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AS LEVEL

Examiners' report

BIOLOGY A

H020

For first teaching in 2015

H020/02 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 2 series overview

This paper covers a broad range of AS Biology topics with 2 level of response questions. Mathematical skills were diverse with one of the LoR questions requiring graph interpretation and a chi squared calculation with statistical conclusions. Questions ranged from simple recall to evaluation questions.

Most candidates attempted all questions and did not use the additional pages at the back of the paper. Calculations were well presented.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• answered all questions with very few non-responses seen • rounded their answers to the correct number of significant figures in line with tabulated results and showed clear workings with a step-by-step approach • used precise scientific terminology with a clarity between related terms, e.g. magnification vs resolution, microscope focus adjustment vs microscope lens magnification • read all parts of the question and avoided ambiguity in their answers, e.g. addressed two contradicting parts of the ant fungus infection statement with clear interpretation of the graphical data • had a clear understanding of scientific terms and definitions and able to interpret the results of a statistical test, e.g. the chi squared test.	• left a lot of questions blank • could not use a given formula to calculate a chi squared value • lacked detail in answers and limited attention paid to the descriptors used, e.g. role of valves was stated but not explained • confused closely related biological terms, e.g. magnification with resolution, translation with transcription • could not identify relevant bonds in a given structural formula.

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Question 1 (a) (i)

1

(a) Students used a transect line to sample species of wildflowers in a field.

(i) Name the type of sampling method used in a transect line.

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

Random sampling was often stated which would not be appropriate when using a transect line. Candidates that did recognise this as a non-random sampling method often stated stratified sampling which would not require a transect line. Some answers referred to the equipment involved, e.g. quadrats without naming the sampling method.

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Question 1 (a) (ii)

(ii) This table shows their findings.

Species	**Number of organisms (*n*)**	***n*/*N***	$(n/N)^2$
Foxglove	3	0.13	0.02
Meadow buttercup	7		
Oxeye daisy	9		
Yellow rattle	4		
	N =		$\sum(n/N)^2$ =
			$1 - \sum(n/N)^2$ =

Calculate the Simpson's Index of Diversity for the field using the data in the above table.

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

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

Simpson's Index of Diversity = ... **[3]**

The question was well answered with good use of the table and a consistent approach to decimal places. Errors occurred when answers were rounded too quickly, particularly when calculating the square of n/N.

OCR support

The Mathematical skills handbook – decimal places and significant figures is a great resource for candidates.

There are also a range of resources on Maths for Biology, including a tutorial and quiz for every maths skills assessed in the qualification.

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Question 1 (a) (iii)

(iii) State what can be concluded about the diversity of the field from your answer in **(a)(ii)**.

.....

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

The question was well answered with candidates showing a clear understanding of the relevance of the Simpsons Index Diversity value calculated. A few answers stated high species evenness or richness and it should be appreciated that species biodiversity is a combination of the two.

Question 1 (b)

(b) The students then used a sweep net to sample animals in two different parts of a river.

They did this by holding the sweep net in the water and at the same time kicking the riverbed downstream.

Suggest how they could improve their sampling method to obtain more valid results.

.....

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

Many answers referenced 'reliability' of the data collected with suggestions of repeating the method. Candidates often suggested a different method or a different location which does not pay attention to the request for an improvement to the method. Candidates should be aware that validity for a method is referring to controlled variables.

OCR support

Further guidance on Language of measurement can be found on Teach Cambridge.

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Question 1 (c)

(c) Black oak trees are an example of a keystone species within an oak woodland ecosystem in England.

Suggest what would happen to the ecosystem if the black oak trees died out.

.....

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

Answers often lacked detail with statements referring to the destruction of the ecosystem without any reference to components within the ecosystem. Many answers referred to organisms not surviving but did not connect the role of the oak tree in determining their fate. Conversely answers discussed the role of the oak tree in an organism's niche but did not state what effect its loss would have on the organism.

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Question 2 (a) (i)

2

(a) Zombie-ant fungus is a pathogen that causes a disease in ants.

Fig. 2.1 shows an ant infected by the zombie-ant fungus.

