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Examiners' report

BIOLOGY A

H420
For first teaching in 2015

H420/01 Summer 2018 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. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

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

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Paper H420/01 series overview

H420/01 is one of three components assessed during this examination session for the new two year GCE A Level Biology A specification. For H420/01 candidates needed to demonstrate breadth and depth of knowledge across modules 1, 2, 3 and 5 with 15 multiple choice and two Level of Response questions included in the 100 marks.

Mathematical and practical skills were embedded within the multiple choice questions in section **A** and the longer responses required in section **B**. The question paper appeared to be accessible to candidates across the ability range, and there was no evidence to suggest that candidates were under any time constraints towards the end of the paper.

Candidates who performed well on this paper were able to apply their knowledge to new situations and were also able to demonstrate their advanced practical and mathematical skills as required.

Candidates who performed less well appeared unable to apply their knowledge or use information provided, e.g. diagrams, graphs or figures included in the questions, to support their answers.

Overall, candidates demonstrated a wide range of ability with higher ability candidates applying their knowledge to new situations and appearing more prepared for the increased emphasis on mathematical and practical content to gain higher level marking points. Lower ability candidates were able to demonstrate their ability to learn and recall facts.

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Section A overview

This section of the examination consisted of 15 multiple choice questions covering a range of topics across the assessed modules for this component. Only **AO1** and **AO2** were assessed in section **A**. Some questions involved recall, whilst others required the use of mathematical, practical and/or analytical skills; some questions needed more time than others.

Section **A** achieved a good spread of marks across the range of abilities. Higher ability candidates were able to demonstrate knowledge of the subject content without being distracted by the alternative options offered alongside the correct response.

Candidates had been advised to spend no longer than 20 minutes on this section and the majority of candidates appeared to have managed their time effectively with very few omissions.

A number of responses proved difficult to read due to illegible writing, particularly with regards to **B** and **D** in multiple choice questions where any ambiguity cannot be credited or given the benefit of the doubt.

Question 3

3 The following table describes the approximate percentage mass of different chemical elements in organic polymers.

	Polymer	N (%)	C (%)	O (%)	H (%)	P (%)
A	nucleic acid	20.0	30.0	20.0	10.0	20.0
B	carbohydrate	0.0	33.3	33.3	33.3	0.0
C	protein	30.0	10.0	10.0	0.0	50.0
D	lipid	0.0	50.0	49.0	1.0	0.0

Which of the rows, **A** to **D**, is correct?

Your answer ☐ **[1]**

Many candidates were able to correctly identify nucleic acids (option A) here, demonstrating knowledge of the composition of some organic polymers. Some candidates opted for B which, although providing the correct elements present in carbohydrates, the approximate percentage mass for each of these elements could not be true for carbohydrates.

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Question 4

4 Which of the following statements, **A** to **D**, about DNA replication is correct?

A RNA will bind to DNA through complementary base-pairing.

B The distance between the strands in the double helix will always be the same.

C The proportion of adenine in a nucleic acid will always equal the proportion of guanine.

D The formation of phosphodiester bonds will occur in the same direction on each strand during DNA replication.

Your answer ☐ **[1]**

Due to the action of DNA polymerase, option D provided the correct response for this question. As the two strands of DNA separate during replication the distance between the strands is **not** always the same (option B). Option A was not on the specification but it was decided to credit candidates who had opted for this response based on the function of RNA primers during replication of DNA.

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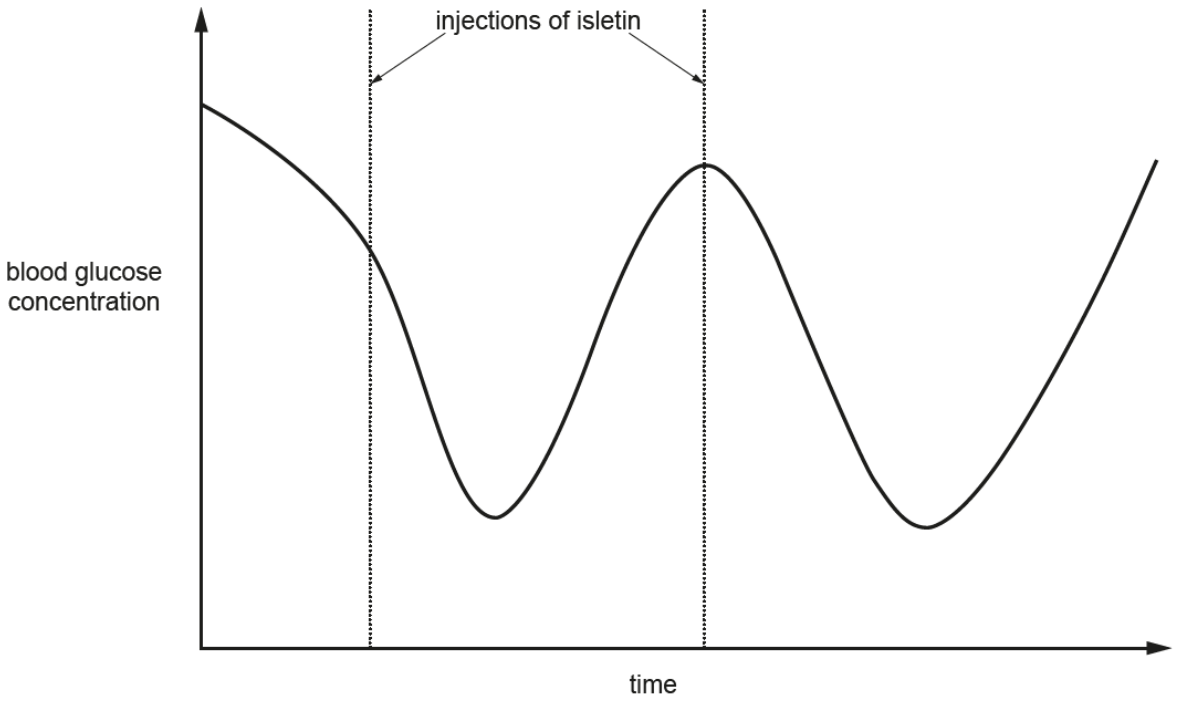
Question 8

8 Banting and Best pioneered experiments into the functions of the pancreas.

In one experiment, they removed the pancreas of dogs. Shortly afterwards, the dogs developed the symptoms of diabetes.

- Banting ground up the removed pancreas to produce an extract.
- He called the extract "isletin".
- The isletin was then injected into dogs that had had their pancreas removed.
- He then tested the blood glucose concentration.

The graph below is a summary of the results.



Which of the following statements correctly explains these results?

1 Isletin is made in the α cells in the islets of Langerhans.
2 Isletin reduces blood glucose concentration.
3 The effects of isletin are short-lived.

