GCE

Biology A

Advanced GCE **H420**

OCR Report to Centres June 2017

About this Examiner Report to Centres

This report on the 2017 Summer assessments aims to highlight:

- areas where students were more successful
- main areas where students may need additional support and some reflection
- points of advice for future examinations

It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

The report also includes:

- An invitation to get involved in Cambridge Assessment's research into **how current reforms are affecting schools and colleges**
- Links to important documents such as **grade boundaries**
- A reminder of our **post-results services** including Enquiries About Results
- **Further support that you can expect from OCR**, such as our Active Results service and CPD programme
- A link to our handy Teacher Guide on **Supporting the move to linear assessment** to support you with the ongoing transition

Understanding how current reforms are affecting schools and colleges
Researchers at Cambridge Assessment[1] are undertaking a research study to better understand how the current reforms to AS and A levels are affecting schools and colleges.
If you are a Head of Department (including deputy and acting Heads), then we would be very grateful if you would take part in this research by completing their survey. If you have already completed the survey this spring/summer then you do not need to complete it again.
The questionnaire will take approximately 15 minutes and all responses will be anonymous.
To take part, please click on this link: https://www.surveymonkey.co.uk/r/KP96LWB

Grade boundaries
Grade boundaries for this, and all other assessments, can be found on Interchange. For more information on the publication of grade boundaries please see the OCR website.

Enquiry About Results
If any of your students' results are not as expected, you may wish to consider one of our Enquiry About Results services. For full information about the options available visit the OCR website. If university places are reliant on the results you are making an enquiry about you may wish to consider the priority 2 service which has an earlier deadline to ensure your enquires are processed in time for university applications.

Supporting the move to linear assessment
This was the first year that students were assessed in a linear structure. To help you navigate the changes and to support you with areas of difficulty, download our helpful Teacher guide: http://www.ocr.org.uk/Images/345911-moving-from-modular-to-linear-science-qualifications-teachers-guide.pdf

Further support from OCR

activeresults

Active Results offers a unique perspective on results data and greater opportunities to understand students' performance.
It allows you to:

- Review reports on the **performance of individual candidates**, cohorts of students and whole centres
- **Analyse results** at question and/or topic level
- **Compare your centre** with OCR national averages or similar OCR centres.
- Identify areas of the curriculum where students excel or struggle and help **pinpoint strengths and weaknesses** of students and teaching departments.

http://www.ocr.org.uk/administration/support-and-tools/active-results/

CPD Hub
Your route to OCR's teacher training

Attend one of our popular CPD courses to hear exam feedback or drop in to an online Q&A session.
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[1] Cambridge Assessment is a not-for-profit non-teaching department of the University of Cambridge, and the parent organisation of OCR, Cambridge International Examinations and Cambridge English Language Assessment.

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Advanced GCE Biology (H420)

OCR REPORT TO CENTRES

H420/01 Biological processes

General Comments:

This was the first examination session for the new two year A Level specification. This 100 mark question paper appeared to be accessible to candidates across the ability range and there was no evidence to suggest that candidates struggled for time towards the end of the paper. However, it was evident that retaining knowledge from the two year course and applying it effectively proved challenging for many.

Centres are to be commended for preparing candidates for the demands of this new format in which multiple choice and level of response questions were being experienced for the first time. 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. It was pleasing to see most candidates focusing their answers on command words and not just describing when the question also required explanation. However, some candidates did not always refer to the information, diagrams, graphs or figures included in the questions to support their answers and units were sometimes either not included or wrongly quoted in responses using data.

Mathematical and practical skills were embedded within the multiple choice questions in section A and the longer responses required in section B. Those candidates who had been more prepared for the increased emphasis on mathematical content were able to express their skills. This was also true of candidates who were more prepared for the practical requirements and able to draw on experience gained from carrying out practical work. Centres are encouraged to use the documents provided by OCR in the form of handbooks for developing practical, drawing and mathematical skills.

Centres are encouraged to explain to candidates the need to write legibly as in some instances, responses proved difficult to read. This is particularly important when using **B** and **D** in multiple choice questions where any ambiguity cannot be credited or given the benefit of the doubt.

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. It should be brought to the attention of centres that some candidates did not use the included additional pages but separate answer booklets. These booklets, often comprising several pages, were not usually necessary with candidates using them for just a few extra words which were sometimes difficult to link to the original prose.

Comments on Individual Questions:

Section A

This section of the paper consisted of 15 multiple choice questions covering a range of topics across the appropriate modules of the Biology A specification. 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.

Candidates had been advised to spend no longer than 20 minutes on this section and candidates appeared to have managed their time effectively. Most candidates attempted all the questions although some chose to omit rather than guess at a response.

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

The questions which required analysis of statements proved more challenging possibly due to the dual challenge of identifying which statements were correct and then choosing which of the options **A** to **D**, applied to their decisions. It should be noted that, for some of these questions e.g. **Q14**, a number of candidates put the number '1' in the answer box rather than the correct response i.e. the letter **D**. As there was no ambiguity, candidates were given the benefit of the doubt in this case. However, candidates need to be aware that, in multiple choice questions, the options for each question are **A** to **D** and that it may not always be possible for examiners to apply benefit of the doubt.

Question 1
A straightforward recall question to start the paper was accessible to all candidates across the ability range, demonstrating a clear grasp of the processes involved in endothermic responses.

Question 2
Despite the novel approach, few were significantly challenged by this question which was answered correctly by a high proportion of candidates. However, some candidates were caught out by the presence of NAD in options **A** and **B** as opposed to NADP needed for the correct response, option **C**.

Question 3
This question proved challenging and was poorly answered by many candidates who struggled with the multiple stages of the calculation. Option **B** was the most common incorrect response, reached by failing to factor in the 2-dimensional nature of the image.

Question 4
This question was straightforward recall and the majority of candidates chose the correct response.

Question 5
There were many correct responses to this question with candidates recognising the use of chromosome number to indicate the doubling and halving of DNA proportion in mitosis and meiosis.

Question 6
Only stronger candidates appeared to understand the processes involved in peritoneal dialysis. Many candidates were challenged by the nature of the question requiring them to rule out the incorrect statements.

Question 7
This question was generally answered well, with candidates being able to discern the difference between correct and incorrect descriptions of the countercurrent process.

Question 8
Candidates did have to process some information from a graph in this question and choose appropriate values to perform a percentage change calculation. Whilst candidates often struggle with such calculations in the question styles of section **B**, this posed little problem for nearly 80% of candidates who identified option **C** as the correct response.

Question 9
This question proved challenging for some candidates with option **D** being the most commonly seen incorrect response.