Fig. 2.1



This fungus affects the behaviour of an ant in these ways:

- An infected ant will climb to a high point in a tree, bite into a branch or leaf and then remain there until it dies.
- The fungus feeds on the dead ant and produces a stalk from the ant's head.
- The stalk then breaks open, releasing fungal spores.

(i) Suggest **two** ways in which the ant's behaviour helps to increase the spread of the zombie-ant fungus.

1 .....

.....

.....

2 .....

.....

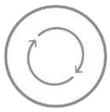
.....

[2]

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Most candidates recognised the main types of behaviour that underpinned the two suggestions and clearly referred to this at the beginning of their answers, e.g. climbing to a high point and biting on a branch. Many answers referred to the infection spreading through the tree as well as the ants. Candidates should make sure they constantly refer to all the information given in the stem of a question as it stated in the opening sentence that the fungus was a disease in ants.

Assessment for learning



Recognition and discussion of disease nomenclature would have helped to emphasise the restriction of the disease to ants and not to other organisms.

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Question 2 (a) (ii)*

(ii)* Scientists carried out a study in 2017 in Taiwan to see if various climatic factors affected the numbers of zombie-ant fungus infections.

Fig. 2.2 and **Fig. 2.3** show the findings of this study.

Fig. 2.2

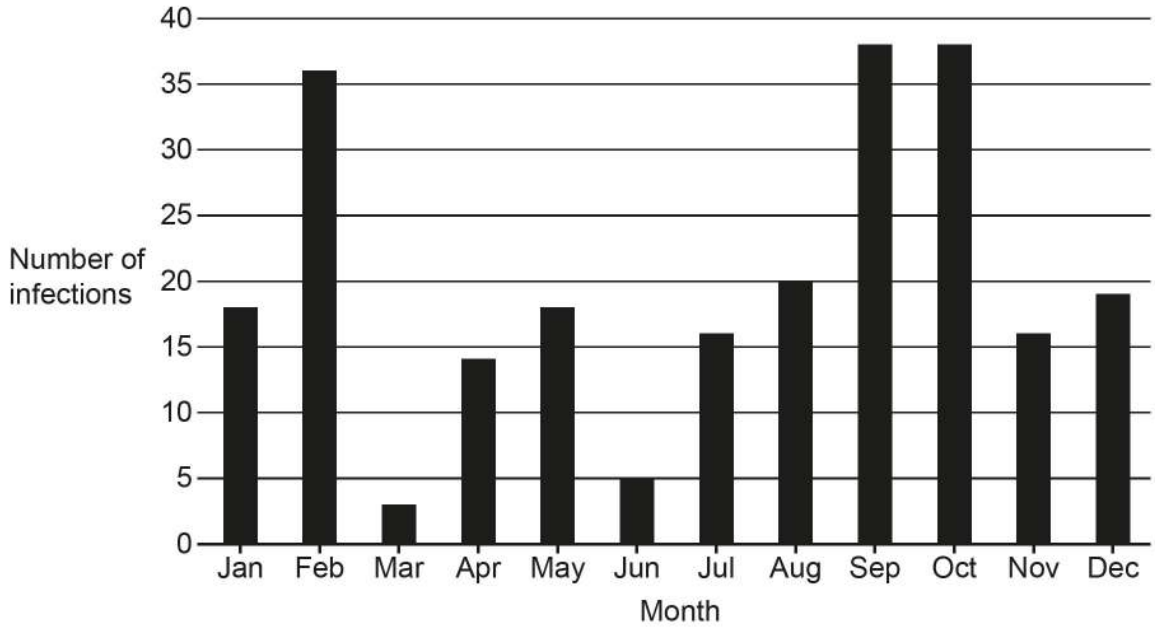


Fig. 2.3

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A student looked at the data in **Fig. 2.2** and **Fig. 2.3** and concluded:

'Zombie-ant fungus infections increase after heavy rainfall but are not affected by temperature.'

Discuss whether the data supports the student's conclusion.

.....

.....

.....

.....

.....

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

Candidates confidently interpreted data from Figure 2.2 and Figure 2.3 with respect to rainfall, often using well estimated data values to back up their statements. Answers regarding the effect of temperature had less clarity with some candidates not referring to the data or reading the scale incorrectly on Figure 2.3 and providing rainfall data instead of temperature. Good answers discussed the student's conclusion with a clear description of the increase after heavy rainfall, with figures and then the relevance of temperature, with figures.