A 1, 2 and 3

B Only 1 and 2

C Only 2 and 3

D Only 1

Your answer ☐ **[1]**

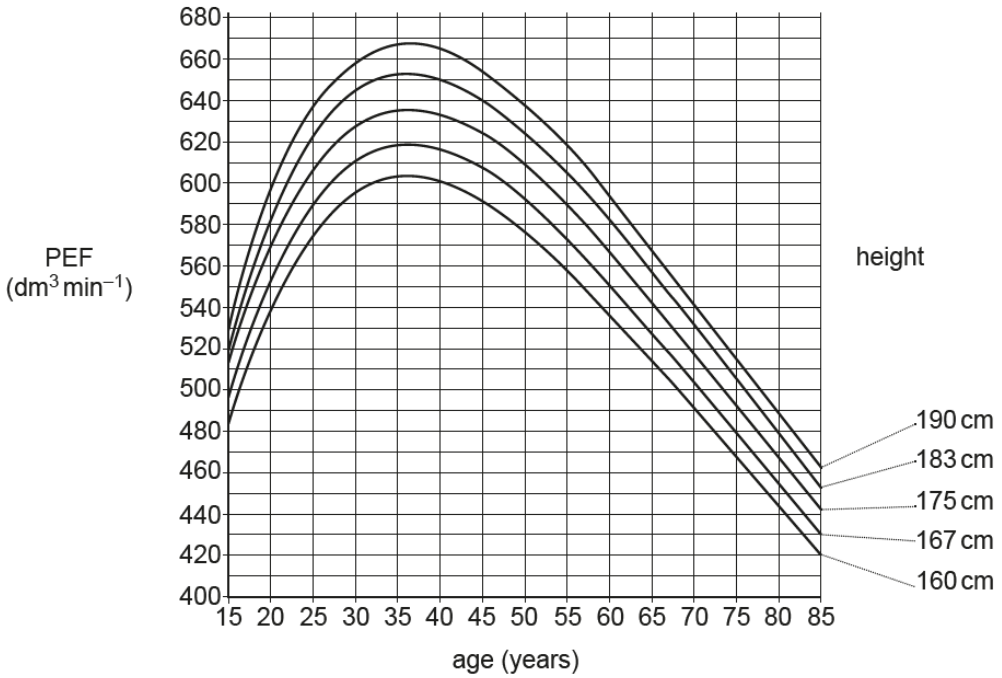
This question provided significant challenge to candidates. Only statements 2 and 3 were correct thereby giving option C as the correct response.

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Question 9

9 Peak expiratory flow (PEF) is a measure of the maximum rate at which a person can exhale.

The graph below shows the typical PEF values for men of different ages and heights.



Which of the following is the percentage increase from the PEF of a 20 year old man of 175 cm to the PEF of a 45 year old man of 183 cm?

A 19.4%

B 10.9%

C 12.3%

D 8.1%

Your answer ☐ **[1]**

Candidates had to process the information in the graph of PEF data and choose the appropriate values to perform their calculation. Candidates often struggle with such percentage calculations in section **B**, but this posed little problem for the majority of candidates who were able to perform the calculation and identify C as the correct option.

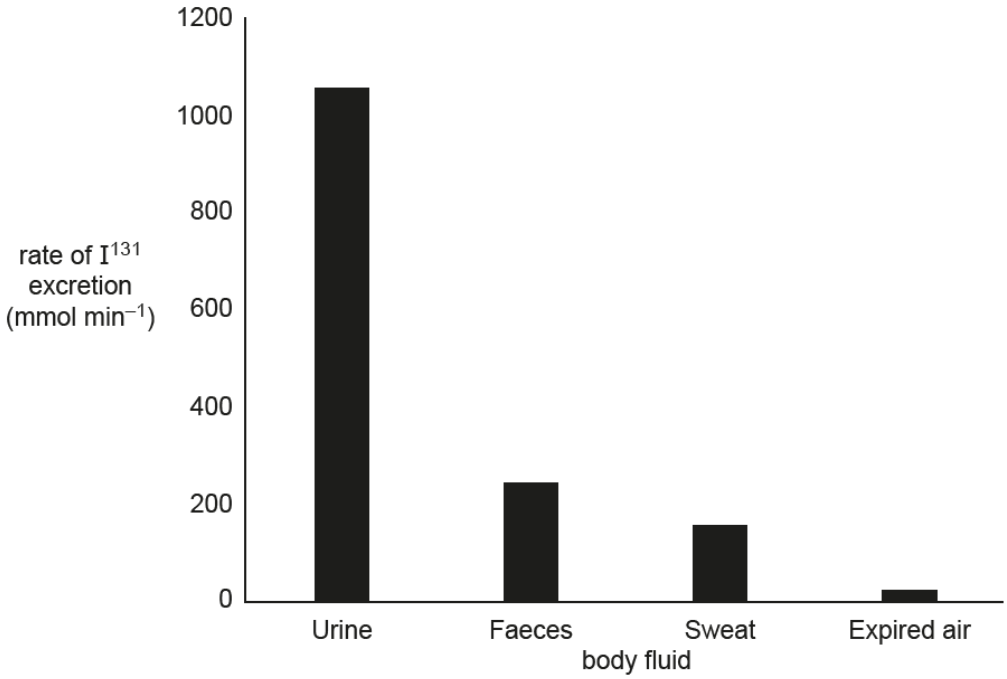
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Question 10

10 One treatment for thyroid cancer is radioactive iodine. The radioisotope I^{131} is used.

The thyroid gland absorbs any iodine that enters the body, so the radioactive isotope kills the cancerous cells in the thyroid gland. The I^{131} is then excreted from the body.

Different body fluids excrete different proportions of I^{131}, as shown in the following graph.



Which of the following, **A** to **D**, correctly explains the different proportions of I^{131} in each body fluid?

A I^{131} is very soluble in water.

B I^{131} is able to cross capillary walls.

C The kidneys are more efficient at excreting I^{131} than the lungs.

D The thyroid gland is well supplied with blood.

Your answer ☐ **[1]**

This question proved challenging for some and required skills in applying knowledge to novel context to choose the most appropriate response.

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Question 11

11 Which of the following, **A** to **D**, is a similarity in the way ATP is made in respiration and photosynthesis?

A both involve NAD

B both involve substrate level phosphorylation

C both involve photons

D both involve proton gradients

Your answer ☐ **[1]**

Option **A** provided a distractor and common incorrect response to the correct option, **C** in this question as statement 1, whilst correct, was irrelevant to the question being asked about ecdysone.

Option B provided a distractor and common incorrect response to the correct option, D, in this question. This is possibly due to misconceptions surrounding the synthesis of ATP by different methods of phosphorylation.

Question 14

14 The table below shows the membrane potentials of different neurones at a cholinergic synapse. The data were recorded on five separate occasions, as shown in the five rows.

	Membrane potential (mV)			
	Presynaptic neurone A	*Presynaptic neurone B*	*Presynaptic neurone C*	*Postsynaptic neurone*
1	+40	–70	–70	–70
2	–70	+40	–70	–70
3	–70	–70	+40	–70
4	+40	+40	–70	–70
5	+40	+40	+40	+40

Which of the following, **A** to **D**, explains these data?