Question 10
Option **A** provided a distractor and common incorrect response to the correct option **C** in this question, as statement 1 relating to the cells synthesising ecdysone, would not form part of an explanation for the site of action of the hormone.

Question 11
The majority of candidates chose the correct option for this question.

Question 12
This question provided significant challenge to candidates. All three statements were correct thereby giving option **A** as the correct response.

Question 13
Candidates had to use values from a table to perform simple calculations, some involving standard form, and then process this information to choose the correct order of SA:V for a group of mammals. Many candidates were able to perform the calculations correctly to achieve the correct response.

Question 14
The correct response, option **D**, was relatively straightforward but some candidates appeared challenged by the use of species' names within the text. A number of candidates put the number '1' in the answer box rather than the letter, **D**.

Question 15
There were many correct responses for the reason why *V.minimum* did not need chloroplasts with candidates demonstrating the ability to make deductions from information provided.

Section B

Question 16
Few candidates gained the mark for **Q16(a)(i)**. Some referred to *production* of heat energy which could not be credited and others focused on the behavioural responses of ectotherms. This highlighted the need for candidates to ensure that they use the information provided in the question if asked to do so.

In **Q16(a)(ii)** the most commonly awarded correct responses were for mark points one and four. Stronger candidates recalled that small organisms, such as insects, have a large(r) SA:V and recognised that they would not have mammalian methods of precise control of body temperature such as vasodilation. Mark point two was awarded less often as candidates failed to make a comparative statement that there was a greater rate of heat loss or that heat was lost more quickly. Centres are encouraged to emphasise the need to use the comparative when discussing alternatives such as that used in mark point two.

The majority of candidates correctly named spiracles for **Q16(b)(i)** and whilst **Q16(b)(ii)** was also generally well-answered there were a number of incorrect responses referring to haemolymph or tissue fluid. The mark points in **Q16(c)** were accessible to candidates across the ability range and there were some extremely confident responses showing a good understanding of this topic. Many candidates linked mark points three and five describing how the small SA:V would mean that diffusion distances would be too great. Stronger candidates consolidated this by explaining that such animals also have high metabolic rates and/or high oxygen demands.

The nine possible mark points for a two mark question meant that the vast majority of candidates were able to achieve at least one mark for **Q16(d)** with over 50% of candidates being credited with both marks. It is pleasing to note that there was a clear indication that practical guidelines had been addressed by centres.

Question 17

In **Q17(a)(i)** both marks were credited for a correct response despite the fact that some candidates did not use the correct calculation, choosing to subtract i.e. $10^{9} – 10^{1} = 10^{8}$ instead of dividing.

A common incorrect answer was (9)99999990 demonstrating a lack of knowledge of how indices are manipulated. There were a number of candidates who used appropriate mathematical skills but failed to gain full marks as they had used the wrong information from the table, comparing the data for co-peptin in the faeces with co-peptin in saliva rather than with C- reactive protein in saliva.

Q17(a)(ii) proved challenging and very few candidates gained either of the marking points. Some candidates recognised that bile would leave the liver and end up in faeces but reference to the liver having a large blood supply or sinusoids was rarely seen.

The necessity to use π in the equation for **Q17(b)(i)** generated three different versions of the correct answer in order to encompass all the various values of π e.g. 3.14 or 22/7. Candidates could gain credit for a variety of responses and many variations that included errors could still gain one or two marks if Examiners could clearly see how candidates had arrived at their response e.g. one mark was awarded for candidates that had used the correct equation for calculating the volume of a sphere. The most common error was using the wrong value for the radius, having confused it with the diameter or simply not knowing the formula for a sphere. The equation for calculating area of a circle rather than volume of a sphere was another common error. Some candidates mistakenly squared the value of the radius or mis-keyed the correct values into the formula and it is recommended that centres encourage candidates to repeat calculations to check for such errors, provided time allows.

For candidates who recognised that an electron microscope was necessary to produce the image of the Kupffer cell**, Q17(b)(ii)** posed few problems and both marks were often achieved. Some candidates suggested a scanning electron microscope rather than transmission which was not credited but error carried forward was used for the second mark of this question to avoid candidates losing both marks. Error carried forward was also used where candidates had incorrectly stated a light microscope but marks were only gained for the mark points in the mark scheme and not for incorrect statements such as '*no organelles can be seen'* or *'has low resolution'.*

Question 18

Q18(a) was a challenge for many candidates because they failed to articulate clearly that rate is not reduced by the limiting factor, but simply capped. Stronger candidates were able to score two marks in a very brief answer but this was rarely seen by Examiners. Mark point one was most commonly awarded but a significant number of candidates referred to the rate being reduced or the reaction being stopped by the limiting factor which could not be credited. Few candidates used an example to express their answer, although many did relate limiting factors to photosynthesis but only in the form of a list of their effect on photosynthesis. A number of candidates failed to gain credit for the first marking point by referring to limiting factors *affecting* the rate without explaining what that effect might be. Mark point two was rarely awarded.

In **Q18(b)(i)** most candidates stated the correct trend or correlation and this was often supported with relevant comparisons of two or more data points. Few went on to expand their response and, consequently, a large percentage of candidates failed to achieve maximum marks here.

Q18(b)(ii) Level of Response

Examiners reported that there were some excellent responses to this question. In such responses, candidates demonstrated the ability to discuss the consequences of lack of oxygen on both aerobic and anaerobic respiration. Details included a relevant discussion of the different

stages of aerobic respiration i.e. link reaction, Krebs cycle or oxidative phosphorylation, with some candidates starting their explanation with the statement *'there would be no oxygen to act as the final electron acceptor'.* Although stronger candidates also gave good detail about anaerobic respiration, generally this was not quite as well expressed. Candidates who referred to the lactate pathway were still able to gain the top level as some plants do use this mechanism. Candidates were often able to state that only glycolysis would be able to occur to produce small quantities of ATP and that NAD would be regenerated but detail about the pyruvate to ethanol pathway was seen less often. To obtain a Level 3 answer, candidates needed to talk about two consequences of the lack of oxygen to the plant and this proved problematic for candidates, as it required them to bring together a variety of different ideas from the A Level course. Many did know that ethanol is toxic, and that less ATP would be produced overall. The best answers included references to a reduction in active transport and the consequences of this on mineral uptake. Candidates who achieved Level 2 were often able to give a great deal of detail about aerobic respiration but were not able to provide the same level of detail about anaerobic respiration and were only able to give one consequence to the plant. Level 1 candidates gave a simple statement such as, '*with no oxygen the plant cannot carry out aerobic respiration'.* Candidates who did not also give a consequence did not pick up any marks. In general, candidates presented good lines of reasoning with structure, so many were able to achieve the higher mark within each level.