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Exemplar 1

The data doesn't support the students conclusion, this is because after the heavy rainfall in May the number of infections in June after this heavy rainfall is the second lowest at 5, therefore, the student is incorrect by saying infections increase as during the heaviest rainfall (1400mm) the number of infections decreased.
Again the data doesn't support the student as they stated that ~~as~~ temperature doesn't affect the number of infections, however, in the hottest month, August (25°C) the infection increased in the following two months both at 38 infections, this soggests that the hotter the environment the higher number of infections.

This exemplar separates the two components of the question with a paragraph and begin each paragraph with a clear statement of their opinion. The answer is succinct but focuses immediately on a relevant point to back up their opinion. Correct data from both figures is provided with units. The response scored 6 marks.

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Question 2 (b)

(b) Complete the table with the type of pathogen that causes the communicable disease.

Communicable Disease	Type of Pathogen
Influenza	
Malaria	
Black sigatoka in bananas	

[3]

Well answered with most candidates correctly stating the pathogen for influenza and malaria. The most common error was confusing Protoctista with Fungi for Black Sigatoka. The spelling for Protoctista was variable and phonetically correct spelling was accepted.

Assessment for learning

Discussing the etymology of these words and treating the Latin names with a phonics approach often helps with correcting poor spelling.

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Question 3 (a)

3

(a) The graph shows the rate of uptake of particles across a membrane by two different methods of diffusion.



State which method shows facilitated diffusion. Explain the reasons for your answer.

Method .....

Explanation .....

.....

.....

.....

.....

[3]

Candidates who correctly identified the method recognised the role of proteins in this transport but often referred to a lack of ATP for the plateau in the rate, suggesting a confusion with active transport. Few answers referred to the two aspects of the method 2 curve, the increase and then the plateau, as the concentration increases.

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Question 3 (b)

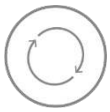
(b) Temperature and concentration are two factors that affect the rate of diffusion.

State **one other** factor that affects the rate of diffusion.

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

Well answered with most candidates stating surface area. Some answers referred to humidity or pH suggesting a confusion with enzymes and transpiration.

Assessment for learning



A good technique for candidates to remember the main factors is discussion of Fick's Law and the adaptation of the lungs. Please note that Fick's Law is not a required knowledge for AS level Biology spec A (H020).

Question 3 (c) (i)

(c) Students used a model cell to investigate the effect of temperature on the rate of diffusion across membranes.

They were provided with:

- a calibrated colorimeter
- a calibration curve
- Benedict's solution and all the apparatus required to carry out a Benedict's test
- glucose solution
- dialysis tubing.

(i) Name **two** more pieces of apparatus they would need to make sure this is a controlled investigation.

1 .....

2 .....

[2]

The question was well answered with candidates recognising the relevance of the investigation title to complete the list of apparatus required. Some answers referred to cuvettes which, although required, is not contributing to a controlled investigation.

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Question 3 (c) (ii)

(ii) Outline the method that the students would use to carry out an investigation into the effect of **temperature** on the diffusion rate in their model cells.

.....

.....

.....

.....

.....

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

This was a good discriminating question. Most candidates were able to recognise the need for different temperatures, often suggesting relevant temperatures to use. Some answers referred to the calibration and use of the colorimeter. Few candidates were familiar with the use of dialysis tubing to form a model cell. This restricted their ability to elaborate on their answer. Many incorrect answers referred to potato or beetroot cylinders as the model cell. Candidates often discussed the dialysis tubing in terms of a covering for the test tubes.

Assessment for learning

The Examiners' reports are an excellent source of information for candidates when refining their understanding of certain techniques and methodology.

OCR support

The practical activity groups provided by OCR are an excellent teaching tool even if the practical is not feasible or an alternative activity has been assessed from a practical perspective. Providing a copy of all the activities to the students will broaden their understanding and knowledge of the practical techniques discussed at A level.

Also the practice PAG materials can be used to reinforce indirect assessment of practical skills.

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Question 3 (d)

(d) The table below shows some results from a model cell investigation.