A divergence

B hyperpolarisation

C spatial summation

D temporal summation

Your answer ☐ **[1]**

Many candidates who noted that data from both pre and post-synaptic neurones had been included in the table and were able to apply their knowledge of membrane potentials to this information went on to choose C as the correct option.

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Question 15

15 The drug metoprolol prevents stimulation of post-synaptic receptors in the sympathetic nervous system.

Which of the following conditions could this drug be used to treat?

1 Muscle fatigue
2 Tachycardia
3 High blood pressure

A 1, 2 and 3

B Only 1 and 2

C Only 2 and 3

D Only 1

Your answer [ ] **[1]**

There were many correct responses to this question with candidates recognising the sympathetic nervous system prompt and its association with heart rate and blood pressure.

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Section B overview

Mathematical and practical skills were embedded throughout the structured questions in section **B**.

Assessment objectives **AO1**, **AO2** and **AO3** were addressed throughout **Q16** to **Q23** with concepts from across the specification including respiration, photosynthesis and communication.

Question 16(a)(i)

16 (a) Gestational diabetes is a medical condition that affects pregnant women. It results in high levels of glucose in the blood, even though the woman produces normal levels of insulin.

(i) Gestational diabetes is most similar to which **other** type of diabetes?

Explain your answer.

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

Question 16(a)(ii)

(ii) Suggest **two** ways a woman with gestational diabetes can manage her condition.

1 .....

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2 .....

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[2]

Both parts (a)(i) and (a)(ii) were well-answered by the majority of candidates. In (a)(i) many identified Type II diabetes and gave a correct explanation to gain both marks. Some explanations could have been improved by including appropriate detail e.g. by stating that **cells** rather than the 'body' do not respond to insulin. In (a)(ii) exercise and low sugar / carbohydrate diets were the most common correct responses but some responses referred to diet without mentioning the need to reduce carbohydrates were not credited e.g. maintain a healthy diet.

Question 16(b)(i)

(b) (i) Skeletal muscle is one of the main tissues where glucose is removed from the blood in response to insulin.

Name the other tissue.

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

Many candidates gave liver (tissue) as the correct response but credit was not given for any other muscle (tissue), or incorrectly named **cells** rather than the tissue.

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Question 16(b)(ii)

(ii) Explain why glucose is required for the contraction of skeletal muscle.

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

Many candidates scored two marks for glucose being used in respiration to produce ATP. Good responses gave detail of how the ATP was important in muscle contraction such as to ***break*** the cross-bridges between myosin and actin. Common misconceptions included ATP being needed for the power stroke or to allow the formation of the cross-bridge between myosin and actin.

Key:

Misconception

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Question 16(c)

(c) During late pregnancy, women find ventilation more difficult, as the developing foetus reduces the volume of the thorax. This can lead to tiredness and difficulty breathing.

A student used a spirometer to measure ventilation in a woman who was 36 weeks pregnant.

Fig. 16.1 shows the trace produced.

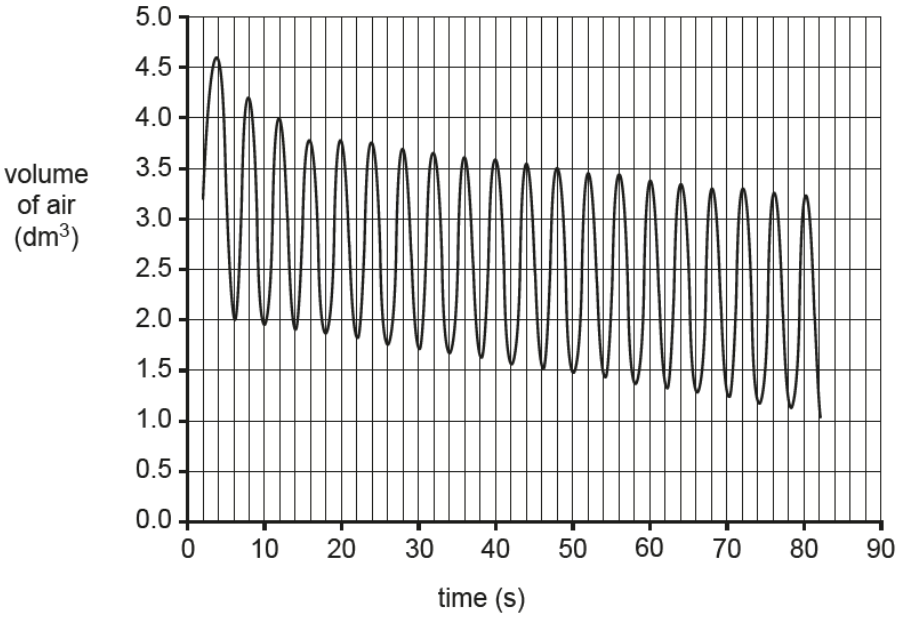


Fig. 16.1

Mean oxygen uptake rate at rest in women is around 0.020 $dm^3 s^{-1}$.

Using these data, the student made the following conclusion:

My data show that being pregnant reduces rate of oxygen uptake by up to 20%.

Evaluate this claim, using the data in Fig. 16.1.

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

Good responses to this question assessing AO3, used the information in Fig. 16.1 to calculate oxygen uptake in $dm^3 s^{-1}$ followed by a calculation to work out the percentage reduction compared to 0.02 $dm^3 s^{-1}$ and then compared this by agreeing or disagreeing with the candidate's statement. Relatively few candidates commented on other aspects about the validity of the claim such as the use of only one woman 36 weeks into her pregnancy.

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Exemplar 1

Evaluate this claim, using the data in Fig. 16.1.

oxygen uptake: $\frac{4.6-3.25}{80} = 0.01687 \text{ dm}^3$

The oxygen uptake for this woman is 0.0169 $dm^3 s^{-1}$ so the student is correct in the sense that being pregnant has reduced the rate of oxygen uptake for this woman by up to 20%. However this is due to only from one pregnant person and one person is not representative of all pregnant women. Furthermore, oxygen uptake could be different at different stages of pregnancy, so the student is incorrect [3]

This response identifies a high attaining response where the candidate has performed a calculation but has also included comments on the validity of the candidate's claim based on the procedure used.

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Question 17(a)(i)

17 (a) Chromista are photosynthetic protoctists that live in water.

Chromista are different from other photosynthetic organisms because they contain the pigment chlorophyll *c*.

Chlorophyll *c* is not found in plants.

(i) Outline the importance of photosynthetic pigments in photosynthesis.

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

AO1 was assessed in this part of the question. Many candidates were able to state that pigments absorbed light, excited electrons and were important in a named stage or process in photosynthesis. Mark points 3 and 4 were most often credited to higher ability candidates who were able to differentiate between primary and accessory pigments and their relevant roles.

Question 17(a)(ii)

(ii) The wavelengths of light absorbed by chlorophyll *c* are different from those wavelengths absorbed by chlorophyll *a* and chlorophyll *b*.