The majority of candidates gained the maximum two marks for **Q18(c)(i).** However, there were those who incorrectly described or drew the bonding between the hydrogen on water and the nitrate ion rather than the oxygen atom of nitrate. Numerous candidates also suggested that the oxygen on the nitrate ion is 'slightly' negative or that nitrate is a polar molecule in an attempt to gain marking point two; neither of these options could be credited. It was noted by Examiners that candidates were often better at expressing their ideas in a diagram rather than in written text and many candidates scored the maximum marks from their diagrams.

Q18(c)(ii) was surprisingly challenging despite the desired responses being fairly straightforward. Good responses clearly indicated that active transport of mineral ions or solutes into the endodermis would lead to water entering by osmosis. A large number of incorrect responses were seen which referred to water being actively transported or water moving down a concentration gradient.

Q18(d) was generally well-answered with xylem and phloem being the most commonly referred to tissues.

Question 19

The majority of candidates were able to gain at least one mark in **Q19(a)** and the gap fill in **Q19(b)** enabled the majority of candidates to show their knowledge about DNA structure gaining at least three out of the four marks available.

Q19(c)(i) was generally well-answered although some candidates failed to interpret the diagram correctly and gave totally irrelevant structures as their answers. The most common mistake was failing to identify the inter-membrane space or referring to it as the inner-membrane space.

Q19(c)(ii) saw some strong responses with candidates using data to support their answer even though it was not required. Weaker candidates gave vague answers about how fluoride and cyanide 'affected' respiration or repeated the information in the table without attempting a conclusion.

Question 20

In **Q20(a)** it was pleasing to see some candidates remembering the formula for standard deviation (SD), despite this not being a requirement of the specification, and completing the calculation correctly. A few candidates appear to have estimated the SD by looking at the SD calculated for the other sets of data, or using the SD function on their calculators to elicit an

answer. Overall many candidates were awarded maximum marks by either calculating the correct answer **5**, or estimating it would be somewhere between **3** and **6**. Bearing in mind that candidates were told to give their response to one significant figure, Examiners noted that some candidates gave responses to two or more significant figures. A proportion of candidates who had not given a final answer were credited with one mark for calculating the mean. However, there were quite a few candidates who understandably did not attempt the question in the absence of the formula, which should have been included.

Candidates did not require an answer to Q20(a) in order to achieve full marks for **Q20(b)**, however those that did were in the minority. When the bars were plotted they were usually correct, though some candidates plotted the bars thinking the standard deviation was the total length of the bar rather than the length each side of the mean, resulting in the bars being half the required length. Some candidates appeared to have little knowledge of what an error bar should look like and plotted the SD as a number and even sometimes drew a line between points at the base of the graph or drew them as an extra bar. It is worth noting that a number of candidates who drew more conventional error bars would have lost marks had there been a requirement to use a ruler as there were some very poor freehand lines. Some candidates were unsure how to cap the line but the crosses and circles added rarely interfered with the accuracy of the plot.

As the question stem for **Q20(c)** did not guide candidates to use Fig. 20 to access the means some picked a different route and used the figures from Table 20 in their calculations. Both routes could access three marks with 61.54% the most commonly seen correct response. Some candidates lost marks for errors of arithmetic or rounding whilst others that gave the correct number of significant figures in other questions occasionally failed to do so here. Percentage change for the wrong yeast species was seen and, unfortunately, many candidates incorrectly calculated from aerobic to anaerobic giving the incorrect response of 38.10%. A number of candidates also made the mistake of dividing the actual value of the anaerobic CO_2 production rather than the difference between the two values.

In **20(d)(i)** the majority of candidates identified the first statement as incorrect and went on to give the correct reason that *A. pullulans* produced more CO_2 in anaerobic conditions.
Most candidates did identify the second statement as incorrect but only stronger candidates stated that it was incorrect because of the standard deviation overlap or that a statistical test was not carried out. Only stronger candidates grasped the fact that for error to be random the SDs must be wide-ranging thereby gaining credit in **Q20(d)(ii).** Most candidates cited some aspect of the methodology as being inaccurate as evidence for their answer or limitations of equipment rather than reflecting on the results.

Q20(e) was generally well-answered with only a few incorrect responses seen, the most common being Golgi apparatus or nucleus.

Question 21

Q21(a) Level of Response

Some candidates gave an excellent evaluation of the firm's claim, discussing bias and validity in great detail. A few candidates failed to achieve any marks despite offering an extended response. Such responses tended to discuss the merits of Diatin over Zeatin or Kinetin without criticising the rigour of the investigation. Some candidates, usually those gaining a Level 3 response, noticed that the axes were reversed in the question, with the independent variable on the y axis instead of the x axis. Candidates should be reminded to look critically at data and query points such as a lack of numerical data being presented and the potential lack of objectivity by the company. Candidates were better able to discuss issues with the validity of the experiment. Many spotted that no species or type of plant had been named and that no control variables were given. Some were also able to state that the concentration of the hormones had not been given. It is recommended that centres encourage candidates to practise responding to this style of questioning which draws on extended writing in a practical context.

Q21(b) proved challenging and candidates seemed to have had little preparation in analysing and redesigning experiments. The majority of marks awarded pertained to the control of light and selection of seedlings. Very few achieved maximum marks and Examiners commented on the fact that some candidates gave responses that included aspects of the experiment that had already been taken into account in the method provided.

Question 22

Generally, it appeared to Examiners that candidates were not fully familiar with the histology of the kidney and thus could not link what was shown in the image to the functional aspects required for responding to **Q22(a)(i)** and **(ii)**. Stronger candidates achieved maximum marks for both question parts, but there was no particular pattern evident in the incorrect responses.

Q22(b)(i) required a comparison of similarities and differences between the convoluted tubules and some candidates struggled to structure their responses appropriately. Weaker candidates were inclined to repeat the information given without processing and in some cases it was unclear whether the comment related to the distal convoluted tubule (DCT), the proximal convoluted tubule (PCT), or both. Good responses were seen where candidates had drawn a table to show similarities and differences thereby clarifying the comparative aspects. Candidates should be encouraged to practise questions involving the command word '*compare'* to develop techniques for expressing similarities and differences within a response.

In **Q22(b)(ii)** many candidates recognised that there would be large quantities of urine produced but there were also responses that referred to dilute urine or increased frequency of urination which did not gain credit. Few candidates mentioned aquaporins for mark point two and of those that did mention it some had the idea that there would be more aquaporins inserted in the cell surface membrane or failed to mention membrane at all in their response.

