GCE

Biology B (Advancing Biology)

Advanced Subsidiary GCE **AS H022**

OCR Report to Centres June 2016

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Advanced Subsidiary GCE Biology B (Advancing Biology (H022))

OCR REPORT TO CENTRES

H022/01 Foundations of biology

General Comments:

This was the first paper presented to candidates following the introduction of the new specification for Biology. AS level Biology B (Advancing Biology) offers a context-based approach to learning with a range of topics assessed across two papers. For H022/01 candidates needed to demonstrate 'breadth' of learning across the whole AS specification. Mathematical and practical skills were embedded within both the multiple choice questions in section **A** and the longer responses required in section **B**. This question paper appeared to be accessible to candidates across the ability range, although there was some evidence to suggest that candidates struggled for time towards the end of the paper. This is possibly due to the fact that candidates were experiencing the multiple choice section for the first time and spent longer than advised on this part of the examination.

Overall, candidates demonstrated a wide range of ability with stronger candidates applying their knowledge to new situations to gain higher level marking points and weaker candidates displaying their ability to learn and recall facts. Centres are encouraged to explain to candidates the need to write legibly as in some instances, responses proved difficult to read.

A significant number of candidates used the additional pages at the end of the paper to complete their responses and examiners would recommend that candidates clearly state the number of the question that their additional response refers to. It would also be helpful if candidates noted the intention to continue their response on the additional pages to guide the examiner to the continuation of their response.

Comments on Individual Questions:

<u>Section A</u>
This section of the paper consisted of 20 multiple choice questions covering a range of topics across the breadth of the new AS Biology B specification. It is therefore important that candidates are fully prepared and ensure thorough revision of the whole AS specification for this examination. Some of the questions were straightforward recall whilst others required the use of mathematical and/or analytical skills; some questions needed more time than others.

Whilst the majority of these questions were attempted, some candidates chose to omit rather than guess a response. Candidates had been advised to spend no longer than 25 minutes on this section so omissions could have been due to timing issues whereby candidates had considered returning to this section later in the examination session, but did not have time to do so.

Candidates should be aware that the answers should be written clearly, without ambiguity. If they change their minds about an answer then it should be crossed out and the intended answer written clearly. When letters are altered, the candidate's intention is frequently unclear and if there is doubt then the mark is not awarded.

Section **A** achieved a good spread of marks with stronger candidates able to demonstrate knowledge of the subject content without being distracted by the alternative options offered alongside the correct response.

Question 1
Although the word genome may have distracted some candidates, this was a straightforward recall question to start the paper.

Question 2
The majority of candidates were aware of the correct sequence for taxonomic classification and could apply this correctly to the new situation. It was answered correctly by a high proportion of candidates.

Question 3
This question was basic recall and had straightforward options with just the four types of immunity to choose from. However, the correct response was only achieved by just over 50% of candidates.

Question 4
There was a requirement to apply a mathematical equation in this question to calculate heart rate. Some candidates found this difficult and it is possible that the missing value in the pie chart distracted them from the simple manipulation of the formula for the calculation.

Question 5
For candidates that understood that a high value for Simpson's Biodiversity Index would be the most appropriate choice for the question asked, they then had to the choose the highest value between 0 and 1, option **B** being the correct response. The majority of candidates incorrectly offered option **D** as their response to this question. It is likely that this distractor highlighted a misunderstanding of the fact that it had to be a value between 0 and 1.

Question 6
Options **A** and **D** were the two most common responses seen as the majority of candidates had correctly identified that the rate of diffusion would increase with increasing concentration gradient. However, only a small number of candidates offered the correct response so it proved to be a challenging question.

Question 7
This should have been fairly straightforward for candidates who could recall the stages of meiosis and put them in the correct order. However, many candidates incorrectly suggested option **A**, possibly as they had failed to notice that three of the diagrams showed meiosis I whilst diagram 4 was demonstrating meiosis II so needed to be last in the order.

Question 8
Candidates with a good understanding of the formation of a disaccharide by a condensation reaction could identify the correct formula for lactose. Some candidates simply added together the formulae of the two monosaccharides without removing the molecule of water from the total thereby giving option **B** as an incorrect response.

Question 9
Candidates did have to process some information from a table in this question and choose appropriate values to perform a simple calculation. A significant number of candidates, either chose the incorrect values to use, or were unable to perform the calculation correctly.

Question 10
This question was straightforward recall and the majority of candidates chose the correct response.