Suggest why Chromista need pigments that are different from those of other photosynthetic organisms.

.....

.....

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

There were few correct responses for this part of the question which was assessing AO2. Many candidates were able to appreciate that living in water was the reason behind the need for a different pigment but did not mention the fact that it was because only certain (shorter) wavelengths of light penetrated sufficiently to reach Chromista.

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Question 17(b)

(b) Fig. 17.1 is a diagram of the chloroplast found in a Chromista cell.

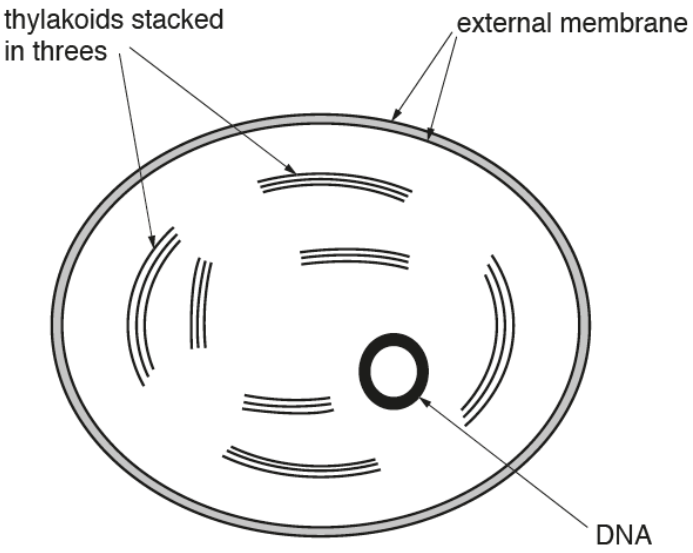


Fig. 17.1

Outline the structural differences between the Chromista chloroplast in Fig. 17.1 and the chloroplasts found in flowering plants.

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.....

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

This part of the question was generally well-answered with a good demonstration of knowledge across the ability range regarding the presence of grana, inter-granal lamellae and a greater number of thylakoids in the chloroplasts of flowering plants compared to Chromista. It was important for candidates to specify which chloroplast was being discussed to achieve full marks.

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Question 17(c)(i)

(c) Fig. 17.2 is a diagram of part of the plasma membrane of a Chromista cell.

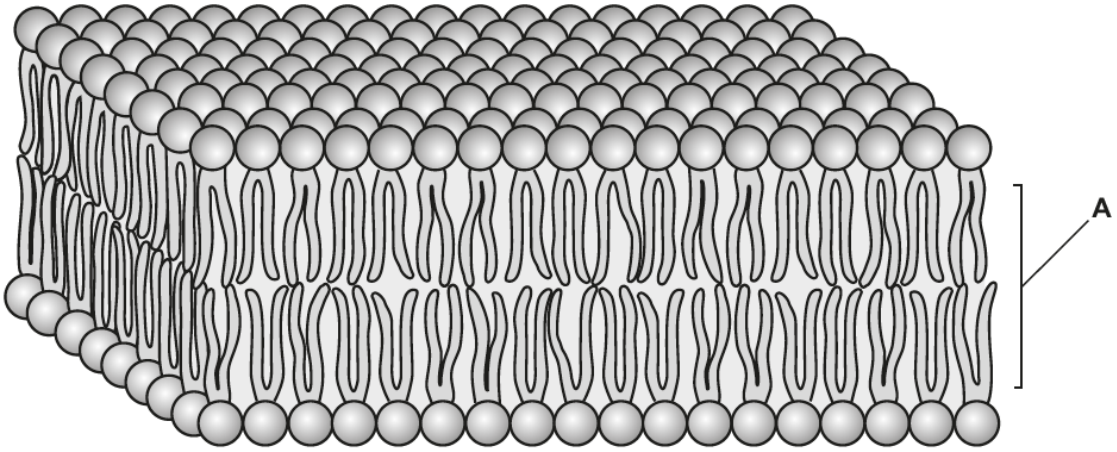


Fig. 17.2

(i) State and explain how **one** property of region **A** in Fig. 17.2 contributes to the stability of the plasma membrane.

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

Good responses identified region A as the tail of the phospholipid and correctly described its property as being hydrophobic. Credit was also given to candidates who stated that the region could contain cholesterol. It is important for candidates to look at diagrams carefully as there were a number of responses in which the candidates described region A as the whole phospholipid bilayer which could not be credited.

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Question 17(c)(ii)

(ii) There are differences between the plasma membrane and membranes within cells.

Outline the role of membranes **within** cells.

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.....

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

Many candidates gained credit for demonstrating knowledge of compartmentalisation as separating organelles and their contents from the cytoplasm. Weaker candidates gave confused statements which referenced the plasma or cell surface membranes rather than focus their response on the membranes **within** cells. Some good responses included reference to the specific roles of membrane-bound organelles such as lysosomes and vesicles.

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Question 18(a)*

18 (a)* Plants lose water by transpiration.

The rate of transpiration varies between different species of plant.

The rate of transpiration can be measured using a potometer.

Plan an investigation into the rate of transpiration in two species of plant that would allow valid data to be collected.

Details of how to set up a potometer are not required.