In **Q22(c)(i)** there were some excellent responses where candidates recognised that podocytes must already be differentiated and so in the G_0 stage. A surprisingly high number of candidates incorrectly stated that podocytes do not have a nucleus and that this is the reason why they could not undergo mitosis.

Many candidates knew that adult stem cells had the ability to differentiate to achieve mark point one in **Q22(c)(ii)**, but some contradicted their response by using the incorrect term, i.e. totipotent or pluripotent.

H420/02 Biological diversity

General Comments:

This series of papers, was the first in the new A Level Specification and many candidates found the paper challenging. Most candidates attempted all the questions, but there were some questions that several candidates failed to answer.

The paper was different in style from those of the legacy specification and this should be taken into account as centres deliver the specification content.

- There are fewer questions that depend solely on recall of knowledge. In a high proportion of questions, candidates are expected to consider how knowledge they have learned can be applied to a potentially unfamiliar context.
- There is more reliance on analysing data and drawing conclusions. Often candidates were given a conclusion and were then required to evaluate the link between the conclusion and the evidence, e.g. 16(b)(ii), 17(b)(ii) and 19(b)(iii). When answering questions such as this, candidates should consider the evidence they have been given and select evidence that both supports and does not support the given conclusion for use in their answer.
- The proportion of questions requiring mathematical skill has increased in all A Level Biology papers. Questions involving calculations were more likely to be omitted by candidates. The Mathematical Requirements are clearly set out in the specification and candidates are expected to be able to perform all aspects of these in examinations. Additional support material is available on the OCR website.
- Assessment of practical skills is embedded in the specification. Thus, the paper contained questions that assume that candidates have carried out appropriate practical work, e.g. 20c, and can draw on this experience in order to provide suitable answers.
- Level of Response (LoR) questions are also new to A Level Biology. These questions are marked in a holistic way. The points on the mark scheme do not represent an exhaustive list of discrete marking points but are simply used as a guide to locate the response into one of three marking levels. Responses are expected to deal with all aspects of the question in order to satisfy the highest level. Examiners are looking for clear scientific points to be made that will be relevant and cover the question that has been asked. Scientific language should be of a suitable standard and ideas should be conveyed with order and clarity. It is worth noting that, notwithstanding the variability of handwriting, candidates should be able to construct a level 3 answer within the space provided on the question paper. Answers that span 2 or 3 pages are not necessary and often contain irrelevant information which makes the award of the higher mark within a level difficult.

Examiners were pleased that candidates were indicating when an answer extended onto the additional answer space. However, it was noted that some centres are unnecessarily supplying additional sheets or answer booklets before candidates have used the additional answer space at the back of the question paper, which is to be discouraged.

Comments on Individual Questions:

Section A

The inclusion of multiple choice questions is a new feature for A Level Biology. Given that one of the possible options would be correct, very few questions were not attempted, as candidates realised that by selecting a 'random' letter they had at least a 1 in 4 chance of being right. Candidates should be aware that 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 were altered, the candidate's intention was frequently unclear and if

there was doubt then the mark was not awarded. The questions varied from straightforward recall to those requiring analysis and deduction, with some requiring the use of mathematical skills or relying on the experience gained from carrying out practical work. This section achieved a good spread of marks.

Question 1
About half of candidates got the mark. The most common incorrect answer was D, suggesting that many candidates were not aware that membranes are a site of reactions.

Question 2
A large majority of candidates achieved the mark.

Question 3
Two thirds of candidates achieved this mark, recognising that none of the cells in the photograph was a lymphocyte.

Question 4
The first question requiring a calculation proved challenging. Only a quarter of candidates worked out that a haploid number of 8 would give 2^8 different gametic possibilities.

Question 5
Almost all candidates achieved this mark.

Question 6
A clear majority of candidates had either successfully learned the definition of species evenness or realised that one species cannot have a relative number of individuals.

Question 7
Almost two-thirds of candidates were correct about pioneer communities.

Question 8
Around two thirds of candidates also achieved this mark. The most common incorrect response was A, suggesting that some candidates are unclear about how exponential growth (stage W) can be described.

Question 9
This was another mathematical question and only 1 in 5 candidates achieved the mark.

Question 10
Almost all candidates achieved this mark.

Question 11
Around half of candidates were able to successfully apply their knowledge of biochemistry to the context of a plasma membrane.

Question 12
A little over half of candidates achieved this mark.

Question 13
Around two thirds of candidates understood that meiosis was not involved in body plan development.

Question 14
A little over a third of candidates achieved this mark.

Question 15

Around a third of candidates achieved this mark. All possible answers were seen, in almost equal proportions.

Section B

Question 16

Just under half of candidates gained one mark for **Q16(a)(i)** for alluding to the dangerous nature of capturing jaguars but very few gained a second mark. Many candidates did not notice the reference to the capture-recapture technique and answered in terms of the inappropriateness of camera traps, which did not gain credit.

Q16(a)(ii) The strongest candidates coped with the evaluative nature of this question well and achieved full marks – usually for the first three points on the mark scheme plus marking point 4, 5 or 6. The majority of candidates focused only on the extent to which the data did not support the conclusion and often scored three marks. The fourth marking point was seen regularly but candidates often used the term 'reliability' which is not encouraged because of its ambiguous nature. Centres should refer to the OCR Practical Skills Handbook for a list of terms used to describe investigative results and their agreed definitions. Although the candidates were not explicitly directed to complete a calculation for this question, almost all did and the vast majority of these were correct.

Q16(a)(iii) This was generally well answered. Candidates who thought that jaguars lived alongside tigers or cheetahs were not penalised for incorrect general knowledge.

Q16(b) The majority of candidates knew the definitions of conservation and preservation and were able to use information given in the question to exemplify why Madidi is an example of conservation to gain at least two marks. All marking points were seen but surprisingly few referred to the contextual examples of logging, farming or nut harvesting given in the introduction. Some candidates simply stated definitions without reference to the example and gained one or two marks. A small minority of candidates discussed *in situ* and *ex situ* conservation, gaining no credit.

Question 17

Q17(a)(i) Almost two thirds of candidates got the mark.

Q17(a)(ii) Just over half of candidates got full marks but many displayed the results of a dihybrid cross between two parents that were heterozygous for both characteristics – candidates are reminded of the need to read the question carefully. Without the correct genotypes, credit could not be given for any stated phenotypes. A surprising number of responses did not conform to convention, for example writing 'YRyr' instead of 'YyRr'. In the current series this approach did not result in lost marks but candidates are advised to follow convention in future.

