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Examiners' report

BIOLOGY A

H420

For first teaching in 2015

H420/03 Autumn 2021 series

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

	Reports for the November 2021 series will provide a broad commentary about candidate performance, with the aim for them to be useful future teaching tools. As an exception for this series they will not contain any questions from the question paper nor examples of candidate responses.

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.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

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Paper 3 series overview

H420/03 is one of the three examination components for GCE Biology A. This component assesses content from across all areas of Biology, and links together the different areas, within different contexts, some practical, some familiar and some novel. To do well on this paper, candidates need to be comfortable applying their knowledge and understanding to unfamiliar contexts and be familiar with a range of practical techniques. They must also be able to analyse, interpret and evaluate ideas and evidence. They need to be able to reach conclusions, develop and refine practical design and procedures. This, together with the fact it relies on learning and applying knowledge from two years of work, has proved a difficult test for some candidates. However, all questions were accessible to candidates, and there seemed to be no time issues with completing the examination. The examination produced a good spread of marks and most candidates attempted all the questions.

Examiners were pleased to see that many candidates used the additional answer spaces provided in the paper, rather than continuing their answers outside the provided lines.

Centres are advised to encourage candidates to spend a little time reading the question and ensuring that they supply information that relates to and answers the question. Even if the science is correct, if it does not answer the question then it will not be given marks.

Candidates who did well on this paper generally did the following:	***Candidates who did less well on this paper generally did the following:***
• showed well developed mathematical skills enabling them to perform complex calculations • produced clear and concise responses for Level of Response questions • had a good practical knowledge, with the ability to understand and apply the information given to the questions being asked • showed the ability to interpret information given in diagrams, tables and graphs and use it to answer related questions • converted between numbers in ordinary and standard form.	• found it difficult to apply what they had learnt to unfamiliar situations, scoring most of their marks on questions involving recall and understanding • produced responses which lacked depth, particularly to practical based questions • produced responses which were often peripheral to what had been asked, sometimes simply repeating information provided • found it difficult to answer mathematical based calculations • found it difficult to use images supplied in the question paper to answer related questions.

Comments on responses by question type

Level of response questions

Both Level of Response questions produced a full range of marks, with many candidates scoring well on both questions. In Q2(a), some candidates mistook cell C for a cell undergoing interphase rather than a cell in prophase. Identifying cell E as a cell undergoing cytokinesis rather than a cell in late telophase, was also seen frequently. The question stem mentions that all three cells are undergoing mitosis, which means that C could not be interphase and E could not be cytokinesis. Cell D was sometimes described as metaphase rather than anaphase, despite the image showing the chromatids separating and being pulled to opposite sides of the cell. Candidates needed to describe in detail the stages in mitosis in all three cells to access Level 3 for 5 or 6 marks.

The second Level of Response Question 3(b) was not answered as well as Q2(a). Candidates were generally confident in describing possible control variables. The difficult part of this question, which required on the spot thinking, was to describe plausible, practical aspects of how callose production could be observed. A lot of candidates overthought this part of the answer and described the use of the Benedict's test for sugars or the Iodine test for starch. Neither would be likely to yield any meaningful data. Candidates who described simpler more relevant ideas (e.g. taking tissue samples from the same place, use of a microscope or appropriate staining) were able to access Level 3 for 5 or 6 marks.

Other

The candidates during this session tended to score better on AO1 questions – demonstrating knowledge and understanding (e.g. Questons1(c)(iv), 3(c), 3(d), 4(b)(ii), 4(c)) than on AO2 – applying knowledge and understanding (e.g. Questions 1(c)(ii),2(b)(ii) or on AO3 – analysing, interpreting, and evaluating scientific information, ideas and evidence (e.g. Questions 2(d)(I), 5(b)).

Question 1

Many candidates could correctly identify the spiracle from the photomicrograph in Q1(a), with fewer candidates identifying B as trachea. A common error was to identify B as a tracheole. In Q1(b)(ii), few candidates could suggest an improvement to the student's method, possibly indicating little hands-on experience of fish anatomy. Removing gills was often stated as an improvement but this was not linked to either removing the operculum first or observing the removed gills using a hand lens or microscope. Most unsuccessful responses for Q1(c)(i) did not understand the relationship between tidal volume, breathing rate and ventilation rate, and there was also some confusion when converting dm^3 to cm^3. Few candidates scored a mark in Q1(c)(ii), with many candidates writing responses with the correct type of ideas but without sufficient detail. For example, many candidates wrote that artificial selection leads to a smaller gene pool, rather than linking this to more inbreeding leading to the smaller gene pool. The rest of Question 1 was generally well answered with most candidates scoring marks.