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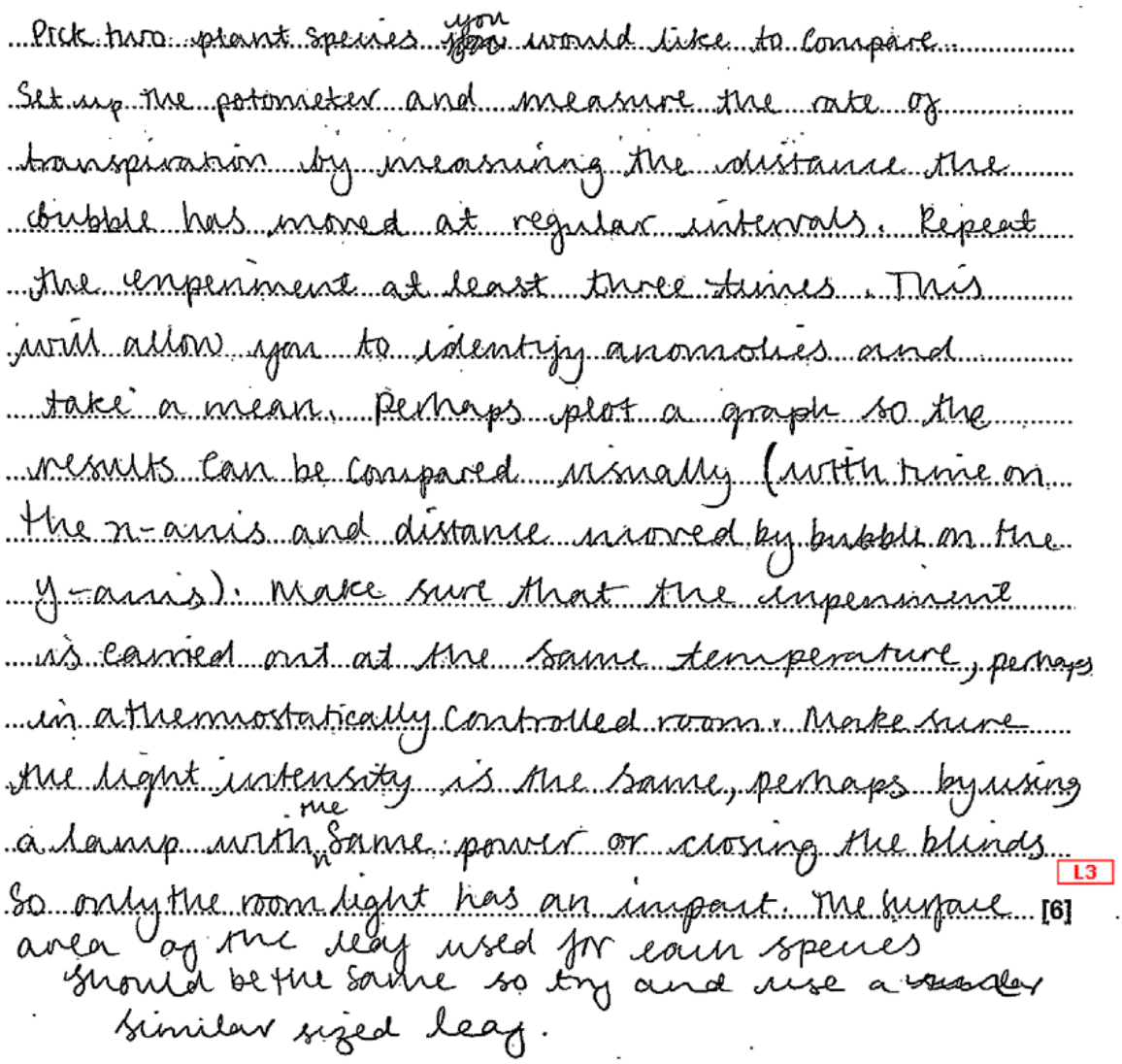
.....

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

This Level of Response question assessed AO3 and practical skills in the context of using a bubble or mass potometer. Good Level 3 responses could explain the basic principles, the need to control variables, and mentioned performing replicates for both species of plants. Many went on to describe relevant calculations for processing the data obtained. Level 2 responses described a basic method with less attention given to processing the data obtained. Some lower level responses described the wrong apparatus with mention of counting oxygen bubbles or measuring volumes in a gas syringe. It was important that candidates followed the instruction that advised "Details of how to set up a potometer are not required" to avoid writing irrelevant material. Some candidates also forgot to mention how to measure the rate of transpiration i.e. by measuring the distance travelled by the bubble or meniscus in a fixed time interval.

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Exemplar 2


Pick two plant species you would like to compare. Set up the potometer and measure the rate of transpiration by measuring the distance the bubble has moved at regular intervals. Repeat the experiment at least three times. This will allow you to identify anomolies and take a mean. Perhaps plot a graph so the results can be compared visually (with time on the x-axis and distance moved by bubble on the y-axis). Make sure that the experiment is carried out at the same temperature, perhaps in a thermostatically controlled room. Make sure the light intensity is the same, perhaps by using a lamp with the same power or closing the blinds. So only the room light has an impact. The surface area of the leaf used for each species should be the same so try and use a similar sized leaf.

L3 [6]

This is a good example of a Level 3 six mark response. The candidate provided a concise, well-written response to the question in the available space provided.

Question 18(b)

(b) Plant cell walls are made of cellulose. Cellulose is a polymer of β-glucose.

Give **three** properties of cellulose that make it suitable as the basis of plant cell walls.

1 .....

2 .....

3 .....

[3]

Many candidates gained one mark here with the most common response being 'insoluble'. However, few candidates gained three marks. Many candidates gave structural details rather than properties of cellulose or described properties of the cellulose cell wall rather than the polymer, cellulose. Responses that were not credited for these reasons included permeable, rigid and strong (without mention of tensile strength).

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Question 18(c)

(c) Cellulose cannot be digested by animals. Some mammals have bacteria in their stomachs that produce enzymes that can digest cellulose.

Explain whether the action of these enzymes is intracellular or extracellular.

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.....

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

The majority of candidates who deduced that the enzyme action was extracellular went on to explain their choice. Incorrect responses were seen where candidates appeared to confuse being inside an organ i.e. the stomach with being inside a cell.

Question 19(a)

19 Honeypot ants belong to several different genera. Some specialised individuals are used as food storage vessels. These individuals have swollen abdomens that store various foods, which can be given to members of the colony when required.

One such individual is shown in Fig. 19.1.



Fig. 19.1

An investigation was carried out into the respiratory substrate of three different genera of honeypot ant, by measuring oxygen uptake and carbon dioxide production.

The data are shown in Table 19.1.

Genus	CO_2 produced ($mm^3 s^{-1}$)	O_2 consumed ($mm^3 s^{-1}$)
Camponotus	0.89	0.88
Melophorus	0.59	0.66
Cataglyphis	1.01	1.47

Table 19.1

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(a) Use the data in Table 19.1 to suggest the likely diet of each genus of honeypot ant.

Justify your answer.

Genus	Diet	Justification
Camponotus	mainly carbohydrate	....
Melophorus	....	....
Cataglyphis	....	....

[3]

There were some excellent responses from candidates who were able to correctly calculate RQ values and then suggest the correct diet, although some candidates confused protein and lipids. Some candidates described the justifications in words but did not include numerical data or calculations and whilst not credited for this, they could still be credited for a correct diet column.

Exemplar 3

Genus	CO_2 produced ($mm^3 s^{-1}$)	O_2 consumed ($mm^3 s^{-1}$)	RQ
Camponotus	0.89	0.88	1.01
Melophorus	0.59	0.66	0.893
Cataglyphis	1.01	1.47	0.68

Table 19.1

(a) Use the data in Table 19.1 to suggest the likely diet of each genus of honeypot ant.

Justify your answer.

Genus	Diet	Justification
Camponotus	mainly carbohydrate	RQ is nearly one (high RQ)
Melophorus	mainly lipid	RQ is 0·89 (high but lower than carb)
Cataglyphis	mainly protein	RQ is 0·69 (lower than lipid/carb RQ)

[3]

This exemplar shows correct justification with clear calculations of the RQ values. Although they have confused the two respiratory substrates in the diet column.

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Question 19(b)

(b) Chitin is a polysaccharide found in insects. It is used to form the hard outer casing of their bodies.

Fig. 19.2 shows the chemical structure of chitin.