Q17(b)(i) Around half of candidates got full marks, but it was hard to give credit for incorrect answers if no working was given. Many candidates made good use of the grid provided. A significant minority of candidates used 9, 3, 3, 1 as the expected numbers but were still able to access two of the three marks. Candidates should be aware answers given to an inappropriate number of significant figures are unlikely to attract full marks.

Q17b(ii) This question differentiated well and candidates who had incorrectly calculated the chi squared value in part (i) were not penalised here. Many candidates gained one mark, invariably for identifying the correct critical value at 3 degrees of freedom. Those who chose the wrong critical value were still able to access two of the three available marks. A reasonable minority of candidates gained a mark for correctly stating the relationship between their calculated chi squared value and their chosen critical value in terms of significant difference. Candidates who simply stated 'the results are significant' were not awarded marking point 2. The command word

'discuss' ought to have encouraged candidates to address the implication of the chi squared test in terms of the numerical probability that any difference observed was due to chance but most did not attempt this and only a few were credited with a mark for it.

Q17b(iii) This question also differentiated well between candidates of differing ability. Around a third of candidates recognised linkage and most of these went on to achieve two or three marks. Many candidates cited mutations or random fertilization as a possible explanation, with no credit.

Q17(c)(i) This level of response question allowed candidates to demonstrate their understanding of the key processes of protein synthesis and the effect of mutation on the polypeptide produced. Most candidates were able to gain some credit but the question discriminated well between candidates of differing ability. Many candidates made errors that prevented them from accessing either the higher marking levels or the communication mark within a level. Examples of this included failure to mention base or amino acid sequences, using bases in the context of amino acids, stating that bases code for the *productio*n of amino acids and stating that the amino acid sequence *codes for* the primary structure of a protein.

The command word 'outline' should have encouraged candidates to give the main features of transcription and translation but many used the entire available writing space to detail every aspect of this process. Many answers described levels of protein structure beyond primary and even explored enzyme action. Although not incorrect, such information was outside the scope of the question and hence often resulted in the award of the lower mark within a level rather than the upper.

Q17(c)(ii) This question was intended to stretch the thinking of more able candidates and the mark was awarded to only 10% of answers. Many candidates did appear to understand the idea of dominant and recessive alleles but did not express their answer in terms of the proteins that would be synthesized. It was clear that many candidates did not really understand what recessive means; many thought that merely being mutated or less frequent in a population makes an allele recessive.

Question 18

Q18(a) This topic was new to A Level Biology but it had clearly been taught by centres and learned by candidates. All marking points appeared regularly and many answers got two marks. Candidates are supposed to know that potato blight is not a bacterium so references to antibacterial chemicals were not credited. Some candidates described aspects of an animal immune response and were not credited.

Q18(b)(i) Most candidates were able to refer to clones being genetically identical. Many were able to communicate that this would remove a confounding variable but few candidates used the technical term: 'validity'. Some attempted to describe validity by using the term 'fair test' or even 'reliable'. Centres are again referred to the OCR Practical Skills Handbook for help with the correct use of such terms.

Q18(b)(ii) Around half of candidates correctly referred to micropropagation or tissue culture. Cuttings and vegetative propagation were commonly seen un-creditworthy responses. Around half of candidates also correctly suggested that asepsis would reduce microbial contamination. Many were not awarded the second mark because they said simply that infection would be reduced without mentioning microorganisms.

Q18(b)(iii) Many candidates found the mathematical skills involved in calculating the area of a triangle and rectangle challenging and full marks were awarded for only about a quarter of answers.

Q18(b)(iv) A majority of candidates could divide their answer to part 1 by 1250 and were awarded this mark. However, it should be noted that the question asked for a proportion so answers presented as a ratio were not credited.

Q18(b)(v) Just under half of candidates scored a mark here – usually for some description of one of the first two marking points. Very few candidates referred to Fig. 18 within their answer, despite being told to do so, so it was rare to award both the available marks. A number of candidates misinterpreted the significance of the word 'visibly', suggesting that the area under the curve could measure invisible infection. Others referred to leaves being shed and gained no credit.

Q18(b)(vi) Many candidates gained full marks here. Frequent responses that did not gain credit often lacked precision. Examples of this included: 'pH' rather than 'soil pH'; 'soil nutrients' rather than 'soil minerals' or 'amount of light' rather than 'light intensity'. Many candidates suggested atmospheric CO_2 concentration and were not credited as it is unrealistic to suppose that this factor would vary significantly between non-adjacent fields. A small minority of candidates suggested biotic factors.

Question 19

Q19(a) Most candidates were able to gain one mark. No scale was given on the figure so general references to size did not gain credit. Most correct responses referred to thumb length or palm length. Answers that discussed the pattern of lines on the palm were not credited. Responses needed to refer to either the chimpanzee or the human to avoid ambiguity, for example, 'the length of the thumb' on its own, gained no credit.

Q19(b)(i) Around half of candidates were able to calculate a rate from a straight line on a graph but some of those did not then appreciate that the y-axis of the graph was already expressed as a percentage and so wrote 17.7%. Many such responses were able to get a mark if they had shown their working out.

Q19(b)(ii) Around half of candidates gained the first mark. Fewer achieved the second marking point – it often appeared that candidates were attempting a much more complex calculation than their first answer plus and minus 20% written out as a range. Candidates are reminded to read over their answers to see if they make sense, for example an answer of 5 million years was given a range of 7 to 14 million years.

Q19(b)(iii) It was less common to see Level 3 answers here than in the other Level of Response question. The command word was 'evaluate' which ought to have guided candidates to discuss the evidence for reclassification from both sides, for and against. The best answers did just that, backing up their points with evidence from the figures provided and relating their evidence to the principles of classification they had learned. Many candidates looked at only one side of the debate, which meant Level 3 could not be achieved. Candidates were asked to use their own knowledge about classification but many gave their own knowledge and opinion about chimpanzees. This approach gained no credit and often meant the communication mark within a given level was not awarded.

Within Level 1 answers, there was a lot of confusion, misconceptions and incorrect use of key terms. Some candidates thought that pentadactyl limbs were relevant to classification at the level of genus while some discussed the possibility that humans and chimps had similar hands because of convergent evolution. Others thought that humans could not possibly be in the same genus as chimps because of the presence of bonobos in that genus already. It is worth noting that 'they have a common ancestor' rarely gains any credit – any two species have a common ancestor. The insertion of the word 'recent' would have gained some candidates an extra mark.

Q19(b)(iv) This was designed as a challenging question and the mark was rarely achieved.

