the letter '**P**'. **[1]**

The majority of candidates gained the mark here either labelling a bond between a phosphate group and the sugar or by circling the whole phosphodiester bond. Some candidates labelled the phosphate group.

Question 27 (b) (ii)

(ii) TET enzymes remove CH_3 groups from a cytosine base only when it is next to a guanine base in the same DNA strand.

Identify a cytosine base that could have CH_3 removed by TET by adding the letter '**T**' to a base **in the diagram above**. **[1]**

Few candidates were able to work out the correct part of the molecule to label. The range of responses given suggested that for many it was a guess.

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Question 28 (a)

28 (a) Four organelles are listed in the table below.

Complete the table.

For each organelle place a tick (✓) in the box for a correct description and leave the box empty if the description is incorrect.

Organelle	A membrane-bound organelle	Found in both animal and plant cells	Has a role in lipid production
Rough endoplasmic reticulum			
Smooth endoplasmic reticulum			
Ribosome			
Mitochondrion			

[4]

This proved to be a good discriminator particularly at the lower end. Many candidates demonstrated a good understanding of cell ultrastructure achieving 3 or 4 marks. The most common error was thinking that ribosomes are membrane-bound organelles.

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Question 28 (b)

(b) Starch and glycogen are polysaccharides. Starch is present in plant cells, and glycogen is present in animal cells. Glucose is a monosaccharide present in both types of cell.

Outline how the different properties of glucose, starch and glycogen relate to their functions in cells.

.....

.....

.....

.....

.....

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

An excellent discriminator with only the most able candidates achieving the full 4 marks in a well organised and concise response. Almost all candidates had some knowledge to share even it was often confused and organised poorly. Less able candidates described the general structure of the carbohydrates while a few included the structure of cellulose. The most frequently given marks were glucose being soluble, glucose being used in respiration and starch or glycogen being used for storage. Some common mistakes included: easy release of glucose from the polysaccharides rather than rapid release, or not comparing the potential rate of release in glycogen to that in starch.

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Exemplar 3

Glucose has two isomers, alpha glucose and beta glucose It is soluble and provides energy in respiration, a dissolved sugar. Glycogen is made up of alpha glucose and is a store of ~~&~~ glucose in animals. Store in muscle and liver cells, effective because it is highly branched, allowing it to be broken down ~~quicker~~ more rapidly and released back into blood when needed. Starch is a Store of glucose in plants, it is a large, insoluble molecule broken down to release glucose when needed. **[4]**

The exemplar shown an organised response. The candidate has written about glucose, then about glycogen followed by starch. The response scored 3 marks out of the 4 available. The candidate has stated that glucose is soluble and used in respiration. The third mark is given for glycogen being a store of glucose. The candidate has narrowly missed out on 2 further mark points. Lower down in the response the candidate writes that glycogen can be broken down more rapidly. Unfortunately, it is not clear that glycogen is broken down more rapidly than starch due to the larger number of branch-ends available. The candidate has also mentioned that starch is insoluble but has not added that it is compact. Overall, this was a good well-structured response from an able candidate.

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Question 26: part a Figure 26.1: photo of dissected heart, © VICTOR HABBICK VISIONS/SCIENCE PHOTO LIBRARY

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