GCE

Biology B (Advancing Biology)

Advanced GCE **H422**

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.
https://www.cpdhub.ocr.org.uk

[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.

CONTENTS

H422 Advanced GCE Biology B (Advancing Biology)

OCR REPORT TO CENTRES

H422/01 Fundamentals of biology

General Comments:

This was the first paper presented to candidates at Advanced Level following the introduction of the new specification for Biology B (Advancing Biology). For H422/01 candidates needed to demonstrate a breadth of learning across the whole specification. Mathematical and practical skills were embedded in both section A (the multiple-choice questions) and section B (longer responses). The question paper appeared to be accessible to candidates across the ability range and there was no evidence that candidates struggled for time.

Comments on Individual Questions:

Section A

This section of the paper consisted of 30 multiple-choice items covering a range of topics across the A Level Biology B specification. Most candidates attempted all questions although some candidates chose to omit rather than guess a response.

Candidates should be aware that answers to multiple-choice questions should be clearly written. In such cases that an answer needs to be changed, one letter should be crossed out and the new answer written clearly (beside, rather than inside, the box if this is clearer). If the intended response is unclear, the mark is not awarded.

Question 1

Most candidates were familiar with the north/west rule for counting cells in a haemocytometer and answered this question correctly.

Question 2

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

Question 3

This question was more demanding as candidates had to identify which of three statements were correct. Encouragingly more than 50% of candidates chose the correct option on this challenging area of biology.

Question 4

This question was straightforward recall but less than half of all candidates remembered the chemicals that bind to haemoglobin.

Question 5

Most candidates could accurately calculate the diameter of the cell and select the correct answer written in standard form.

Question 6

Less than half of all candidates were correctly able to identify the target of bacteriostatic antibiotics, the most common error being option **A** – the cell wall.

Question 7

This question contained a lot of information for candidates to process and proved to be quite challenging to candidates.

Question 8

This was a straightforward question about the location of photolysis.

Question 9

Candidates should be very familiar with this graph showing pressure changes in the heart, yet the correct response was only achieved by just over 50% of the candidates.

Question 10

This question should have been straightforward but candidates commonly answered **C** suggesting that they had confused the idea of sucrose moving out the companion cell into the sieve element with the loading of the companion cell from the source cell.

Question 11

This question brought together various pieces of information about the autonomic nervous system. Incorrect response **B** was most common which indicated that some candidates had overlooked the fact that the pre-ganglionic neurotransmitter in the sympathetic nervous system is acetylcholine.

Question 12

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

Question 13

This was a straightforward question interpreting knowledge of biochemical tests and the majority of candidates chose the correct response.

Question 14

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

Question 15

It was encouraging to see that this question, testing understanding of probability tables, was correctly answered by many candidates.

Question 16

A disappointing number of candidates failed to recall this straightforward fact about the role of ATP in muscle contraction.

Question 17

Candidates did not perform well on this question. The most common incorrect answer was option **B** suggesting that candidates had not read the options carefully and failed to spot the reference to reduced NAD in statement 2.

Question 18

The majority of candidates were able to use their mathematical skills well to identify the correct response.

Question 19

If candidates knew the equation for the respiratory quotient, this was an easy mark.

Question 20

Most candidates could identify the disulfide bonds on the antibody but some confused the constant and variable regions, thus **A** was a common incorrect answer.

Question 21

This was a straightforward question which only demanded a small amount of biological knowledge.

Question 22

A surprising number of candidates could not identify the region of bond formation in a secondary structure of a protein.

Question 23

Only the candidates who understood that the reduced NAD is oxidised in anaerobic respiration could respond correctly, with option **C** being a very tempting distractor.

Question 24

Candidates found this question very difficult with most students opting for response **A**.

Question 25

This question was assessing whether candidates understood that not all the DNA sequence is transcribed into mature mRNA. The most common incorrect response was that repair of the mRNA took place.

Question 26

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

Question 27

Another straightforward question but a disappointing number of candidates answered correctly.

Question 28

A straightforward question but most candidates did not recall the information needed for a correct response.