Question 11
This question proved challenging for some and required careful reading to choose the most appropriate response for the role of phosphatidylserine in apoptosis.

Question 12
This question highlighted the challenges that many candidates have with percentage increase

calculations. Provided they read the correct data from the graph and used the correct mathematical formula the response should have been straightforward.

Question 13
Candidates had a lot of information to process in this question. They not only had to put the statements about water transport in plants in the correct order, they also had to eliminate statements that were not relevant. It was not unexpected that candidates found this to be a challenging question.

Question 14
This is another instance where the question should be read carefully with option **B** offering the only possible correct response.

Question 15
Another question where there was a lot of information for candidates to process, which then also required a calculation. Despite the calculation being fairly straightforward, extracting the required information from the diagram, not surprisingly, proved challenging.

Question 16
This was a straightforward question about the organelles involved in the synthesis of antibodies. Many candidates knew that antibodies were protein molecules but then were unsure of the order of movement through the organelles during protein synthesis. Option **C** was the most common incorrect response, suggesting confusion in the sequence for ribosomes and endoplasmic reticulum.

Question 17
Many candidates correctly read the ECG trace and spotted the timescale leading them to option **D** as the correct response.

Question 18
The majority of candidates chose the correct option for this question.

Question 19
This was a tough mathematical challenge at the end of this section and there were some omissions. Switching between units of volume i.e. mm^3 and cm^3 and expressing numbers as 'powers of 10' proved difficult for many candidates.

Question 20
A straightforward recall question completed this section, although some candidates confused Klinefelter's with Turner's syndrome.

Section B

There was some evidence that candidates had spent longer than advised on section **A** and therefore there were a number of 'no responses' seen towards the end of this section in **Q25** and **Q26**.

Question 21
This question addressed **AO3** with a practical theme aimed at assessing the ability of candidates to apply practical experience to a situation involving the osmosis of erythrocytes. A coloured insert was supplied to candidates to provide visual results and context for the question parts. Centres are encouraged to allow candidates to undertake the practical components of the specification where possible as it is important that candidates continue to appreciate the procedures detailed in the specification. As Centres become more familiar with the new

specification, it is hoped that candidates will become more confident in applying their knowledge in a practical-based context.

Q21(a) A significant number of candidates failed to grasp the concept of this osmosis practical. Test tube B, on the insert, showed that haemolysis had taken place (described in the question stem) and candidates were required to explain how water had entered the cells by osmosis which caused the plasma membranes to rupture. Candidates who realised this generally gained both marking points, but many responses were too vague to gain credit or simply stated that haemolysis had occurred without offering an explanation.

The most common correct response in **Q21(b)** was that 'it gave time for haemolysis to occur'. A common misconception among candidates was that a reaction was involved in this process which could not be credited.

Q21(c) was generally well answered with many candidates confidently referring to 'quantitative' and 'qualitative' in their responses, demonstrating knowledge of the use of a colorimeter.

Candidates achieved marks on **Q21(d)(i)** by describing the differences in absorbance as concentration increased, with few candidates opting to suggest what was happening with regards to haemolysis. Some candidates considered that the changes in absorbance were either 'quicker' or 'slower' which was incorrect. Centres are advised to encourage candidates to practice looking at graphs or tables of data and making comparative statements to describe the relationships or conclusions drawn from the data. This is where candidates could pick up what are relatively easy marks for a straight forward description or comparison.
Q21(d)(ii) proved challenging. Stronger candidates understood the idea that the missing data was important to be able to determine the point (concentration) at which haemolysis occurred.

Question 22
AO1 and **AO2** were addressed in this question which had a plant theme in an evolutionary context.

In **Q22(a)(i),** the majority of candidates were able to correctly identify **S** as the point at which xylem and phloem tissues would appear on the phylogenetic tree and were also able to suggest a suitable adaptation in **Q22(a)(ii)** that would have enabled primitive plants to live on land; with *'development of roots'* being the most common correct response.

In **Q22(a)(iii),** some candidates understood that as plants evolved they would need a transport system as they would become too large/multicellular, or would have a lower SA:V ratio. However, many responses did not portray this idea and credit was not given for statements such as, '*it would be needed to transport nutrients'.*

It appeared that candidates did not understand the 'role of a sink' in **Q22(b),** and few candidates achieved full marks. It is important that candidates read questions carefully as many candidates spent time describing other details such as the role of the source or the mechanism of translocation rather than answering the actual question.

Question 23
This question addressed both **AO1** and **AO2**. The candidates' knowledge of the concepts surrounding antibodies and protein synthesis were being examined in the novel context of the disease, Listeriosis.

