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Examiners' report

BIOLOGY A

H420

For first teaching in 2015

H420/02 Autumn 2020 series

Version 1

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 Autumn 2020 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 answers.

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 2 series overview

The Biological Diversity paper assesses Modules 1, 2, 4 and 6.

Candidates seemed to find this paper less challenging than in previous sessions and there was no evidence of candidates running out of time. a higher proportion of questions involved single words or selecting answers from a list and most candidates seemed comfortable with this style of question.

To do well on this paper candidates needed to recall key knowledge and apply it in the context of the paper. They also needed to apply their understanding of scientific investigations to the situations covered in the questions. It was important for candidates to read the questions carefully. Candidates also needed to demonstrate effective numerical skills.

Use of key terms was not such an issue as it has been in previous years. However, it is worth highlighting the following:

- The confusion between kingdom and domain, and bacteria and prokaryotes often cost candidates marks in **21(b)**.
- The correct use of carbon dioxide (rather than carbon) and the ability to name the correct nitrogen-containing molecule or ion (as opposed to stating 'nitrogen') was often a source of credit in **20(c)**.

A number of the questions on the paper, **18(a)**, **19**, **20(b)**, **21(b)** and **22**, tested learning outcomes from AS topics and there was evidence that performance on these topics was a little better than the standard seen on Year 12 topics in previous sessions.

Performance was mixed on the practical skills based questions, **16(b)**, **17(a)**, **18(b)(i)**, **21(a)(iii)**, but very few candidates appeared to have practised drawing a line of best fit.

The proportion of questions requiring mathematical skill remained at around 10%, as in all A Level Biology papers. Most candidates coped well with the maths skills questions, but it is worth reminding candidates to show their working as marks can be picked up for correct working even if the final answer is incorrect.

Although the answer spaces provided on the paper are meant to suggest an appropriate length of answer, many candidates find it necessary, perfectly reasonably, to continue their answer beyond the space provided. Examiners were pleased that candidates were indicating when an answer extended onto the additional answer space. However, it was again noted that some centres are unnecessarily supplying additional sheets or answer booklets before candidates had used the additional answer space at the back of the question paper. When candidates' answers need to overrun the provided answer space it is strongly recommended that they use the additional pages at the back where their answer will be seen by examiners.

Candidates who did well on this paper generally did the following:	***Candidates who did less well on this paper generally did the following:***
• read the questions carefully before beginning their answer • used any extra information given when constructing their answer • recalled and used precise key terms correctly	• based their answer on the general idea of the question • ignored extra information • used general rather than precise terms or confused precise terms that have a different meaning

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Themes in candidate responses

It was evident from many responses that candidates had not absorbed all the information they had been given in the question: in **18(b)(iii)** many candidates cited emigration despite this option having been removed by the wording of the question; **19(b)** stated clearly that *Hydra* are animals but close to half of the answers to **19(b)(i)** referred to them as plants. The simple calculation in **19(c)(i)** could only be answered correctly if candidates used all the information that was given, most did not. **21(a)(ii)** encouraged candidates to refer to the graph but many did not.

Moreover, there was a general tendency for candidates to assume unfamiliar organisms were plants: many thought *Hydra* was a plant and most assumed algae were also. Referring to *Hydra* as a plant in a Level of response question (based, presumably on its overall body shape and sessile appearance) is unlikely to have cost many candidates marks but, in **21(b)(i)**, it was impossible to achieve full marks unless the candidate realised that algae are not plants.

In data evaluation questions candidates are often answering with generic ideas such as 'not repeated', 'no control', 'control more variables' or 'do a statistical test'. Such responses did not gain any marks in questions **17(b)(iii)**, **18(a)(ii)** and **21(a)(iii)**. These AO3 questions usually need much more context specific evaluative points to gain any credit.

Comments on responses by question type

Multiple choice questions

Candidates found the multiple choice questions more accessible than in previous sessions.

Candidates did well on questions **1**, **6**, **7**, **10**, **11** and **9**.

In question **4** many candidates thought C was a lymphocyte, despite the lobed nucleus.

Candidates struggled with the multiple-response questions, including many candidates not realising that size can distinguish eukaryotic from prokaryotic cells in question **5**.

In question 12, however, candidates' responses seemed to be random guesses. .

Level of Response questions

Candidates continued to write concise answers to the Level of Response (LoR) questions and very few used the additional pages available for these. Centres appeared to have acted on advice given in previous reports that the answer to a question worth 6 marks should, on average be only twice as long as the answer to a question worth 3 marks. It is still true that responses that continue at length onto additional pages often struggle to retain enough coherence to achieve the upper mark within a given level.