Question 29

Candidates did not perform well on this question. The most common incorrect answer was option **A** suggesting that candidates had not read the options carefully. Statement 3 incorrectly stated that **each** cone cell contains three photosensitive pigments, not that there are three types of cone cells.

Question 30

Candidates scored highly on this question, most correctly identifying the pair of primers that could be used to amplify DNA from all species.

Section B

Question 31

Q31(a) addressed **AO1** criteria with the remaining parts of the question addressing **AO2** and some **AO3** in **(b)(iii).**

Q31(a) was generally done well.

There were two common incorrect responses in **Q31(b)(i).** Many candidates suggested that the role of the genetic counsellor was to work out the genotype of the parents rather than predict the probability of their child being born with a genetic disease. Secondly, there were some inaccurate descriptions of how they might do this referring to a genetic cross, Punnet square or family tree rather than the more scientific term of pedigree analysis.

Most candidates scored at least one mark for part **(b)(ii)** and did restrict their answers to ethical considerations. However, the question asked about testing for sickle cell anaemia and therefore more generalised responses suggesting that this might lead to designer babies were not credited.

Q31(c) was a Level of Response item in which candidates were required to **describe** and **explain** a set of data as well as comment on the quality of the data. Overall the level of communication was good with the majority producing well-organised and logical responses.

Most candidates successfully described the data, made good use of the graph and could make the link between the higher survival rates of those children with sickle cell trait and the associated protection from malaria. However, some candidates described the data without giving any explanations. Weaker explanations were sometimes rather vague and generalised e.g. anaemia leading to less oxygen availability or less respiration. There were also significant numbers of candidates who described the resistance to malaria inaccurately as immunity, not comprehending that this is the production of antibodies. Candidates who could give a good scientific explanation of why sickle cell anaemia was life threatening referred to the clumping together of the abnormal haemoglobin and subsequent blockages in capillaries/damage to organs. Likewise, a good scientific explanation for the protection of those with sickle cell trait sometimes referred to peroxide in the cells killing the malarial parasite or referred to an increase in the production of carbon monoxide preventing the development of the disease.

A failure by some candidates to read the question carefully resulted in them making no comment on data quality. This did limit their marks. Some good comments on data quality were seen but candidates do need to think carefully about how the data might have been collected and understand the difference between a study of this nature and a controlled experiment in which the independent variable is the only factor which is changed.

Question 32

Q32(a) addressed **AO1** criteria, part **(b)(i)** was focused on **AO3,** part **b(ii)** was focused on **AO2** and the Level of Response question, part **(c),** addressed both **AO1** and **AO2**.

Q32(a) was done well although candidates need to be careful when writing β cells so not to confuse it with B cells (remembering that B cells are very different to β cells). The most common incorrect responses were channel/receptor proteins and there was still some evidence of candidates confusing glycogenesis with glycogenolysis and occasionally gluconeogenesis.

In **Q32(b)(i)** most candidates correctly identified type 2 diabetes although fewer used evidence from the figure to explain their conclusion and simply stated that type 1 diabetes produced no insulin.

The calculation in **Q32(b)(ii)** was done well by many candidates although a few did not notice the reference to 2 significant figures.

Q32(c) was the second Level of Response question. Outlining the role of enzymes in recombinant DNA technology appeared to be more accessible than the first with significantly more candidates achieving the higher marks. Organised and well-structured responses were seen from many candidates with the attention to scientific detail proving to be the discriminating feature. The most common stage to be left out of the sequence was the transformation stage – even simple mixing of the bacteria and the plasmid together was often omitted. DNA ligase was sometimes omitted or inaccurately replaced with DNA polymerase. Descriptions of how the enzyme catalysed the formation of hydrogen bonds rather than phosphodiester bonds were not uncommon and less regularly seen errors included the injection of the plasmid into cells (sometimes even into human cells). It was pleasing to see a good range of additional material relating to identification of the transformed bacteria.

Question 33

Q33(a)(i) and **(b)** tested **AO1**, with most of the remainder testing **AO2** criteria.