Q23(a)(i) required candidates to provide meanings for two of the terms from the specification and whilst a good number of candidates could explain the meaning of *phagocytosis*, the term *opsonin* proved more challenging. Alternative wording was used to credit good responses, but in cases where the full meaning of the term was not provided, marks were not awarded. For candidates who spotted the trigger for **Q23(a)(ii)**, i.e. production of proteins in mammalian cells,

this was a fairly straightforward question and there were some good responses demonstrating clear understanding of how proteins are produced and transported within the mammalian cell as opposed to a bacterial (prokaryotic) cell. However, there were a few 'no responses' seen for this part of the question and it is possible that some candidates failed to take on board the context or did not understand that protein synthesis would be different in bacterial cells as they did not have organelles.

The diagram of the antibody in **Q23(b)** would not have been familiar to candidates but the question was straightforward in asking candidates to recall three labelled parts of the antibody and describe their function. Whilst many candidates could identify **X**, **Y** and **Z**, few were able to consolidate their responses by providing the function for each which was required to gain full credit. Candidates did not receive credit for stating that the hinge region (**Z**) '*allowed the antibody to move*' unless they had clarified that this would then enable it to attach to more than one antigen. The preferred wording here was 'flex' rather than 'move'.

In **Q23(c)** examiners were pleased to see a number of candidates clearly referring to ELISA tests in their responses and whilst not a learning outcome on the specification, descriptions of such techniques were credited as examples of extended reading on this topic. Reference to flow cytometry was rarely seen, but candidates were able to gain marks in other ways by outlining detail such as antibodies binding to p60 or the bacterial antigens.

Question 24
This question addressed mainly **AO1** and **AO2**. Candidates were required to demonstrate their mathematical skills by performing a percentage decrease calculation.

Q24(a) was well answered and many candidates were able to describe the meaning of the term '*chronic disease*'.

In **Q24(b)(i)** most of the correct responses were those in which candidates had described the meaning of a multipotent cell. Some misconceptions were evident, such as the idea that a multipotent cell could differentiate into <u>any</u> type of cell, which could not be credited. **Q24(b)(ii)** was a straightforward question in which candidates were simply asked to compare an image of two abnormal chromosomes with what they would expect to see in an image of normal chromosomes. Candidates need to ensure that they clearly describe their observations to avoid ambiguity.

Examiners reported that many candidates appeared confident in recognising that the technique in **Q24(b)(iii)** was karyotyping, but descriptions were sometimes too vague to gain further credit.

Good responses to **Q24(c)** demonstrated an understanding that a phase 3 trial would need a larger number of participants and that these participants would have the disease thereby gaining both marks.

Most candidates attempted the calculation in **Q24(d)(i)** and there were few 'no responses'. It was noted that candidates who correctly performed the calculation also gave their response to three significant figures as requested.

To gain credit for **Q24(d)(ii)**, it was important for candidates to comment on the scales for **both** x and y axes. It was also important for candidates to have the idea that the different scales were needed to present all the data because of large differences between the two patients e.g. patient G had a <u>*much*</u> higher blast count.

Question 25
In this question **AO2** and **AO3** were being tested and as in **Q21**, candidates were required to draw on practical experience. There was also a standard deviation calculation but this was well scaffolded and accessible to candidates across the ability range.

In **Q25(a)**, many candidates could offer a suggestion as to why 'age' was an unsuitable factor for investigation but few went on to do the same for 'environmental temperature'. Both were needed for one mark.

Q25(b)(i) and **(b)(ii)** were generally well answered by the majority of candidates.

The scaffolding provided for the standard deviation calculation in **Q25(b)(iii)** enabled the majority of candidates to score at least one mark. However, it was a concern that some candidates placed a negative sign in front of a squared number e.g. -7^2 became -49 which was not credited. An inappropriate number of decimal places were also not credited but this was only penalised once which meant that candidates could gain credit for responses further in the calculation. Some candidates failed to include the first row in their calculation but once again 'error carried forward' was applied which enabled them to gain marks despite this initial error. Stronger candidates had the clear idea that some heart rates were more than one standard deviation from the mean with some candidates showing evidence that they had calculated the mean heart rate at 66bpm to answer **Q25(b)(iv)**. However, there were misconceptions with the meaning of standard deviation evident; the most common being that one SD meant that it should be equal to 1.

Question 26
This question provided a straightforward end to the question paper with short answers involving **AO1** recall or straightforward **AO2** 'suggest' style questions. Timing issues were the most likely cause of 'no responses' for some of the question parts.