Temperature (°C)	Concentration of glucose found outside the dialysis tubing after two minutes ($mol\,dm^{-3}$)
10	1.5
20	3.6
30	4.7
40	5.8

Explain these results in terms of the effect of temperature on the rate of diffusion.

.....

.....

.....

.....

.....

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

Many candidates were able to explain the data in terms of an increase in kinetic energy of particles and an increased rate of diffusion. However, confusion often arose with relating these details to a membrane and the effect of temperature on membrane permeability. Candidates should appreciate that the results referred to a model cell investigation and should have been discussed in that context, not in the setting of a living cell. Few candidates analysed the results, often quoting from the table but not extrapolating the data.

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Question 4 (a) (i)

4

(a) An aneurysm is a bulge in a blood vessel caused by a weakness in the wall of the blood vessel.

If an aneurysm bursts it can be very serious or even fatal.

(i) Scientists can measure the size of an aneurysm. An investigation measured the ratio of collagen to elastin in the blood vessel wall in five patients with an aneurysm.

The table shows some of their findings.

Patient	Size of aneurysm (cm)	Ratio of collagen to elastin
A	0.00	2 : 1
B	0.03	3 : 1
C	0.50	4 : 1
D	1.10	7 : 1
E	2.20	8 : 1

Based only on the data in the table, suggest a hypothesis on the formation of aneurysms.

.....

.....

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

The question was well answered. Good answers separated the 2:1 ratio from the others, having appreciated the baseline relevance of patient A's data. Some answers referred to more collagen as a cause of the aneurysm without appreciating that it is relative to elastin and may not necessarily mean an increase in collagen in isolation.

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Question 4 (a) (ii)

(ii) Students looked at data on aneurysms in different groups of people of the same age.

The table shows their findings.

Group	Observed frequency of people with aneurysms (*O*)	Expected frequency of people with aneurysms (*E*)
Females	566	600
Males	377	343

Calculate chi squared for this data.

Use the formula: $\chi^2 = \sum \frac{(O-E)^2}{E}$

Give your answer to **4** significant figures.

χ^2 = ... **[3]**

A good differentiator with some candidates achieving maximum marks but many didn't attempt the question. The most common error was to use the female or male data instead of both.

Calculation:

= $(-34)^2/600 + (34)^2/343$

= 1156/600 + 1156/343

= 1.927 + 3.370 = 5.2968

Rounding up to 4 sig figs = 5.297

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Question 4 (a) (iii)

(iii) The table shows part of a statistical table for the chi squared test.

	Probability (%)			
	10	5	1	0.5
df				
1	2.706	3.841	6.635	7.879
2	4.605	5.991	9.210	10.60
3	6.251	7.815	11.34	12.84
4	7.779	9.488	13.28	14.86

Using the table above and your answer to **(ii)**, state what conclusion the student would make with 95% confidence?

.....

.....

.....

.....

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

Only a few candidates could interpret their answer from question 4 (a) (ii) and provide an answer in this question. Although candidates were able to select the correct probability, there was often confusion with the degrees of freedom required for a chi squared test.

The degrees of freedom for chi- squared test is calculated as:

df = (r-1) (c-1)

r = number of rows

c = number of columns

Calculation for df:

df = (2-1) (2-1) = 1

OCR support

The Mathematical skills handbook covers contexts in biology and the chi squared test.

There is also additional support on statistics on 'Maths for Biology' resources, which include a tutorial and a quiz, as well as the 'Statistics for Biologists' resource.

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Exemplar 2

The χ^2 value is greater than the critical value at $p = 5\%$ at $df = 1$. so the null hypothesis can be rejected.

This exemplar lays out the order in which to answer a conclusion from a statistical test, starting with a comparison of the calculated value with the critical value, referring to the degrees of freedom used and concluding with a correct rejection of the null hypothesis.

Question 4 (b) (i)

(b)
(i) Explain the role of valves in veins.

.....

.....

.....

.....

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

Most candidates realised that valves prevent the backflow of blood but did not explain this role, merely stating it. Some answers referred solely to the role of valves in the heart rather than veins.

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Question 4 (b) (ii)

(ii) The smooth muscle content in some arteriole walls is more than double the smooth muscle content in the walls of some arteries.

Explain how arterioles are better adapted than arteries to allow the blood to flow into an individual organ

.....