Question 20

Q20(a)(i) Around half of candidates got one mark for identifying glycosidic bonds as a common feature. Where candidates incorrectly identified the bond as 1,6 glycosidic, the mark was not awarded.
Many candidates correctly identified hexose sugars but, of these, only a minority said there were two of them (in each molecule). The question asked for *structural* similarities, so frequent answers about condensation reactions were not credited.

Q20(a)(ii) This was a challenging question and 3 marks were rarely awarded. A relatively high number of candidates omitted it altogether or did not fill all the available boxes. Around half of candidates gained one mark for recognising either β-glucose and α-glucose or describing the alternating orientation of sugar residues in lactose. Some candidates achieved both of these marks. Very few candidates attached the prefixes, α and β, to the glycosidic bonds. There were a large number of incorrect references to 1,6 glycosidic bonds for either disaccharide. A common error was to comment on properties, such as solubility or polarity, rather than structure.

Q20(b)(i) Few candidates achieved full marks for this question, many candidates focused on their knowledge of respiration rather than applying their knowledge of the structure and function of glucose from module 2 and so were only awarded the AVP as respiration is not directly tested in this paper. All other marking points were seen, but not particularly often. Some candidates who wrote about bond energy were unable to gain the first marking point because they said that that hydrogen or glycosidic bonds were the source of energy. References to energy being produced, made or created were not credited. Many candidates confused galactose with glycogen – perhaps as a result of having studied mark schemes on previous papers. A significant number wrote about glucose and galactose having similar structures but then failed to gain more marks by stating explicitly how the structure of glucose is related to its function, which they ought to have learned when studying module 2.

Q20(b)(ii) This question could be answered in two ways. A large majority of candidates correctly suggested that lactose was too big to cross the membrane. Fewer followed this up with the correct explanation in terms of fitting between phospholipids or needing the presence of a channel. A less common suggestion was the idea of the lack of a concentration gradient, but again few went on to talk about the need for a carrier protein or pump. Many candidates were unable to express the concept of a low concentration gradient well enough to be awarded the mark. Many candidates suggested both explanations but failed to explain them as directed and so received only one mark.

Q20(b)(iii) This question was intended to be challenging but fewer than half of candidates gained even one mark. Although *E. coli* was mentioned three times in the question, around half of candidates discussed the use of lactose by mammals, the presence of proteins in mammalian cell membranes, ageing in mammals or lactose intolerance, without any reference to *E. coli*. Some candidates realised that the question was about the *lac* operon but still discussed this in terms of the young mammals rather than *E. coli*. Very few candidates were awarded both available marks.

Q20(c) This question differentiated well between candidates. Candidates should be familiar with this type of practical from the practical endorsement (PAG 5), and most ought to have carried out a similar practical activity.

A large proportion of candidates began their answers with detailed descriptions of various aspects of the Benedict's test that were not relevant to the calibration process but then went on to score marks with relevant descriptions of the calibration procedure. Some focused on describing a Benedict's test or explaining the principle which they were not asked to do, and so did not receive much, if any, credit. All of the marking points were seen but serial dilutions were less commonly suggested despite these being a feature of OCR's PAG activities. It is worth noting that in order to construct a calibration curve, more than one known concentration needs to

be used. Centres are reminded that the practical components of the syllabus are integral to students being able to apply their theoretical learning; performing these practical activities will enable candidates to relate to these elements when tested in the examinations.

Question 21

Q21(a) This was generally well answered by most candidates. The most common incorrect response was the third, where several candidates put 'sticky' or 'exposed'.

Q21(b) This question differentiated well between candidates with all marking points seen. Common responses that were not credited included referring to the plasmid imprecisely as DNA, or incorrectly as a bacterium. Many candidates also stated that the DNA ligase was used to form hydrogen bonds and were not credited for mentioning the ligase. Some candidates described the events occurring in step D, as opposed to C, and gained no marks. Precise and correct use of key terms is essential when answering knowledge and understanding questions such as this.

Q21(c) Around half of candidates achieved at least one mark. All marking points were seen. A number of candidates used extra space to describe in detail the process of replica plating. As these candidates often achieved full marks anyway, their time might have been better spent on other questions. A minority of candidates discussed testing to see if the donor gene was expressed and received no credit.

Q21(d) Around half of candidates achieved one mark and a quarter got two, usually the first two points on the mark scheme. Some failed to gain the first mark by referring simply to DNA rather than cDNA or single-stranded DNA. Some candidates discussed mRNA or PCR and electrophoresis and gained no credit.

Q21(e) Antibiotic resistance was correctly identified by a little under half of candidates. As this is a science qualification, candidates who discussed 'playing God' or ethical concerns about bacterial rights received no credit.

H420/03 Unified biology

General Comments:

This was a new paper, with a greater emphasis on AO2 'Application of knowledge and understanding of scientific ideas, processes, techniques and procedures' and AO3 'Analysis, interpretation and evaluation of scientific information, ideas, and evidence', rather than AO1 'Demonstrate knowledge and understanding of scientific ideas, processes, techniques 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 paper. The paper produced a good spread of marks.

Most candidates attempted all the questions but there has been an increase seen in the number of NR (no response), particularly to practical based and mathematical based questions (e.g. Q1(b)(i), Q2(b)(iii), Q4(c)(ii)) and this was more clearly seen amongst middle and lower scoring candidates. There was evidence that many of the lower scoring candidates struggled to get to grips with the increase in the number of AO2 and AO3 based questions, scoring most of their marks on the questions involving AO1 (recall and understanding). Equally it was pleasing to see a number of higher scoring scripts at the top end of the range, and these candidates tended to have well developed mathematical skills and a good practical knowledge, with the ability to understand and apply the information given to the questions being asked.

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 awarded marks.

Comments on Individual Questions:

Question 1

Q1(a)(i) Many candidates correctly identified the R group of leucine on Figure 1.1, although some omitted the CH_2 group above the alpha carbon, or circled the amine or carboxyl group. A surprising number of candidates made no attempt at all.

Q1(a)(ii) Some candidates failed to provide a suitable statement about the chemical properties about leucine and amino acid X, often simply stating that their chemical properties or their R_f values would be similar. However, many candidates appreciated that they would have similar solubilities or R groups, which gained credit.

Q1(a)(iii) Many candidates placed a spot at the correct point on Figure 1.1, gaining full marks. Where the position was incorrect, some were able to score marks for their working. Some mis-measured the distance travelled by amino acid Y and/or the solvent front, but then understood that 0.2 should be subtracted from their calculated R_f value and then multiplied by 5, which gained credit. Others calculated the correct R_f value, subtracted 0.2 but then failed to multiply by 5. A minority of candidates did not take into account the R_f value of Y at all and simply multiplied 0.2 by 5, which gained no credit.