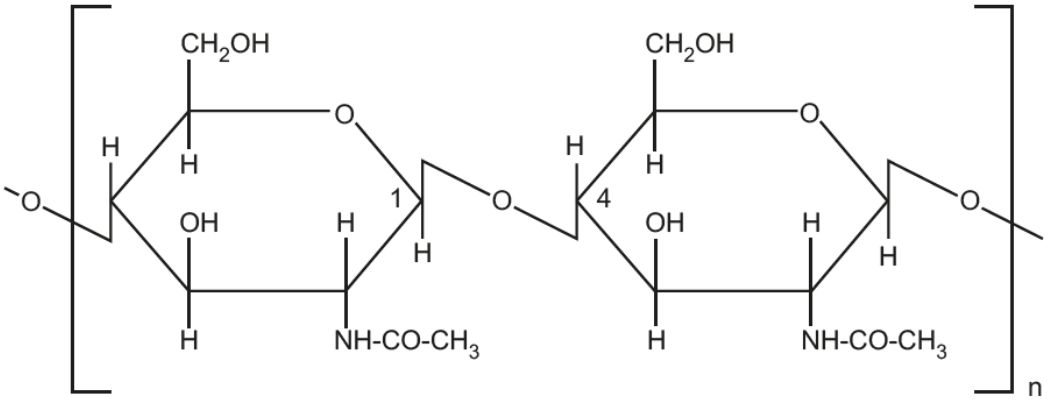


Fig. 19.2

Using information from Fig. 19.2, state **two** similarities and **two** differences between the structures of chitin and glycogen.

Similarity 1 .....

.....

Similarity 2 .....

.....

Difference 1 .....

.....

Difference 2 .....

.....

[4]

Many candidates were able to achieve at least two to three marks in this part of the question which was assessing AO2. Some candidates were not credited due to using terms incorrectly such as stating that 'they are hexose sugars' instead of 'contain' or 'have hexose sugars.' Many candidates recognised the fact that both contained glycosidic bonds, but this was not sufficient to gain credit. Good responses gave required detail and referred to the type of bonds present i.e. 1-4 or 1-6. For differences, some candidates did not specify which polymer they were referring to so could not be credited for certain mark points.

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Question 19(c)

(c)* Insects use glucose to generate ATP.

Outline the processes involved in the generation of ATP through **chemiosmosis**.

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

This Level of Response question assessed AO1 in the context of chemiosmosis. There were some excellent responses with candidates across the ability range demonstrating their ability to recall the process of chemiosmosis, the molecules involved and where in the cell it takes place. Many candidates followed the prompt in the question stem and referred only to chemiosmosis. Some candidates wrote extended responses including all stages of aerobic respiration which was not required and so were credited the lower mark within the level for their communication statement. There were some common errors seen in lower attaining responses which included mixing up the structures of mitochondria and chloroplasts and confusion about whether it was electrons or protons moving through the electron transport chain or ATP synthase.

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Exemplar 4

Glucose is first broken down into two pyruvate molecules in the cytoplasm of the cell during a process called glycolysis. ~~This produces~~ The two pyruvate molecules then are actively transported into the mitochondrial matrix to the link reaction (also known as oxidative decarboxylation). The pyruvate is decarboxylated and dehydrogenated to form an acetyl group which then goes to the Krebs cycle via a coenzyme called Coenzyme A. During the dehydrogenation of intermediates and pyruvate in the glycolysis and the link reaction, coenzyme NAD^+ is reduced to reduced NAD. In the Krebs Cycle further decarboxylation and dehydrogenation of citrate (formed by oxaloacetate and an acetyl group) reduces ~~produces~~ yet more NAD^+ to reduced NAD and FAD to $FADH_2$. These reduced coenzymes then move to the cristae for oxidative phosphorylation where they are oxidised releasing ~~and pass the~~ H^+ ions and electrons. The [6] electrons move through the electron carriers of the electron transport chain where they release energy each time they pass through an electron carrier. This energy is used to pump H^+ across the membrane of the cristae and into the intermembrane space. this leads to a proton gradient building up and this which causes H^+ to flow back down through the ~~Membrane~~ membrane down the H^+ concentration gradient. But due to the impermeability of the membrane to H^+ ions they flow through ATP Synthase which catalyses the formation of ATP from ADP and Pi. This is the process of producing ATP from chemiosmosis.

L3 ^

This exemplar shows an excellent Level 3 response for science content. The candidate has been credited with the lower mark within the level as over half of the response contains irrelevant detail about other stages in aerobic respiration which was not required.

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Question 20(a)(i)

20 (a) A student carried out an investigation into the effect of ethanol on the permeability of cell membranes in beetroot.

The student's method comprised the following five steps:

1. Cut equal sized pieces of beetroot using a cork borer.
2. Wash the pieces in running water.
3. Place the pieces in 100 cm^3 of different concentrations of ethanol.
4. After 5 minutes, remove samples from each of the ethanol solutions.
5. Place each of the samples into a colorimeter to collect quantitative data.

(i) Each step in the student's method relies on certain assumptions.

For each assumption listed below, select the **numbered step** from the student's method that relies upon that assumption.

*Assumption **A***

Pigment will only leak into the solution if membranes are disrupted.

*Assumption **A** relates to step* .....

*Assumption **B***

Absorbance is proportional to concentration of pigment.

*Assumption **B** relates to step* .....

*Assumption **C***

Pigment will be released when the beetroot is sliced.

*Assumption **C** relates to step* .....

[3]

Many candidates correctly selected the steps that relied upon assumptions **A** and **B.** For assumption **C** many chose step 1 i.e. the stage when the beetroot is sliced rather than the correct response i.e. step 2.

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Question 20(a)(ii)

(ii) The student kept the ethanol solutions at a constant temperature. State **two other** variables which need to be controlled in this investigation to ensure the data collected are valid.

1 .....

2 .....

[2]

AO3 was being assessed in this part of the question. There were some excellent responses from candidates who understood the importance of specifying an appropriate measurement for the beetroot pieces; such as length, surface area or volume. There were also many good responses which included ideas such as time taken to wash the beetroot pieces and pH. Low attaining responses were often those in which candidates had suggested variables that had already been stated in the question as being controlled, such as the volume of ethanol or the time the beetroot was left in the ethanol.

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Question 20(b)(i)

(b) Fig. 20.1 shows the graph plotted by the student.