There were few correct responses to **Q26(a)(i)**. The label line on the diagram was indicating the <u>lumen</u> of the blood vessel which was required to gain the mark point.

Q26(a)(ii) required knowledge of the different types of epithelial cell present in the respiratory system and good responses gave either '*lack of cilia'* or '*flattened, thin cells'* as a difference for squamous epithelial cells.

There were some confident responses seen for **Q26(a)(iii)** when describing the roles of elastic tissue and smooth muscle in the bronchioles. However, there is still some confusion over the correct terms to use and some candidates confused 'expand' with 'relax' or 'contract' with 'stretch'. There was also some ambiguity as to the 'stretching of the bronchioles' which could suggest that the bronchioles were lengthening rather than the lumen of the bronchiole being widened.

Q26(b) was accessible to the ability range with *'trachea'* and *'needed for support or to prevent collapse'* being the most common correct responses.

Candidates needed to apply their knowledge of HIV as a retrovirus to this question about the RS virus in **Q26(c)**. Many candidates were able to suggest RNA for **(c)(i)** but fewer candidates went on to suggest a correct response for the problem of developing a vaccine for the virus in **(c)(ii)**.

H022/02 Biology in depth

General Comments

The calculations proved challenging for many candidates.

The following are points that should be clarified when teaching this unit: structure and strengthen are rarely enough on their own to gain marks when describing a function; heart strings are not real anatomical structures.

Candidates should also practice writing balanced answers to questions that require longer, more developed answers such as the level of response questions.

Comments on Individual Questions

Question 1 asked candidates to describe the roles of three structures in a plant cell and carry out a magnification calculation. Candidates were then asked about an investigation into transpiration and mechanism of stomatal opening.

The question tested **AO1**, **AO2** and **AO3**.

Many candidates found **Q1(a)** difficult. Some candidates named the cell structures and others wrote functions for wrongly identified organelles usually mitochondria for chloroplast or the production of ATP and nucleus for nucleolus or general references to the storage of genetic material. Candidates often lost the mark for cell wall for referring to structure or strength neither of which were enough to gain the mark. **Q1(b)(i)** was a straightforward magnification calculation but many candidates did not score any marks. Not all candidates showed their working contrary to the instructions given in the question. It is worth pointing out that there was evidence that a lot of candidates used the IAM formula but most were not able to interpret the answers correctly, they clearly didn't really understand the formula and were not able to appreciate how unlikely it was that some of the answers they obtained were correct. Many candidates forgot to multiply by 10 and therefore lost a mark. More candidates gained marks in **Q1(b)(ii)**, often thanks to an error carried forward from the previous question. However, the comments made about **(b)(i)** could equally apply here. Not as many candidates got **Q1(c)(i)** correct as they should have done, as candidates often incorrectly stated water loss by transpiration. The most common correct response in **(c)(ii)** was wind and to carry out the investigation with closed windows and doors. Candidates who mentioned leaves often did not mention surface area or gave the control simply as the amount of leaves. There were many incorrect responses referring to time of day and light intensity. The most common correct answer in **Q1(d)** was about plants not losing too much water, with many candidates talking about deserts being dry and plants dehydrating. Very few attempted an explanation of the mechanism of guard cell opening and of those that did, quite a few failed to name the ion used as potassium. Candidates who wrote about the cells swelling often gave no further detail such as the unequal thickness of the cell wall or bending of the cell.

Question 2 asked candidates how amino acids and proteins could be identified and included a chromatography calculation. A new style level of response question asked candidates to explain the movement of amino acids into muscle cells and their use in protein synthesis.

The question tested **AO1**, **AO2** and **AO3**.

Many candidates scored highly in **Q2(c)(i)** and correctly got all three mark points. The candidates that didn't had tended to guess from the rf values and spots that the answer was tyrosine and did not get the mark point for the calculation. Many candidates incorrectly wrote

about repeating the test or doing them on separate papers as a reference for **Q2(c)ii**. Quite a few candidates suggested using a different solvent but found it hard to justify this and get the second mark. The most common level achieved in **Q2(d)** was two, with many candidates getting three to four marks. This was often due to the fact that students wrote a lot about protein synthesis and very little, correct, information about the transport of amino acids to the muscle cell. Very few candidates wrote enough to justify levels five or six being awarded.