In **Q33(a)(i)** the question addressed practical procedures and it was encouraging to see that most candidates were familiar with the setting up of the potometer.

The calculation of the standard deviation in **Q33(a)(ii)** caused a few problems, although more than 50% achieved the full 2 marks. The most common mistake was candidates who thought that n -1 = 4 (the number of treatments minus 1) rather than n -1 = 2 (the number of replicates minus 1). Candidates should remember that the standard deviation is a measure of variation around the mean and n is the number of values that make up the mean.

Q33(a)(iii) required a description of the data which was done well, followed by an explanation which they found more difficult. Few candidates could give a clear and succinct explanation. To achieve full marks candidates needed to give a clear link to increasing air movement reducing the water (vapour) potential around the stomata so that there was a steeper water (vapour) potential gradient. Too many candidates referred to water being blown off the leaf, some even describing droplets being blown away or water moving out of the leaf by osmosis.

Q33(a)(iv) was answered well and only a few candidates did not achieve these marks.

There was a poor understanding of what was required by **Q33(a)(v)**. Although many candidates seemed to appreciate that water uptake was not the same as transpiration, fewer were able to explain that water was used (and produced) in the plant. The most common correct answer was that water was used in photosynthesis but it was disappointing to see that few candidates appreciated that water is essential to maintain the turgor of a plant.

Overall **Q33(b)** was answered well by a good number of candidates. There were, however, a few misconceptions identified; in particular candidates should realise that in osmosis water diffuses across a partially permeable membrane and therefore water cannot move by osmosis along the apoplast pathway. There were many correct responses describing the role of the Casparian strip.

Question 34

Q34(a)(i) and **(ii)** tested **AO1**, **Q34b(i)** tested **AO2** and **Q34(b)(ii)** addressed **AO3**.

Q34(a)(i) tended to be either completely correct or wrong, very few candidates achieving partially correct responses. **Q34(a)(ii)** was not answered well with many candidates thinking that T killer cells killed the virus rather than the virus infected host cells. References to the cell membrane and various other cellular features indicated that candidates had a poor understanding of the nature of viruses.

Q34(b)(i) was a demanding question with many candidates not understanding that each dosage regime was one experiment and that the number of antibodies was measured after one month and then after 3 years. The question asked candidates to compare the 2-dose regime with the 3-dose regime for both viral strains. It was common for candidates to focus on the differences in the data instead of explaining how similar most of the data was. Many candidates highlighted tiny differences in median antibody levels despite the extremely large and overlapping ranges. The only candidates to gain full marks were those who appreciated that the 2-dose regime after 3 years was the only data set that had a significantly different median antibody level to all other data because the range did not overlap with any other.

Q34(b)(ii) was a stretch and challenge question and the marks reflected this. Many candidates were clearly familiar with the primary and secondary immune response but relatively few could explain this in good biological detail. Few candidates mentioned the lack of memory cells prior to the first dose or the idea that clonal selection/expansion took time. Similarly, after the second exposure many candidates failed to mention memory cells differentiating and the subsequent plasma cells producing antibodies. Overall, answers were too generalised to gain marks.

Question 35

Q35(a)(i) tested **AO1** criteria, **(a)(ii)** and **(b)(ii)** addressed **AO3** and **(b)(i)** was **AO2**. **Part (c)** tested both **AO1** and **AO2**.

Q35(a)(i) There are two elements to species diversity and most candidates only referred to species richness, completely omitting reference to species evenness. Candidates were often imprecise in their definitions of species richness. There were many unclear statements using terms such as amount, type and range of species (e.g. the number of types of species) as well as some more significant inaccuracies such as the number of species in a population. Candidates should be encouraged to keep their definitions clear and use simple language.

Q35(a)(ii) asked candidates to identify variables that could be controlled in this field based investigation. Although there were many good responses, candidates do need to remember to apply their knowledge to the question being asked. A few candidates listed variables that were completely inappropriate for a trial recording species of bird e.g. use the same size quadrat, control the number of predators.