Question 2

Limited understanding of the cell cycle and the checkpoints in the cell cycle resulted in few candidates scoring full marks in Q2(b)(i) and Q2(b)(ii). The wording in Q2(b)(ii) 'cells with chromosomes that had been replicated despite containing damaged DNA' indicates that the relevant checkpoint is G1 rather than G2. This is because the DNA damage was present before replication in the S phase, but this was not discovered. Few candidates scored full marks in Q2(d)(i) as many candidates were uncertain about the difference between using evidence to evaluate a statement, rather than just describing what the graph showed. Although there was often some attempt to discuss the evidence for and against the statement, many only quoted evidence for their own conclusion either agreeing with the statement or

providing evidence against it. Many candidates did not realise the growth curve had a logarithmic scale for the number of cells in the culture, and so did not realise that the growth curve did have an exponential growth phase present (between day 1 and 2). Many candidates could then not convert the $\log_{10}$ number of cells from the graph to estimate the number of bacterial cells present on day 1 for Q2(d)(ii). Candidates could often not describe a procedure to estimate bacterial population in Q2(d)(iii), with few candidates suggesting the use of serial dilutions or the idea of scaling up the count from a serial dilution. Many candidates correctly suggested growing bacteria on agar plates, but then mistakenly believed that you were counting individual bacteria from these plates, rather than counting the colonies of bacteria.

	AfL	Candidates should be encouraged to set out their working clearly, rather than just writing down final answer in calculations involving multiple steps. This would help candidates to gain 1or 2 marks for correct steps in the calculation even if the final answer is incorrect. Practice at reading logarithmic scales from growth curves and using readings to estimate the number of bacteria grown over a certain length of time would also be useful, as would practice at converting between numbers in standard and ordinary form. See Maths for Biology and Maths skills handbook.

Question 3

Most candidates scored well on this question, showing a good understanding of plant diseases and examples of defences against herbivory. In Q3(a), many candidates recognised that callose was branched and that the alternate glucose molecules were not rotated 180º.Others confused the types of glycosidic bonds found between the monomers in cellulose and callose. Some candidates gave examples of human viral diseases in Q3(c) which did not gain credit. Likewise, the suggestion that insects develop immunity to insecticides in Q3(e) was not credited.

Question 4

Most candidates answered Q4(b)(ii) and Q4(c) well, showing a good understanding of the Krebs cycle and chemiosmosis. Among some candidates, there was some confusion of how the proton gradient is established and few candidates mentioned that energy provided by the flow of protons through ATP synthase is used to join ADP and P_i to form ATP.

Very few candidates scored 2 marks for Q4(a). This question required a candidate to describe performing the Benedict's test for a reducing sugar which would produce a negative result and then repeating the test after boiling with Hydrochloric acid. Boiling with Hydrochloric acid before performing the first Benedict's test would not enable you to differentiate a positive test for a reducing sugar from a positive test for a non – reducing sugar.

Very few candidates understood the meaning of the RQ values in Fig 4.3. Most candidates linked the RQ value to the amount of respiration taking place or the relative amounts of carbon dioxide being released compared to oxygen consumed. Few were able to link the RQ value to the type of respiratory substrate mainly being used at 0W and 50W, although many realised the high RQ value at 250W indicated that anaerobic respiration was taking place.

	AfL	As well as calculating RQ values, encourage candidates to interpret RQ values in terms of types of respiratory substrate being used and whether respiration is aerobic or anaerobic.

Question 5

Most candidates were able to describe the habitat of *D. antarctica* as having lower light levels in Q5(b), although few could suggest reasons for this. Some responses ignored the evidence of the graph and incorrectly focused on temperature differences between the two habitats.

Few candidates scored full marks for the calculation of Spearman's Rank Correlation Coefficient in Q5(c)(i). This was because most squared the absolute differences between the values rather than squaring the differences in rank. The importance of writing down the steps in the calculation was shown by the fact that often candidates gained marks for these steps as error carry forward (ECF). Candidates confused this statistical test with other tests such as the student's t-test or chi squared test, when answering Q5(c)(ii) and Q5(c)(iii). Very few concluded that the value worked out for Q5(c)(i) showed a significant positive correlation and the value given for Q5(c)(ii) would show no significant correlation. Many candidates' answers referred to null hypotheses being accepted or rejected or to there being a significant difference between the water content of soil and the mean rate of photosynthesis. Most candidates could suggest an advantage for Q5(d)(i) and could correctly identify the letter representing fucoxanthin in Q5(d)(ii).

	**AfL**	Give candidates opportunities to select and use the full range of statistical tests, and to interpret the significance of those tests. Mathematical skills statistics booklet Maths Skills Handbook

Common misconceptions

Candidates often thought that interphase and cytokinesis were stages in mitosis in Q2(a).

Candidates often thought that to test for a non- reducing sugar you do not need a negative test for the reducing sugar first in Q4(a).

Key teaching and learning points – comments on improving performance

Candidates often found it difficult at applying their knowledge to new situations. For example, explaining how DNA sequencing could help scientists work out the probability of West Highland Terriers develop CPF.

Candidates could practise more with unknown graphs and diagrams supplied to them. For example, comparing non-standard and standard growth curves.

Candidates found carrying out multiple step calculations difficult.

Candidates did not perform well when describing practical procedures.

Guidance on using this paper as a mock

This paper covers a range of topics from all modules, so if used in its entirety is best used after the content of the specification has been completed. When using this paper as a mock, refer to the guidance in the mark scheme as this gives further explanation of the mark points and examples of what can be accepted as alternative wording for some of those mark points.

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