.....

.....

.....

.....

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

Most candidates struggled to answer this question. Candidates rarely referred to arterioles branching into capillaries and thus the importance of controlling blood flow in the arterioles. Answers often referred to arterioles as increasing blood pressure so blood flow increases as it enters organs.

Assessment for learning

Arterioles should be regarded as the resistant vessels with the smooth muscle restricting blood flow to help lower the pressure as blood enters the capillaries. Analogies with physics and electrical current/resistance would be relevant to these concepts.

Misconception

A common misconception is vasoconstriction increasing blood flow and pressure.

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Question 4 (c)*

(c)* Heart action in a mammalian heart starts at the sino-atrial node (SAN).

Describe how heart action is initiated and coordinated by the SAN **and** explain why the muscle in the walls of the atria does not contract at the same time as the muscle in the walls of the ventricles.

Details of hormonal and nervous control are **not** required.

.....

.....

.....

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

Good answers had a clear flow from the SAN and atrial systole through the Bundle of His to Purkyne fibres and ventricular systole. These answers concentrated on the electrical activity of the heart and did not become diverted by discussions centred around blood flow through the heart. Some answers did not state the consequences of SAN or AVN activation or mixed the chronology of events. A few candidates confused the AVN node with AV valves.

Assessment for learning

Words that can become mixed together for candidates should be discussed and highlighted to help detangle them. Etymology and discussions beyond the limitations of letter abbreviations for certain scientific words is beneficial.

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Exemplar 3

SAN is present in the right atrium and sends an impulse (wave of excitation) across the atria. This causes the atria to contract. The atrioventricular node (AVN) ensures that the impulse passes in pas travels to the ventricles after a short delay. This prevents the atria and ventricles contracting at the same time. The AVN impose this short delay by making the impulse travel through the Bundle of His before it reaches the ventricles. Purkyne fibres ensure the ventricles contract from the apex of the heart upwards.

This exemplar answer is clear and to the point, with an exact chronology of events and no deviation with blood flow which is irrelevant to the question asked. Reference to a delay is provided within the sequence of events to provide a flow of succinct facts.

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Question 5 (a) (i)

5
(a)
(i) Some students collect a sample of pond water to observe under a light microscope.

They pour some of the pond water onto a microscope slide.

Describe how they could improve their technique in preparing the microscope slide for examination under a light microscope.

.....

.....

.....

.....

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

Few candidates achieved full marks. Many answers discussed improving the method in terms of not pouring the pondwater on the slide but suggested a smear approach, not appreciating that a smear would effectively be a dried sample that would not be appropriate to observe the contents of pond water. A lot of candidates referred to a coverslip but could not recall its name, describing it instead or referring to another slide. Some answers indicated the use of dyes to visualise the contents of pond water.

Misconception

Many candidates believe that dyes are required to see anything using a light microscope.

Dyes are required to distinguish cell types and subcellular structures. Organisms can be seen under a light microscope without the need for a colour contrast.

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Question 5 (a) (ii)

(ii) Explain how the students would use the different objective lenses of a light microscope to focus and observe the pond water sample at high power magnification.

.....

.....

.....

.....

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

Candidates struggled to elicit a clear response. Many correctly referred to the objective lenses and starting with the lowest magnification lens but could not articulate how to focus on the pondwater. Answers were often confused with stating the lens as the focusing component on the microscope. Some candidates referred to altering the resolution.

Assessment for learning

Highlighting the difference in resolution between a light microscope and an electron microscope helps to emphasise the fixed nature of resolution for each type of microscope.