Q35(b)(i) was correctly answered by over 90% of the candidates. It required a straightforward substitution of figures into the formulae. **Q35(b)(ii)** was also highly scoring.

Most candidates scored at least 1 mark for **Q35(c)**. To gain all three marks, the candidates had to link the process of eutrophication to the survival of dragonflies. The most common misconception here was that the fertilisers were poisoning the dragonflies.

Question 36

Q36(a)(i) tested **AO1** criteria, **Q36(a)(ii)** and **Q36(b)(i)** addressed AO2 and **Q36(b)(ii)** and **Q36(b)(iii)** targeted **AO3**.

Both **Q36(a)(i)** and **(ii)** were answered well. Candidates are advised to be specific when referring to safety precautions and avoid generalisations such as ‘health checks’.

It was encouraging to see that over 60% of candidates were awarded at least one mark when asked about the type of statistical test that could be used to analyse the data in **Q36(b)(i).** A significant number of candidates justified their choice, clearly explaining how measurements were taken from the same people before and after exercise.

Q36(b)(ii) was another example where candidates showed that they could describe data clearly. They were also able to identify that large error bars illustrated the data was variable but often failed to develop the idea of lack of significance when error bars overlapped.

Q36(b)(iii) required candidates to understand that weightlifting is not an aerobic exercise and occurs in short bursts so this training programme, which candidates were told focused on aerobic fitness, would not be appropriate.

Question 37

Parts **(a)(i)**, **(a)(ii)** and **(b)** tested **AO2**, **part c(i)** was targeted at **AO1**, **(c)(ii)** addressed a mixture of **AO1** and **AO3** and part **(d)** was focused totally on **AO3**.

Q37(a)(i) and **(ii)** both referred to **Fig 37.1** and serve to emphasise how important it is for candidates to read command words. The question was not asking about what happens in the kidney so any references to glucose diffusing out to the tubule and being selectively reabsorbed or proteins being too large to pass through the basement membrane did not gain credit. This was a question about movement of molecules across a partially permeable membrane in the context of dialysis and successful candidates studied the figure and used it to describe and explain the movement of molecules. Those candidates who suggested that glucose would diffuse into the tubing probably made the error based on number of molecules rather than concentration.

Q37(b) was accessible to, and well answered by, most candidates.

Q37(c)(i) was a straightforward recall question but many candidates did not refer to **concentrated** or **packed** red blood cells.

Blood group O was often identified as a donor in **Q37(c)(ii)** but identifying the blood group of the patient was more demanding.

In **Q37(d)** candidates were asked to use the information from a figure to discuss the suitability of treatment options. Candidates were not asked to give advice to the patient, so those that recommended that the patient lose weight before surgery were not credited unlike candidates who stated that the surgery would carry risks.

In questions such as this it is advisable to use as much of the given information as possible. Candidates often failed to realise that a patient who is HIV negative would not be a risk to others when undergoing dialysis. The candidates who scored highly for this question referred to several of the bullet points in the figure.

H422/02 Scientific literacy in biology

General Comments:

This examination paper was felt to be of an appropriate level of difficulty. It generated marks across the ability range and the majority of candidates were able to provide responses to all parts.

Candidates' answers were generally well set out with clear reference to particular structures when comparisons were required. The Level of Response questions were all attempted and the use of the literature was clear to see in candidates answers to **Q1(c)**. However, many candidates did not respond effectively to the descriptor 'evaluate' and did not summarise their discussions or describe the risks and benefits relevant to the questions. The graph skills were poor with many candidates unable to interpret data as continuous, quantitative and treating it as discrete, qualitative data.

One general point which applies to all questions is that candidates should be reminded that when they have used all the writing space provided they should then use the additional pages at the end of the examination paper to continue their response. The continuation should be clearly numbered so that examiners know which question it refers to.

Comments on Individual Questions:

Question 1

Q1(a)(i) was well answered: 95% of candidates gave the necessary level of detail required for this answer; a few candidates stated chloroplasts.