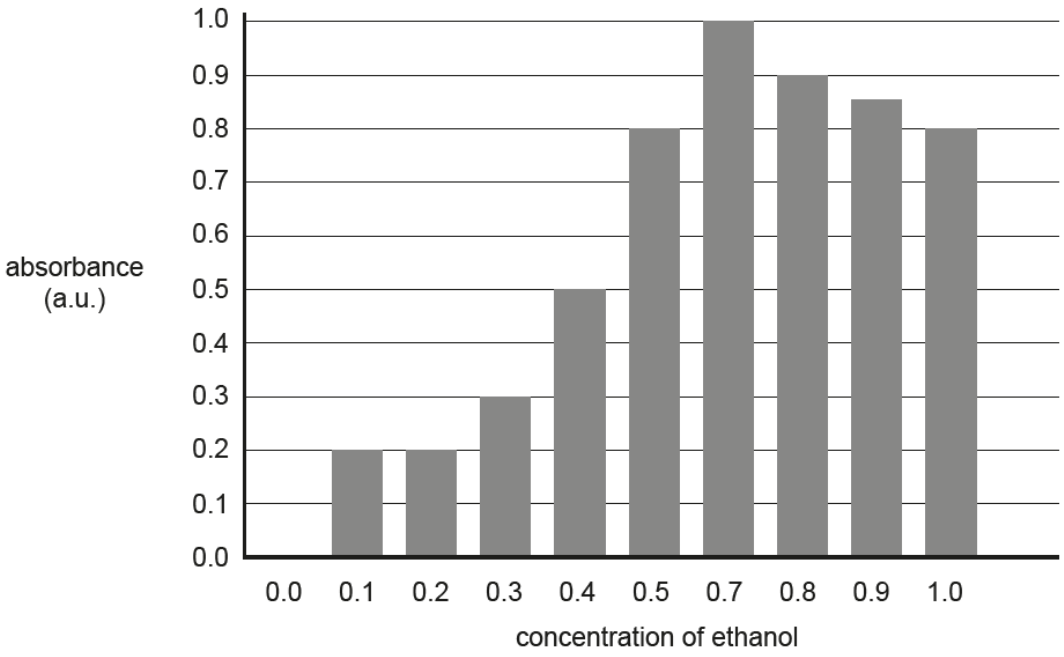


Fig. 20.1

(i) Make **three** criticisms of the way the student has displayed these results.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

This part of the question was generally well-answered with marking points accessible across the ability range.

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Question 20(b)(ii)

(ii) Explain how carrying out replicates would improve this investigation.

.....

.....

.....

.....

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

Candidates who gained full marks generally considered the potential to identify anomalies and calculate means. Marks were lost due to incorrect use of terms such as averages and validity or reference to removing or preventing anomalies. Few candidates used the correct terms, **reproducibility** or **repeatability**, in their responses.

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Question 21(a)(i)

21 (a) The greater blue-ringed octopus, *Hapalochlaena lunulata*, is one of the most venomous of all animals.

Its bite contains tetrodotoxin (TTX), a neurotoxin that can cause paralysis and death within minutes.

(i) The following information has been discovered about the effects of TTX on nerve cells:

- TTX binds to the external surface of the voltage-gated sodium ion channels in the axon membrane.
- Binding of TTX changes the tertiary structure of the channel.
- This means the channel cannot open.

Using the information provided, explain how TTX affects the activity of neurones.

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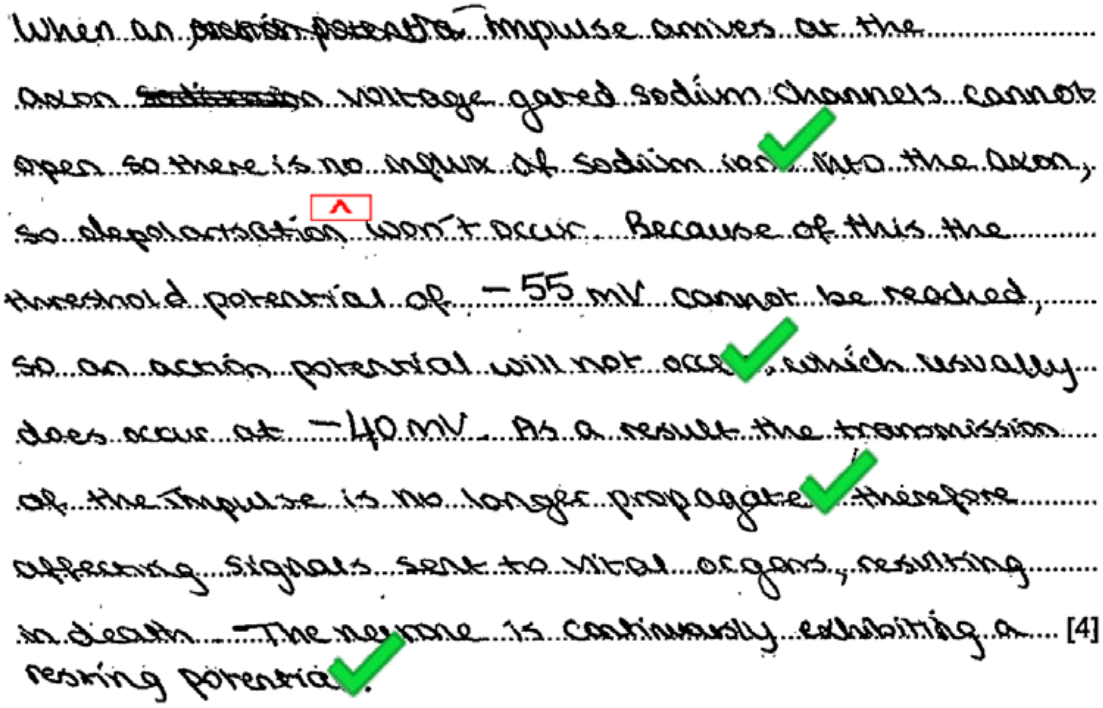
.....

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

Higher ability candidates were able to demonstrate understanding of the transmission of nerve impulses and the consequences of voltage-gated sodium ion channels being unable to open. Responses from lower ability candidates often lacked detail such as not stating that it is the axon **membrane** that is not depolarised. Some responses also showed confusion regarding the concepts.

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Exemplar 5



This exemplar shows an excellent response. The candidate uses terms correctly in applying their knowledge of nerve transmission to this novel context.

Question 21(a)(ii)

(ii) A common cause of death from TTX poisoning is suffocation (not getting enough oxygen) as a result of paralysis of the diaphragm.

Explain how paralysis of the diaphragm could lead to suffocation.

.....

.....

.....

.....

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

Many good responses were seen where candidates gave concise descriptions for all marking points. Some candidates that did not achieve full marks were not specific enough in their statements or made reference to what normally happens during inspiration rather than what happens under the influence of TTX.

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Question 21(a)(iii)

(iii) TTX is also known to reduce the speed of conduction in the Purkyne fibres of the heart.

Suggest and explain what effect this would have on the heart rate.

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.....

.....

.....

.....

.....

.....

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

Many candidates gained credit for suggesting that ventricular systole would slow down which would lead to a decrease in heart rate. In good responses, candidates also suggested that there would be a longer delay between atrial and ventricular systole.

Question 21(b)

(b) Molluscs such as *H. lunulata* have unmyelinated neurones. Saltatory conduction cannot occur in these neurones.

Why is transmission of action potentials along the axon slower in the absence of saltatory conduction?

.....

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

There were few correct responses for this part of the question which was assessing AO2 with many candidates referring to the impulse not being able to jump from node to node, which is a description of saltatory conduction already stated in the stem of the question. Good responses referred to the need for depolarisation to occur along the whole axon (membrane).

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Question 22(a)(i)

22 (a) A scientist used a respirometer to investigate the rate of respiration and photosynthesis of maize in different light intensities.