Misconception

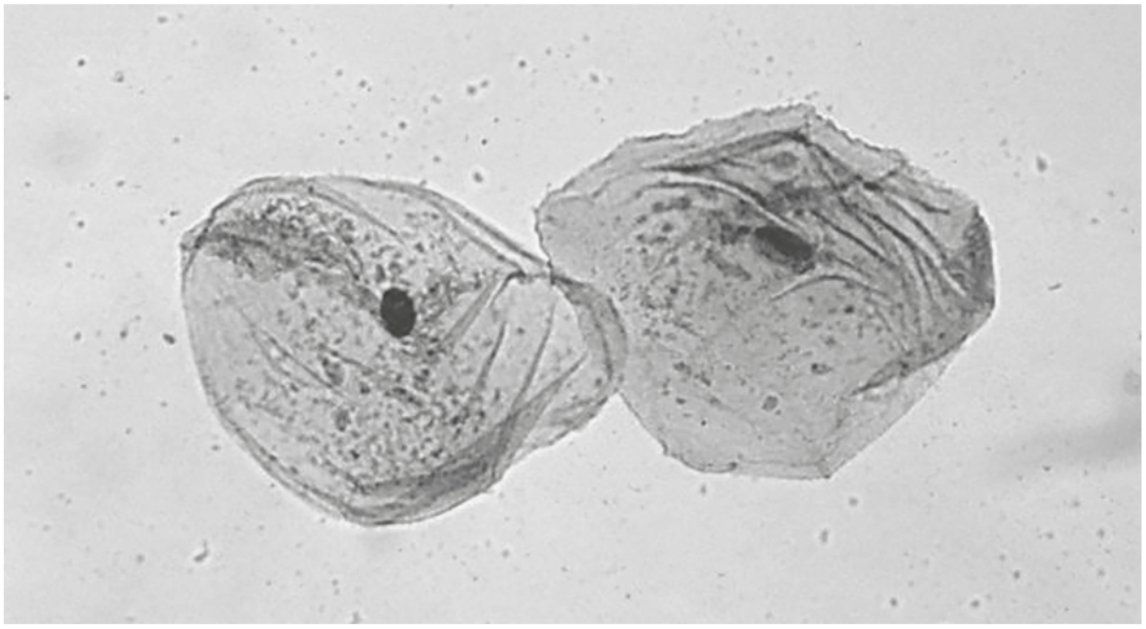
Candidates often confuse magnification with resolution and thus refer to adjusting the resolution of a light microscope as you are using it.

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Question 5 (b)

(b) **Fig. 5.1** shows a photomicrograph of human cheek cells observed by the students under a light microscope.

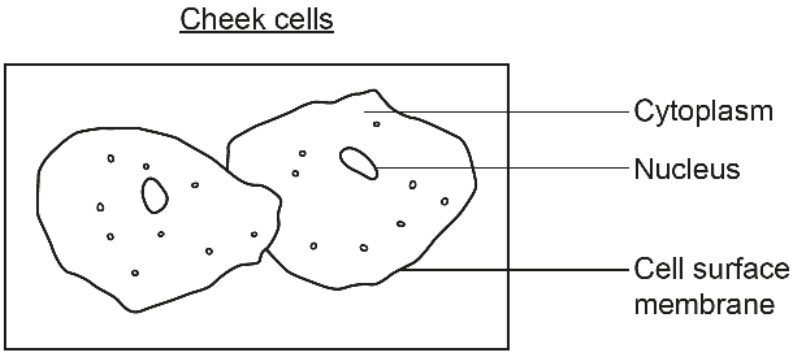
Fig. 5.1



Magnification ×400

Fig. 5.2 shows a drawing made by a student of the cells from this photomicrograph.

Fig. 5.2



Magnification ×400

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A student said **Fig. 5.2** was a correct biological drawing.

Identify **two** pieces of evidence from **Fig. 5.1** and **Fig. 5.2** that support the student's comment.

1 .....

.....

.....

2 .....

.....

.....

[2]

Well answered with most candidates referring to no shading and the magnification. Many candidates also appreciated the relative size of the drawing in relation to the photomicrograph. Some answers discussed the label lines and lack of arrow heads as a piece of evidence without appreciating the question refers to both figures to support the student's statement and not just a list of rules for a good biological drawing.