In **Q1(a)(ii)** the majority of candidates structured their answers well with clear references to plant cells and (cyano)bacteria. Most candidates correctly described the thylakoids in plant cells as stacked with only a minority of those adding that they are in chloroplasts which suggests many did not appreciate that thylakoids were held in an organelle in plant cells when compared to the cyanobacteria. Candidates then struggled to describe where the thylakoids were located in cyanobacteria. Many stated they were attached to or on the cell surface membrane and some described them as outside the cell. Candidates should be reminded to read their answers to make sure they make sense.

Q1(a)(iii) was generally well answered with a few candidates stating cytoplasm only for mp2 and some confusing stroma with matrix of mitochondria.

Q1(a)(iv) was also generally well answered and candidates clearly used and understood the literature provided to complement this question.
Many candidates wrote about the ancient form of RuBisCO which was not worthy of marks as the question asks for an explanation and this was a direct quote from the literature.
Some candidates described the HCO_3^- being pumped into the carboxysome which clearly does not have pumps in the diagram provided.
A few candidates described oxygen as being prevented from entering the cell and/or the carboxysome. Generally candidates tended to imply that no oxygen was surrounding RuBisCO. The presence of the pumps obviously led to this misconception. Candidates should be reminded that gases can simply diffuse at a certain rate through all membranes but pumps will increase the rate of movement for other gases as well as allowing passage of charged ions. As a consequence of this, very few candidates mentioned that carbon dioxide would be able to out-compete oxygen for RuBisCO.

Very few candidates achieved the mark for **Q1(b)(i)**. The majority of answers referred to RuBisCO having more than one active site and that's why it needed standardising. There seemed to be little appreciation of the different concentrations of RuBisCO in the different plants. Those candidates that did realise this then referred to the number of enzymes or amount and not concentration.

In answering **Q1(b)(ii)** most candidates labeled their axes correctly with all the units and used clear keys for the different tobacco plants. Approximately 50% of candidates plotted a bar graph as they did not appreciate that the concentration of carbon dioxide would be quantitative data and thus a linear graph. Candidates should be aware that quantitative data can be plotted even if the given values are not equally distributed. Many candidates that plotted line graphs drew lines of best fit that went beyond the data points, particularly converging at zero. Candidates should be aware that a line of best fit can only be used for the data presented and not extrapolated unless specifically requested in the question.
Most candidates attempted to plot error bars but some only plotted 2 SD values. They had misinterpreted the question stem 'error bars showing 2 standard deviations' and plotted only 2. Candidates should practice plotting standard deviations as error bars and realise that 'showing 2 standard deviations' would mean double the length of the error bars.

Most candidates recognised the greater rate with modification in **Q1(b)(iii)** although some candidates did not appear to refer back to the graph they had just plotted and use the term 'rate', mainly stating that modified plants were better at fixing carbon dioxide. If candidates had looked at the graph to assist with the answer, it would also have prompted more candidates to achieve mp2 and 4 as very few correctly used units when quoting figures and did not refer to error bars not overlapping. Time and space were used discussing the large SD values of the modified plants which were irrelevant as the comparison was always with the wild type.

For **Q1(b)(iv)**, all candidates appreciated that M35 showed greater rate but as before, did not use the term rate or activity, as prompted in the literature and previous graph. There was a good understanding and description of error bars overlapping or SD values being large but some candidates did not follow through by discussing the consequence of this to the data, merely saying the data is less valid without checking the question stem that validity referred to the student's conclusion, not the data.

Candidate responses to **Q1(c)** showed that they had clearly read the literature and had a good understanding of the turbo charged plants. They reworded the information well but often failed to go beyond the information provided. Candidates often referred to e.g. food chains being destroyed, without explaining how. Many candidates discussed supercrops in terms of herbicide resistance or vitamin A deficiency without referring to the turbocharged crops in the literature. Again, vague statements were made about decreasing biodiversity without it being clear how, and some inaccuracies crept in e.g. less herbicide would need to be used if there is herbicide resistant crops.

The vast majority of candidates achieved the mark for **Q2(a)(i)**.

In **Q2(a)(ii)** although most candidates scored, many failed to state the correct stage of nuclear division for meiosis by omitting I or II.