Question 3 asked candidates to identify two structures of the heart and the techniques required to produce good scientific drawings. Candidates were told about the condition known as atrial septal defect and then asked to suggest the reason for the increased cardiac output and why muscle cells fatigue more easily. Candidates were then asked to complete a drawing of a healthy artery.

The question tested **AO1**, **AO2** and **AO3**.

Quite a few students lost a mark for **Q3(a)(i)** by incorrectly stating right or left for either the valve or the chamber. The most common incorrect responses were atria and semi lunar valve. It should be noted that heart strings are not actual anatomical structures. There was a wide range of responses for **Q3(a)(ii)** with some candidates obviously well trained in scientific drawing while others didn't directly address the question, suggesting that other structures should be included or the heart should be looked at from different angles. Very few candidates stated increased stroke volume for **Q3(b)(i)**:those that did get the mark usually got it for a description of more blood leaving the heart. Candidates often lost marks in **(b)(ii)** for referring to less blood or oxygen to the body in general rather than muscles. Oxygen supply was often not considered. Generally, **Q3(c)** was well answered with students drawing correctly and labelling at least two correctly less often.

Question 4 required a knowledge of the immune system and microbiology and included a data analysis question. Candidates were asked about testing the effectiveness of antibiotics and the steps that need to be taken to ensure aseptic conditions. Candidates were then asked to explain the reaction to the Mantoux test and calculate a percentage decrease in cases of antibiotic resistance with decreased use of antibiotics. Candidates were then asked to evaluate the conclusion made by scientists using the graphical data provided.

The question tested both **AO1**, **AO2** and **AO3**.

Many candidates were able to state that gram negative bacteria were more resistant but not why and so only got one mark in **Q4(a)**. Zone of inhibition is not fully understood by a lot of candidates. Most candidates got **Q4(b)(i)** correct and many candidates answered **(b)(ii)** in a way that suggested that they have carried out the practical work and discussed aseptic techniques a lot. However, three marks was rarely achieved because candidates were giving three general laboratory rules from the first mark point or candidates were writing too generally about tools or equipment being sterilised and not slides or loops. Many candidates correctly stated swelling and/or inflammation for **Q4(c)** with the more capable candidates describing an immune response to the presence of an antigen, although quite a few candidates lost this mark for not referring to antigens. Histamine was often stated but the consequences rarely described. The calculation in **Q4(d)(i)** was well answered by many candidates but there were a lot of candidates that clearly did not understand how to calculate a percentage decrease. Less capable candidates discussed the trends on the graph for **(d)(ii)** with no reference to data, which suggests an issue with training candidates to read the question and practice different question types. Very few candidates got the data quote mark point as they missed out some part or incorrectly read some values. A few candidates did not interpret the data correctly, quoting figures for number of prescriptions such as 450,000 rather than 450 per 1000 people. The range of years quoted often covered many years with peaks and troughs so marks could not be awarded.

Question 5 asked about the consequences of a faulty checkpoint in the cell cycle and using body imaging techniques to detect the presence of tumours. There was also another level of response question that asked candidates to discuss the ethical and economic considerations that might be taken into account when screening for inherited forms of cancer.

The question tested both **AO1** and **AO2**.

Some candidates had clearly not read the question properly for **Q5(a)** and wrote about what the G2 checkpoint does in general and didn't go as far as thinking about what would happen if it was faulty. Almost all candidates could state at least one imaging technique for **Q5(b)** and many candidates got three. The most common level achieved in **Q5(c)** was two or three with only a few candidates scoring five or six marks. This was often due to the fact that candidates wrote a lot about ethics and very little about economics. The most common, and often only, economic statement was that it would be expensive to test all babies. A few candidates wrote about the ethical issues with abortions which were not relevant when the question was about screening babies.

Question 6 asked candidates about the different stages of mitosis and meiosis and then finished off with a question about genetic bar coding.

The question tested **AO1**, **AO2** and **AO3**.

Few candidates scored four marks, it was probably most common to see one or two correct rows in the table for **Q6(a)**. This suggests that candidates are generally not very confident with what happens during the different stages of the types of cell division. The first row was most often correct and the last row the most often incorrect. Candidates often mixed up meiosis and mitosis and answered the question with statements referring to asexual reproduction and the production of genetically identical cells for growth or repair. A lot of candidates were not reading the question again in **Q6(c)(i)** and suggested a tissue or part of plant instead of a cellular structure. Those that did put cellular structures quite frequently put ribosome or nucleolus. The candidates that achieved marks for **(c)** often got an advantage but very few candidates got a disadvantage, with many just putting expensive without qualification.

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