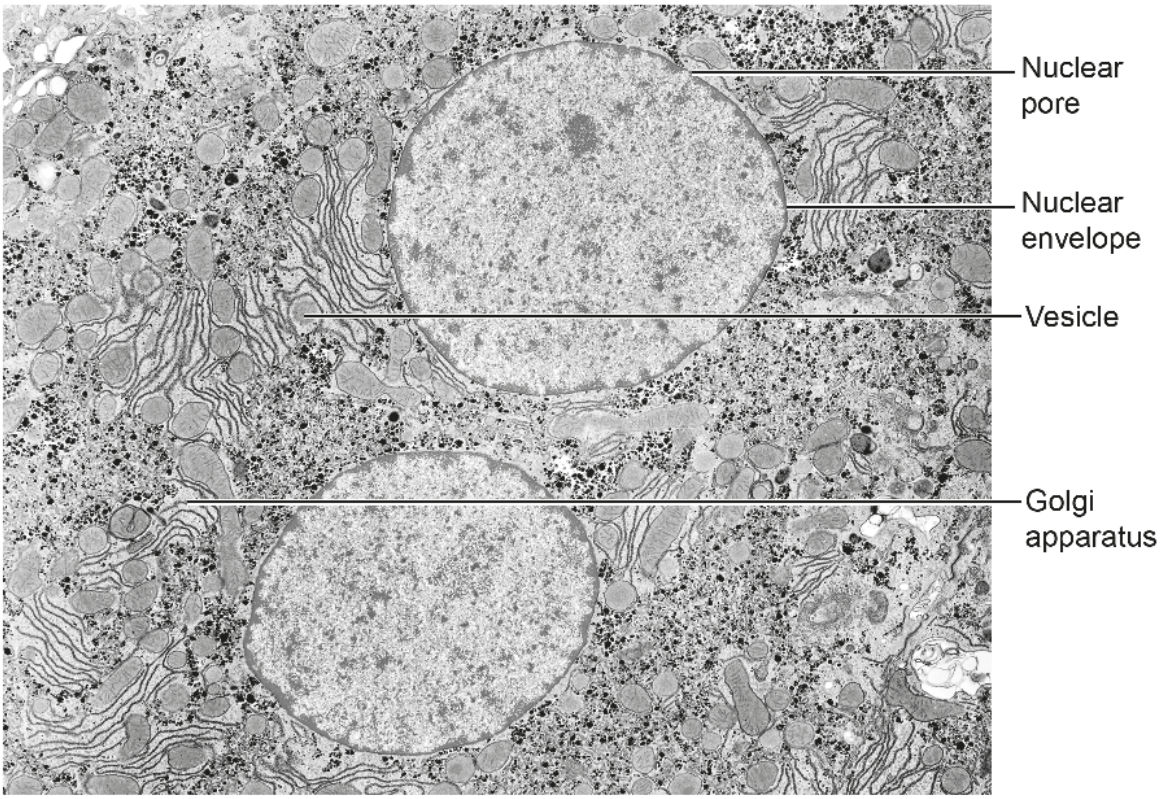
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Question 5 (c) (i)

(c)

(i) **Fig. 5.3** shows a photomicrograph of a liver cell taken from a transmission electron microscope (TEM).

Fig. 5.3



Magnification ×100 000

Identify **two** pieces of evidence that indicate that the image in **Fig. 5.3** was taken using a TEM.

1 .....

.....

.....

2 .....

.....

.....

[2]

Well answered with most candidates referring to the magnification and the visible organelles as compared to a light microscope. A large proportion of candidates also correctly compared the TEM to a scanning EM with statements about the two-dimensional nature of the figure.

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Question 5 (c) (ii)

(ii) Describe how the rough endoplasmic reticulum and the Golgi apparatus are involved in the production of a secretory vesicle that contains protein.

.....

.....

.....

.....

.....

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

Most candidates achieved 1 or 2 marks, but few achieved full marks. Most candidates stated the role of ribosomes in protein synthesis, but few could follow through the exact chronology of the subsequent steps. Many answers focused on the movement of the secretory vesicle and exocytosis of the protein without appreciating the question culminated in the production of a secretory vesicle, not its fate. Some candidates confused translation with transcription. Details of translation were seen at the expense of space and time to discuss the role of the Golgi. Candidates should be mindful of the marking points and how they could be apportioned with respect to all the parts listed in a question.

Question 5 (d)

(d) Outline the importance of the cytoskeleton.

.....

.....

.....

.....

.....

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

Well answered with most candidates achieving 3 marks. Answers often discussed the cytoskeleton in terms of microfilaments and microtubules and were very articulate about the various roles in cells.

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Question 6 (a) (i)

6
(a)
(i) The general structure of an amino acid molecule has one R group and two other groups.