19(b)(i)

Candidates generally found this to be the easier of the two LoR questions on the paper. Encouragingly, many candidates could accurately explain why sexual reproduction leads to genetic variation (crossing over, independent assortment and random fusion of gametes), thus achieving Level 2.A large majority of responses discussed crossing over and independent assortment but many of these ascribed crossing over or independent assortment to the wrong, or the same, phase of meiosis. There was also confusion of key terms: chromatid/chromosome, sister/non-sister, gene/allele. Very few candidates fully answered the question by phrasing their answers in the context of *Hydra* and so responses rarely achieved Level 3.

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20(c)

Most candidates were able to draw out several similarities between the carbon and nitrogen cycles along the lines of the indicative points mentioned on the mark scheme. It was rare for a response to be given no marks. The differences in marks was usually determined by the level of correct detail given about any of the similar aspects of the two cycles. For the award of Level 2, responses needed to have discussed one key similarity in correct detail, for example correctly naming bacteria, inorganic molecules (including gases), organic macromolecules and key processes (such as fixation and decomposition). Many responses achieved Level 2. Only those that discussed multiple points in detail achieved Level 3.

Many identified the fixation process as a similarity, and those that did this usually gave extra detail regarding photosynthesis and nitrogen-fixing bacteria, although incorporation into proteins and nucleic acids was rarely seen. Lower level responses often contained vague references to food chains and feeding. Decomposition was frequently quoted as a similarity but only a minority of responses correctly referenced ammonium ions as the molecule released in this step of the nitrogen cycle. Many lower level responses confused decomposition with denitrification.

The question discriminated well both between and within the levels. The lower mark in Levels 3 and 2 was given relatively often, usually because of confusion about processes and the order in which they were discussed or inclusion of irrelevant material. Commonly seen irrelevant topics included *differences* between the carbon and nitrogen cycle, details about the *function* of nitrogen compounds in organisms and details of the Haber process.

Presenting results

17(b)(ii)

Few candidates were able to correctly draw a line of best bit. Almost half of candidates drew a straight line and many of the others extrapolated beyond the points on the graph. Candidates should refer to the OCR Practical Skills Handbook for guidance on drawing a line of best fit.

i	**OCR support**	Practical skills handbook: https://www.ocr.org.uk/Images/294468-biology-practical-skills-handbook.pdf

18(b)(i)

Most candidates coped well with this question and a large minority achieved full marks. Virtually all candidates drew a bar chart. The most common errors were not labelling the x-axis 'phenotype' and drawing the tongue-rolling and non-tongue-rolling bars touching.

Calculations

17(b)(i)

Most candidates successfully read the enzyme activity for both enzymes from the graph and used the figures correctly to calculate how many times larger one was than the other. A significant minority of candidates did not record their answer to two significant figures as directed by the question. The most common incorrect responses appeared to be calculating a percentage change.

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18(a)(i)

This was usually well answered. All the numbers the candidates were given in the question had two significant figures and the calculated answer for species A was given as two significant figures. Responses that gave answers to more than two significant figures were not given both marks.

18(b)(ii)

Many candidates struggled to apply the Hardy-Weinberg formulae. Where the final answer was incorrect, marks were frequently given for working out. However, it was evident from the working that many candidates had confused q and q^2. It was easier for candidates to be given working marks if the steps in their working were clearly set out in the space provided.

21(a)(i)

Percentage change calculations come up regularly in A Level Biology and most candidates coped well with the calculation, getting an answer within the acceptable range. However, it is unrealistic to use figures from the graph with a precision higher than three significant figures, so it is not appropriate to quote an answer with more than three significant figures. A significant minority of candidates quoted answers with too many significant figures and, hence, were given only one mark.

Interpreting data

17(b)(iii)

Most candidates were able to offer some explanation as to why the data in the graph did not support the conclusion. Around a third noted that pH 5.8, or a closer value, was not (or should have been) tested and slightly more discussed that the optimum pH could be anywhere within a given range for the free and immobilised tannase. A number of candidates stated that the investigation ought to be repeated or that some variable might not have been controlled. Such generic responses were not credited. Marking point 5, which was correct in the context of this question, was rarely credited and marking point 6 was not seen by examiners.

18(a)(ii)

Most responses achieved one mark, invariably for a version of the first marking point. Most candidates were able to give some indication that the evidence they were offering was intended to support the given conclusion but a few simply stated the evidence without any link to the conclusion and did not get a mark. Only around half of responses discussed ways in which the data did not support the conclusion but most of these cited a perceived small sample size, despite there being no data about sample size, or an unequal *number* of gene loci. Marking points 2 to 5 were seen only sporadically.