Q1(b)(i) A relatively small number of candidates were able to state a material that could be used in the stationary phase of thin layer chromatography. Silica gel was the most frequent correct answer although other suitable alternatives, such as silicon dioxide or aluminium oxide, were occasionally seen. Many candidates erroneously suggested paper or named a solvent.

Q1(b)(ii) Most candidates gained at least one mark for identifying the thylakoid membrane as the precise location of photosynthetic pigments in a chloroplast. Many then went on to state that pigments would be found in the photosystems or light harvesting clusters.

Q1(c) The differences between thin layer chromatography and the form of electrophoresis used to sequence DNA were well understood by the majority of candidates. Most appreciated that electrophoresis required electricity in order to separate the DNA fragments. Many also stated that in electrophoresis, DNA would be separated by mass or length, while in TLC, molecules would be separated by solubility or interaction with the stationary phase. There were several references to fluorescent or radioactive tags being needed to visualise the DNA fragments, or the use of dyes, such as ninhydrin, in TLC. Some commented on the need for a buffer in electrophoresis although there was little mention of electrophoresis being computerised or automated. Hardly any mention of the separation of charged particles in electrophoresis and non-charged particles in TLC was seen.

Question 2

This was a long question (24% of the marks) that tested a good range of AOs and mathematical skills.

Q2a(i) On the whole this question was well answered by the majority of candidates, with most candidates gaining at least one mark and a high proportion gaining both marks. However confusion over tertiary and quaternary structure was evident. Most candidates realised that the α-helix was part of the secondary structure but some candidates failed to realise that when 2 different polypeptides chains are involved then the level of structure is quaternary.

Q2a(ii) Candidates may have been taught that antibodies are specific to one antigen and as a result they found this question challenging. Whilst there were some good responses, many did not understand the link between cross-reactivity of anti-gliadin antibodies and the same/similar antigens on other foods.
A few candidates realised that the antigen must be present on other proteins/foods but failed to mention the term "antigen" so gained no credit; often replacing the term antigen with the term receptor. Some candidates realised that the antibodies produced must not be specific to the gliadin antigen but did not use the terms variable region/binding site in their answers so again scored no marks.
Very few candidates achieved mark points 2, 4 and 5 for mentioning that the antigen is a short sequence of amino acids or that antibodies bind to mast cells/T lymphocytes and that mast cells release histamine.

Q2(b)(i) This question proved to be a good discriminator. This was a difficult graph to interpret and some candidates were confused in their answers. There were numerous responses based entirely on recall of aerobic respiration followed by anaerobic respiration when yeast is used to produce ethanol. Candidates seemed quite happy to ignore or misrepresent the evidence of the graph to fit with their preconceptions. Good candidates just looked at the evidence and drew the correct if unfamiliar conclusion, which was that anaerobic respiration was followed by aerobic respiration.
Weaker candidates did not get to grips with the idea that glucose was used as a respiratory substrate at first, and then ethanol. Neither did they link that with the type of respiration. Weaker candidates often gave a detailed description of the graph, quoting data in great detail, but did not mention the type of respiration occurring rather taking the approach of manipulating data, which gained no credit.

Q2(b)(ii) This was well answered on the whole, and many candidates scored two marks. The majority of candidates got two marks for mentioning the use of aseptic techniques and mark point 3 or 4 for the use of optimum temperature or optimum pH. Some candidates stated control temperature and pH rather than the idea that these factors needed to be suitable for the yeast,

and it was disappointing to see that some candidates suggested that the 'culture' should be sterilised, which gained no credit.

Q2(b)(iii) Many candidates had trouble with this calculation. It was clear which candidates had been taught how to calculate population numbers in relation to dilutions. However, a large proportion of the candidates then failed to give their answer in standard form or to three significant figures, and so only gained one mark. It is important that centres make sure that candidates know how to calculate serial dilutions and are able to put their answer into standard form and the correct number of significant figures.
Some candidates were able to work out that there were 150 bacteria in 1 ml of 10^{-2} dilution, but then got confused and were unable to convert this to 15000 in 1 ml of original culture and hence then calculate
15000 x 25 = 375000 (3.75×10^5) in 25 cm^3 of the original culture.

Q2(b)(iv) Many candidates scored well on this question and it was good to see how many realised that using a pH probe is not an accurate way to measure respiration rate. However, some candidates used very vague language, such as 'a range of temperatures' without qualification, and a sizeable proportion gave only 'yes, because…' or 'no, because…' answers, obviously not understanding the significance of term 'evaluate'. Candidates need to be taught that when asked to evaluate they need to put arguments for and against. Weaker candidates suggested that pH needed controlling which showed a lack of understanding of the question. A number also did not get mp 4 under the Yes section because they did not mention that by doing repeats one can help to identify the anomaly. Instead they went one step further and were mentioning removing the anomaly or discarding it in order to calculate the mean.

Q2(b)(v) This was well answered, showing that many candidates seem to understand how to interpret statistical calculated values. It was clear that many candidates had been taught this basic statistical test and what it showed. However a significant number of students still gave confusing answers and failed to understand that if the *t* value is less than the critical value at p = 0.05, the null hypothesis should be accepted and there is no significant difference. They often confused results not being significantly different with the null hypothesis being rejected so they ended up getting no marks. Very weak candidates just stated that the results were not different. The words significant or different were missing from the responses.

Question 3

Q3(a)(i) A minority of candidates scored this mark for identifying the adaptation as an anatomical adaptation. A range of answers were seen; 'physiological' was the most common mistake.

Q3(a)(ii) Fewer than 5% of candidates accessed Level 3 on this question. The majority of the rest only accessed Level 1 due to the fact that they were able to identify that the evolution of a tiger with striped fur was due to natural selection, but they did not correctly identify a mutation in a structural gene as being the main cause. Many students who fell into this category wrote about a 'mutation in a gene for striped fur' rather than naming the structural gene as being responsible for fur colour or producing a coloured pigment. In a few cases, candidates correctly identified a structural gene, and gave a developed example of how regulatory genes may contribute to stripes, giving access to Level 3. However, the role of regulatory genes in controlling gene expression is an area which was poorly understood by the majority of candidates.
The other main weakness in response to this question lies in the identification of the correct selection pressure for stripes being better adaptation for hunting due to camouflage. Only approximately 50% of candidates identified this. The Communication mark within a level was given in most cases, except where the odd candidate left out large amounts of detail or incorporated lots of irrelevant material.