Name the **two** other groups in an amino acid molecule.

1 .....

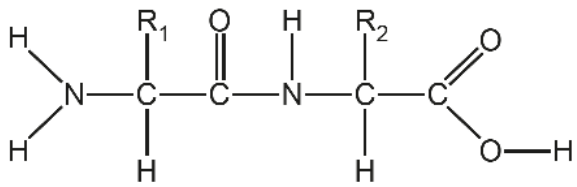
2 .....

[2]

Well answered with most candidates achieving 2 marks. Some answers referred to the carboxylic acid as a hydroxyl group. Candidates should realise that the functional group relates to all the atoms coming from the terminal carbon.

Question 6 (a) (ii)

(ii) Below is a diagram of a dipeptide.



Draw a circle around the peptide bond. Answer on the diagram. **[1]**

Many candidates correctly identified the peptide bond and often restricted their circle to just one bond. A lot of candidates omitted this question part.

Question 6 (a) (iii)

(iii) Name the type of reaction involved in breaking the peptide bond.

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

The majority of candidates achieved this mark. Some answers confused it with condensation.

Assessment for learning

Splitting the word and discussing lysis as breaking will cement any reference to breaking with lysis to help eliminate confusion with these two opposing terms.

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Question 6 (b)

(b) Which statements about biological molecules are true and which are false?

Tick (✓) **one** box in each row.

Statement	True	False
Breaking one ester bond in a triglyceride produces glycerol and three fatty acids.		
Ribose is a hexose monosaccharide.		
In an alpha glucose molecule, the hydroxyl (OH) group is positioned below carbon 1.		

[2]

Well answered with a large number of candidates achieving 2 marks. The common error was stating that ribose was a hexose.

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Copyright information

Question 2 (a) and 2 (a) ii: Context. Information about zombie ant fungus., © Evaluating the tradeoffs of a generalist parasitoid fungus, Ophiocordyceps unilateralis, on different sympatric ant hosts, Wei-Jiun Lin et al, Scientific Reports, Springer Nature, Apr 14, 2020.

Question 2 (a): Fig. 2.1, Context Image, A photo image of an ant infected with the Zombi fungus., © Ophiocordyceps unilateralis: The Zombie Ant Fungus – BIOL421 @UNBC – Insects, Fungi and Society, Alex Mckenna, March 31, 2017. This work by Alex Mckenna is licensed under a Creative Commons CC-BY Attribution 4.0 International License.

Question 2 (a) (ii) Fig 2.2 Bar chart showing findings of the study, © Evaluating the tradeoffs of a generalist parasitoid fungus, Ophiocordyceps unilateralis, on different sympatric ant hosts, Wei-Jiun Lin et al, Scientific Reports, Springer Nature, Apr 14, 2020.

Question 4 (a) (i): Table 4.1, Adapted data from textbook to create a table of size of aneurysm and ratio of collagen to elastin., A Level Biology for OCR. Year 1 and AS, Page 175 of text book, 978-0-19-835191-7, 2015, Oxford University Press. Ann Fullick. Jo Locke. Paul Bircher.

Question 4 (a) (ii): Adapted text to create data table. Table of frequencies of aneurysms in different gender group., © Statistics and Facts - Brain Aneurysm Foundation (bafound.org).

Question 4 (b) (ii): Adapted text from textbook. How arterioles are better adapted than arteries to allow the flow of blood into an individual organ., A Level Biology for OCR. Year 1 and AS. Page p176 of text book. 978-0-19-835191-7, 2015. Oxford University Press. Ann Fullick. Jo Locke. Paul Bircher.

Question 4 (c): Adapted text from A Level Biology for OCR. Year 1 and AS. Page p189, 978-0-19-835191-7, 2015. Oxford University Press. Ann Fullick, Jo Locke, Paul Bircher.

Question 5 (b): Fig. 5.1, Photomicrograph of two cheek cells under light microscope, OCR is aware that third party material appeared in this exam but it has not been possible to identify and acknowledge the source

Question 5 (c) (i): Fig. 5.3, Photomicrograph of liver cells under an electron microscope, © Science Photo Library / Alamy Stock Photo

Question 6 (a) (ii): diagram of a dipeptide. © www.cronodon.com

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