21(a)(ii)

Almost all candidates knew what a dynamic ecosystem was but few used data from the graph to back up their answer and even fewer gave figures with units.

21(a)(iii)

Three marks were available for discussing weaknesse*s* in the student's conclusion but most candidates picked a single weakness, usually the apparently contradictory 'dip' in the summer, and discussed it at length. Marking points 1 or 2 were seen in fewer than a quarter of responses. Marking point 4 was given occasionally but candidates often referred vaguely to 'a factor' causing 'the changes', as opposed to a more specific factor causing an increase.

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Drawing conclusions

21(b)(i)

This question differentiated well between candidates. Candidates understood the instruction about how to structure responses and often gained several marks for explaining why certain kingdoms could be dismissed. However, few candidates achieved full marks because most stated that algae were plants. Some candidates lost marks for using 'bacteria', in place of 'prokaryote' and the less successful responses showed confusion between kingdoms and domains.

21(b)(ii)

Few candidates gained this mark, perhaps not appreciating the significance of 'strong' and 'kingdom', in the question. Many responses referred to lifestyle adaptations, or evidence that is used to distinguish between domains.

Other

16(a)

Just over half of candidates achieved all 5 marks for this gap fill about the genetic control of body plan in multicellular organisms. The main errors were stating that transcription factors bind to ribosomes, rather than DNA, and that kingdoms were domains or phyla. Occasionally candidates misnamed transcription factors as regulator factors.

16(b)

Most candidates achieved one mark for each part of this question. Most often for a version of the first or second marking points in part **(i)** or the second marking point in part **(ii).** A significant minority of candidates gained a second mark, often for suggesting that fruit fly genetics or body parts were relatively simple or that mice more closely resembled humans. A significant minority of responses implied that candidates imagined that the animals used for such investigations are routinely collected by scientists from the wild and, hence, relative abundance (or public dislike) might me a significant driver in species selection. The last two marking points in part **(ii)** were never seen by examiners. A minority of candidates thought that DNA would be visible as fruit flies are small.

17(a)

Most candidates achieved a mark here.

17(b)(iv)

Most responses achieved one mark, usually for a version of the first marking point. The other marking points were seen, but rarely.

17(c)(i)

Many candidates achieved both marks, most often for suggesting that the product would not be contaminated with enzyme, so purification was not needed and so enzymes could be reused. A few candidates expressed the potential advantages that an immobilised enzyme being able to operate over a range of temperatures might provide well enough to be given the fourth marking point. Very few candidates were given the final marking point. Responses that stated that immobilised enzymes were, 'cheap', 'more efficient' or 'more active', without further explanation, were not credited.

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17(c)(ii)

Almost half of responses achieved a mark here, most often for referring to high set-up costs. A small number gained credit by discussing that some active sites might be hidden or that their shape might be distorted. The final marking point was rarely seen.

18(b)(iii)

Responses to this question were mixed. The two most common correct answers were about the population not being large enough and the possibility of mutations. Despite the question stem guiding candidates not to discuss emigration/immigration, many did.

19(a)(i)

This straightforward question was mostly answered correctly. A number of candidates incorrectly included 'interphase' or 'cytokinesis' in their list of names.

19(a)(ii)

Most candidates achieved at least one mark. The first two marking points were most commonly given. The third marking point was given less often; many candidates discussed the favourable conditions present in the summer, but they did not explain that the (genetically identical) offspring would therefore also find these conditions favourable.

19(b)(ii)

Many candidates described why conditions in winter might be harsh for *Hydra*. However, they did not then explain why this might lead to sexual reproduction (because some of the genetically variable offspring might survive). Several candidates stated that eggs can lie dormant to survive the winter, but this alone did not achieve the mark as the information was stated in the question.

19(c)(i)

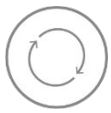
The mathematical demands of this question were not high but the correct answer of 224 was rarely seen. Many candidates suggested 112 (which was the correct chromatid number) and if these candidates had then used the information given in the question (that a single DNA molecule contains two strands), they would have reached the correct answer (112 x 2 = 224).

19(c)(ii)

This mark was rarely given.

?	**Misconception**	The question told candidates that the sporophyte is diploid and the gametophyte is haploid; so meiosis must occur somewhere between these two stages. The candidates were also told that the spores grow into a gametophyte. Candidates ought to know that growth occurs by mitosis so this means that the spores must have the same chromosome number as the gametophyte, in other words. they must also be haploid. Meiosis must, therefore, have occurred between sporophyte and spores. Many candidates incorrectly placed a cross where sperm and egg were being formed, presumably not appreciating that many organisms are very different from mammals and that gametes are not always formed by meiosis.