Q3(b) Most candidates failed to give the correct final result but managed to score at least one of the three marks available. A high proportion of candidates were able to correctly calculate the value of p and q but then got lost trying to substitute them into the equation. A few candidates

calculated 2pq correctly but did not go on to calculate the percentage, while some others followed the calculation to the end but did not round up the result to one significant figure.

Question 4

Q4(a) A low percentage of candidates (<10%) achieved four marks on this question and many had zero or only one mark awarded. Common mistakes included:

- Column 1 - not being specific in saying that the location for Rhizobium is in the **root** nodules or leguminous **roots**.
- Columns 2 and 3 - missing the charge on NO_2^- or incorrectly expressing it as a positive ion NO_2^+ OR putting ammonia as a positive ion NH_3^+.
- Column 4 - mixing up oxidation and reduction.

A surprising number of candidates also left blank spaces on this question, suggesting a lack of understanding of the nitrogen cycle.

Q4(b)(i) It was pleasing to see that the majority of candidates were awarded two or three marks for this question accessing marking points 2, 3 and 4, for identifying H_2 as a competitive inhibitor and CO as a non-competitive inhibitor (and then going on to add how this affects the shape of the enzyme's active site). The other two marking points for this question were rarely mentioned, but sometimes the marks for these were missed when candidates did not expressly say that as ATP is needed, the process is active/energy requiring or for saying that acidic conditions are tolerated or increase reaction rate.
In addition, some marks were lost for marking points 3 and 4 as students mistake CO for CO_2.

Q4(b)(ii) Few candidates obtained full marks on this question. Those that did talked about the removal of oxygen and CO and therefore removal of inhibition of the enzyme. Some common errors/omissions on this question included:

- Candidates mentioned the removal/ binding of CO/oxygen by leghaemoglobin but did not then mention how this affects the enzyme.
- Candidates talked about how leghaemoglobin provides the Iron (from the haem group) for the enzyme's prosthetic group or protons/electrons for the reaction.

Q4(c)(i) A small proportion of candidates were awarded full marks for this question. Many gained one mark for an answer of 7600, for incorrectly multiplying 950 000 by 8, instead of 9, and then correctly converting it to kJ. The remainder were awarded no marks due to an incorrect calculation or giving an answer of 7,600,000 and not converting it to kJ.

Q4(c)(ii) The majority of candidates were awarded one mark here for either a fully correct answer or ECF from Q4(c)(i). Where not awarded, this was mainly due to students not giving their answers to the correct number of significant figures.

Question 5

Q5(a)(i) Successful candidates correctly used the key terms antigen and antibody and related their actions to the effects on nerve cells. The role of phagocytes, macrophages and T cells were frequently correctly stated. Candidates lost marks by failing to relate their answers to the nervous system instead giving a more general account of auto immune conditions. Weaker candidates were not specific enough in associating the correct part of the immune system with an attack on nerve cells. There was also confusion between the terms antigen and receptor.

Q5(a)(ii) Most candidates correctly identified that the Myelin sheath was missing or incomplete, and most could link this to a lack of saltatory conduction or fewer Schwann cells, to gain two marks.

Q5(b)(i) Generally, candidates seemed to have not understood this question. Candidates often gave vague explanations relating to brain or spinal cord damage, or to a reduction on the speed of reflexes, as an example of a symptom. Many who correctly described a symptom of MS failed

to identify the part of the brain which had been damaged to cause that symptom and so gained no credit.

Q5(b)(ii) Stronger candidates answered this question successfully. However, there was frequent confusion amongst other candidates between frequency and speed of impulses (reaching the NMJ), release and production (of neurotransmitter) and (depolarisation of) post synaptic membrane and post synaptic neurone.

Question 6

Most candidates gained either a Level 2 or Level 3 for this question, with the majority picking up the communication mark too. Candidates generally explained the improvements to the method in much better detail than the improvements to the presentation. All points from the Indicative Scientific Points were seen but most candidates only used two from the method and one or two from the presentation in their answers.

Candidates had lots of suggestions about improving the experimental technique and there were some good suggestions for processing the data, but in both cases the explanation was often weak or even non-existent. For example, many thought that increasing the age range would have improved results, rather than introduce another variable, and some candidates could not adequately explain why increasing sample sizes or repeats improved the experiment. There was a lack of the term anomalies when referring to repeats and if they were mentioned, candidates often thought that repeats allow anomalies to be 'eliminated' or 'removed,' rather than just identified.

Many candidates struggled with the actual meanings of the terms repeatability, accuracy, precision (all defined in the ASE publication 'Language of Measurement' and reproduced in the OCR A Level Biology Practical Skills Handbook) and reliability (which no longer has any special meaning – see note in the Practical Skills Handbook), often using them in an incorrect context. For example, some candidates noticed that the number of significant figures were not the same but failed to give the correct reason and used the term accuracy instead of precision. Missing units in column headings were on many occasions identified but the reason for their presence was unclear. There was also a common misconception of placing the data in multiple tables, e.g. smokers and non-smokers and males /females. However, many candidates suggested presenting the data graphically to allow trends to be spotted more easily.

Examiners would advise candidates to concentrate on fewer improvements and to ensure that both a method and a data improvement is described and explained to gain access to the higher levels.

To help prepare candidates for this type of question in the exam, centres are advised to use familiar concepts in a variety of different contexts and also practise designing and criticising experimental design when planning experiments.

Question 7

While this was a seemingly straightforward question, very few candidates achieved full marks here.

Q7(a)(i) Candidates often overcomplicated their answers which were generally much longer than the spaces provided. The vast majority of candidates knew the structure of both insects and fish exchange systems, but candidates lost marks due to a lack of 'many' or a reference to 'branching' to explain how surface area was increased. The term 'spiracles' was used frequently when writing answers in this part, which gained no credit. Another common error was talking about tracheal fluid for insects, and the counter-current system for fish, rather than the structure of the gas exchange systems to increase surface area.

Q7(a)(ii) Some candidates failed to realise that oxygen would be in short supply and instead wrote in terms of extracting the oxygen from water, which gained no credit. Some candidates used vague terminology such as ‘air’ or 'gas' instead of oxygen, and so failed to get the first mp for the oxygen being in short supply. Many candidates simply referred to the lugworm being surrounded by water as a reason for the external gills and some said it was just due to it being an advantageous adaptation. There was very little reference to the rate of diffusion being too slow or the possibility that lugworms may have a higher metabolic rate, which would have also gained credit.

Q7(b) This question proved to be a good differentiator, with only the most capable candidates scoring 4 marks. The most common errors seen by examiners were Acetylcholine or Adrenaline being used instead of Noradrenaline, and the term occurring/finished/happening being used to explain when internal intercostal muscles are used in expiration.

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