- The scientist placed ten maize seedlings in a respirometer and kept it in the dark for three hours.
- The respirometer contained soda-lime to remove any CO_2 produced by the seedlings.
- The scientist placed ten maize seedlings in a separate respirometer without soda-lime and placed it in different light intensities for three hours at a time.

Light intensity (lux)	Distance moved by fluid in respirometer (mm)
0	–3.7
1020	–0.8
1510	0.0
1700	1.2
2000	2.9

Table 22.1

(i) The diameter of the capillary tubing was 0.1 mm.

The volume of a cylinder can be calculated using the following formula:
volume of cylinder = $\pi r^2 l$

Calculate the **rate of oxygen uptake** by the seedlings in the dark. Give your answer to **two** significant figures. Show your working.

Answer = ... $mm^3 h^{-1}$ **[3]**

Mathematical skills were being assessed in this part of the question. To achieve all three marks a great deal of processing was required. Candidates had to choose the correct figure from Table 22.1, calculate the radius using the figure given for diameter, substitute their figures into the equation provided and then divide by three to obtain a response in mm^3 per hour. Many candidates were credited with all three marks. Many others gained two marks for a correct calculation because they had not written their response to two significant figures. Some candidates appeared to forget to divide by three and gained one mark, others used the diameter instead of the radius in their calculation which was not credited.

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Question 22(a)(ii)

(ii) 1700 lux is a typical light intensity on a cloudy day in the UK. Calculate the percentage increase in gas production between 1700 and 2000 lux. Show your working.

Answer = ... % **[2]**

A wide range of answers were accepted by examiners to account for responses written as whole numbers, to two significant figures or to a number of decimal places. Many candidates were credited with both marks.

Question 22(b)

(b) The scientist made the following claim:

> These results suggest that, in maize seedlings, the rate of photosynthesis only exceeds the rate of respiration when the light intensity is above 1510 lux.

Use the data in Table 22.1 to explain why the scientist made this claim.

.....

.....

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.....

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

Many candidates demonstrated the ability to use the data in Table 22.1 to describe the results for 1500 lux and conclude from this that the rates of respiration and photosynthesis were equal, thereby gaining both marks.

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Question 23(a)

23 (a) A student looked at slides of different tissues under a light microscope.

The four viewed images are labelled **W**, **X**, **Y** and **Z** in Fig. 23.1, **on the insert**.

Identify tissues **W**, **X** and **Y**.

W .....

X .....

Y .....

[3]

Generally this question was well-answered and it was clear that many candidates had seen images of tissues similar to those shown in Fig. 23.1. Credit could not be given for 'skeletal' or 'muscle' (tissue) for **Y** which were commonly seen incorrect responses. 'Skeletal' could also apply to other types of tissue found in the skeleton e.g. bone, and 'muscle' could also apply to other types of muscle tissue e.g. smooth muscle.

Question 23(b)

(b) The student wrote the following summary about the control of heart rate.

When the heart rate is too low the level of carboxylic acid in the blood becomes higher than normal. The vagus nerve sends action potentials to the AVN to increase the contraction rate of the heart muscle. The baroreceptors in the walls of the blood vessels then detect that the pH of the blood is normal, so heart rate can return to resting.

The endocrine system can also change heart rate. Release of the hormone adrenaline from the adrenal medulla causes the smooth muscle of the heart to contract more frequently.

Identify **and** correct any biological errors in the student's summary.

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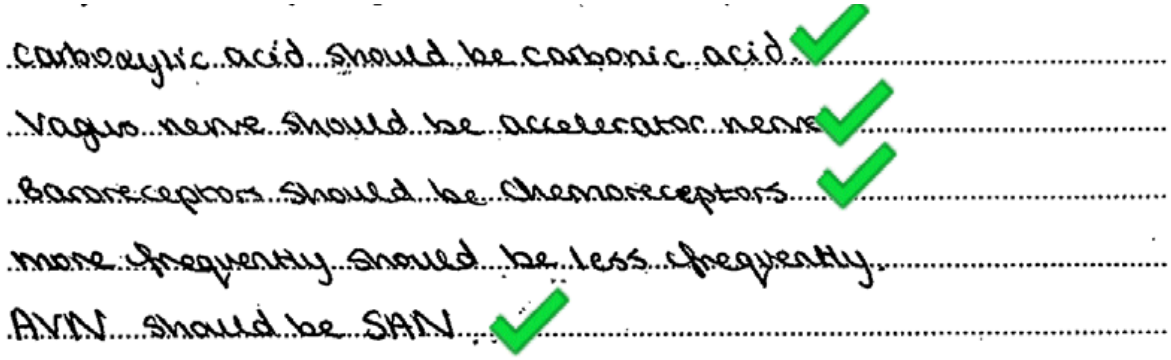
..... **[4]**

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There were some excellent responses where candidates recognised all the errors and suggested suitable corrections. Many candidates knew that baroreceptors detected pressure change or that chemoreceptors detected pH. Many others also recognised that cardiac muscle is found in the heart and not cardiac muscle.

The question presented some problems for lower ability candidates who were not secure in their knowledge about the cardiovascular system. The marking points that were most frequently answered incorrectly were mark points one and three. Candidates often quoted carbon dioxide instead of carbonic acid, and "SAN sends impulse to AVN" instead of impulse sent from nerve to SAN. Some 'errors' were also corrected which were not intended, e.g. changing endocrine to exocrine, adrenaline to noradrenaline and adrenal medulla to adrenal cortex.

Exemplar 6



This is a very concise correct response where the candidate clearly indicates each error followed by the correction. Some candidates rewrote the prose replacing the errors with the correct terms which was also an acceptable way of presenting their response.

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Question 23(c)(i)

(c) Reflex actions are rapid responses that protect the body from harm.

The Moro reflex is found in babies up to five months of age, and occurs when the baby feels its head is suddenly no longer supported. The Moro reflex is made up of the following responses:

- The baby spreads out its arms then brings them together rapidly.
- The baby cries.

(i) Suggest how the Moro reflex helps to prevent harm to a newborn baby.

.....

.....

.....

.....

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

Many candidates deduced that a crying baby would alert a carer or parent to gain one mark, but few responses gained credit for a second mark point. Most candidates misunderstood the arm movement of the Moro reflex with very few recognising that the baby was trying to grasp an object. Many candidates attempted to explain the arm movements by stating that it was to enable the baby to 'hold their neck forward' or 'break their fall'.

Question 23(c)(ii)

(ii) The Moro reflex gradually disappears and usually stops completely after babies reach nine months. Other reflexes develop as children grow older.

Describe a reflex response a 3-year-old child would make to an object moving towards their eyes **and** explain the advantage of this response.

.....

.....

.....

.....

.....

.....

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

Many candidates stated that the child blinked and prevented damage to the eyes so were credited with two marks. Some candidates referred to flinching or raising their arms which was an alternative response to blinking and was also credited. Good responses were seen where candidates knew that this was an example of an involuntary or innate response thereby gaining three marks.

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Section B, Q19, Fig. 19.1

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