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	**AfL**	When teaching mitosis and meiosis, the use of unfamiliar organisms whose life cycle is very different from humans, e.g. bees, ferns and seaweed can be helpful.

19(c)(iii)

This question was well answered with most candidates scoring 2 marks. Both pairs of marking points were regularly suggested by candidates.

Key point call out

It has been said on many occasions previously, but 'making energy' will not be credited as it contravenes a law of physics!

20(a)(i)

Most candidates achieved 2 marks on this question.

'Decomposition' was the most common incorrect answer for both A and F.

20(a)(ii)

Most candidates achieved the mark. The most frequent incorrect response cited increased respiration in the winter.

20(b)(i)

Most responses gained one or 2 marks on this question. It was very rare to award three. Monomer / polymer and monosaccharide / polysaccharide were the most common correct responses. Correct reference to the presence or absence of glycosidic bonds was also seen regularly. References to branching and 1-6 glycosidic bonds were commonly seen but not credited. Many candidates compared properties, such as solubility or respiratory potential, rather than making structural comparisons as directed.

20(b)(ii)

A little over half of candidates gained this mark. 'Phosphorus' was seen in around a quarter of scripts and a minority gave answers that were not elements, such as 'R-groups'.

22(a)

Almost all candidates correctly wrote letters, rather than names. However, most candidates found these questions challenging. The most common misconceptions were that platelets do not form part of a physical barrier and that lymphocytes are involved in phagocytosis. Many candidates thought skin was a tissue. Most candidates did not achieve the second marking point because their answer did not specify that the cells that make up a tissue were similar or few in variety.

22(b)

Most candidates achieved one mark here, correct responses for both chemicals were seen regularly. Fewer than a quarter of candidates achieved both marks.

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22(b)(i)

Only a minority of candidates achieved this mark.

22(c)(ii)

The mark scheme for this question tested understanding of the process rather than attaching names to definitions. Most responses discussed the absence of antibody production and most, gained a mark for this but some did not express clearly that it was the patients who were not producing the antibodies. Few responses stated or described the process of injecting the plasma.

Common misconceptions

Many candidates seemed to think that the fruit flies and mice used for investigations are continually collected from the wild, or even that the scientists themselves are going out armed with nets and traps! Students should appreciate that such animals are selectively bred for the purpose of investigations and their use does not impact on wild populations.

It has already been mentioned above, but candidates struggled with the concept of gametes being produced by mitosis. Many also could not reconcile a sessile organism with a diffuse body plan that was not a plant, or that a unicellular organism with a chloroplast is not a plant.

Key teaching and learning points – comments on improving performance

Many candidates were choosing an appropriate number of significant figures with which to quote their answers, but some gave answers to an unrealistic level of precision. It is worth noting that answers given to more significant figures than the numbers given in the question do not always receive full credit.

	**OCR support**	Additional support with maths skills can be found in the Maths skills handbook: https://www.ocr.org.uk/Images/294471-biology-mathematical-skills-handbook.pdf

An unusually small number of candidates used figures from the graph to support their answer to **21(a)(ii)**. Even fewer gave these figures with units. Although only worth 1 mark on this paper, the skill of describing tables and graphs is tested regularly. Candidates ought to be reminded to support their statements with figures accompanied by the correct units.

Guidance on using this paper as a mock

Examiners found this paper relatively straightforward to mark using the published mark scheme. Some points to note are as follows:

16(b)(i): 'large number of offspring' is not quite good enough for marking point 2.

17(b)(iii): Many candidates state that there could be a *range* (between given pHs) of optimum temperatures. This sort of response gets neither marking point 2 or 3.

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18(a)(ii): For marking point 1, some suggestion of the evidence supporting the conclusion is needed. Merely stating '0.41 in species B is higher than 0.35 in species A' is not enough. However, support is implied if '0.41 in species B is higher than 0.35 in species A' is followed by a 'but'.

18(b)(ii): The additional guidance for working means that 'q = 77 / 248 = 0.31' (which is a common response) gets a working mark – the lack of a square can be ignored because the other half of the equation is correct.

19(a)(ii): 'interphase, prophase, metaphase, anaphase, telophase and cytokinesis' gets one mark.

19(b)(i) and 20(c): It is difficult to be credited with detail if anything in a given strand of candidate information is clearly incorrect.

21(a)(ii): Almost any contextual discussion of change gets a mark. For example, 'the population changes' = 1 mark; 'there are changes in population as you move down the river' = no mark (wrong context).

22(c)(ii): Any named type of immunity given to the answer does not need to be correct (that has been tested in part **(i)**). For example, 'it is active because it has been injected' (however unlikely) is worth the first marking point.

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