Candidates who correctly recognised oestrogen stimulating LH release achieved full marks for **Q2(b)(i)**. Some candidates discussed oestrogen directly causing ovulation and a few felt that both LH and FSH stimulated ovulation. It would be beneficial if these 3 hormones were discussed in terms of their feedback effects on each other and the subsequent changes that occur.

Generally candidates struggled with **Q2(b)(ii)** and found it difficult to incorporate meiotic stages into their answer, concentrating on mitotic division of cells and the release of a secondary oocyte. However, more able candidates understood the pauses in meiosis and often continued to discuss the completion of meiosis II upon fertilisation. A few candidates wrote about eggs: all candidates should discuss the menstrual cycle and oogenesis in terms of oocytes.

The description of the data in **Q2(c)(i)** was well answered by the majority of candidates. Some candidates appreciated the logarithmic scale, although many quoted figures without realising the mathematical significance of the large decreases. Most candidates focused on 50 years as the critical age decrease for follicular loss, probably linking to their knowledge of the menopause without focusing on the graph. The explanations for the loss focused on ovulation but most candidates discussed the follicles being released in ovulation. Candidates should visualise follicles and their enclosed secondary oocyte so they can appreciate the correct terminology. Some candidates stated that follicles are not maturing as women age and thus follicular number decreases and failed to see the logic of their statement that this would lead to a constant level of follicles. The majority of candidates appeared not to realise that other follicles are removed by apoptosis.

All candidates achieved the mark for **Q2(c)(ii)** with a few referring to perimenopause. There were some interesting spellings.

All candidates attempted **Q2(c)(iii)** with the majority correctly identifying one symptom. Candidates should focus on symptoms that are particularly symptomatic of the menopause and not applicable to an everyday emotional change. There were some spelling errors with ‘night sweats’ becoming ‘night sweets’ and ‘hot flushes’ becoming ‘hot flashes’.

Most candidates achieved the mark for **Q3(a)(i)** although a minority of candidates wrote negative feedback.

For **Q3(a)(ii)**, more able candidates answered all omissions with the detail required. Many candidates wrote autonomic for parasympathetic and medulla for medulla oblongata. Candidates could be reminded of the origins of some words/prefixes to help them realise that abbreviations or omissions would not be sufficient, e.g. Latin ‘medulla’ meaning ‘middle region of an organ’.

Most candidates achieved the mark for **Q3(a)(iii)** with a good description of the subjectivity of the level of pain. A few candidates merely described the correlation of heart rate to pain without discussing the relevance of using this technique compared to another.

Although candidates described the influx of sodium ions in their responses to **Q3(b)(i)**, they often did this after describing a synapse transmission. Clearly candidates felt that the receptor was not joined to the sensory neurone directly but via a synapse even though the question stated they were attached. Specific examples of receptors that are part of the sensory neurone e.g. Pacinian corpuscles, may help with this understanding. Some candidates confused the complete depolarisation value of 40 mV with the threshold value of -50 mV. Few candidates mentioned generator potential even though this is a key word that should be associated with receptors and transduction.

Q3(b)(ii) was well answered by candidates although a few were vague in their description and it wasn’t clear they were referring to a nervous system failure, merely stating a consequence of this e.g. cannot move muscles.

Candidates struggled with **Q3(c)(i)** and could not discuss it in sufficient detail. Many candidates discussed electrophoresis separating the SNPs, not appreciating that it separates on the basis of size and a probe would need to be used to pick up individual SNPs. Indeed some candidates stated that the DNA ladder would identify the SNPs and did not seem to realise that a DNA ladder is also based on size only. Many candidates spoke about PCR being used to amplify the

sample thus not realising that this would not be necessary as enough DNA would be available to proceed without performing PCR.

For **Q3(c)(ii)** most candidates achieved mp2 with a good understanding of the financial cost of testing everyone. Some candidates felt that the emotional impact of testing everyone should be considered and a few discussed the testing in terms of causing harm to the patient. Thus some candidates had not connected this question with the previous question of taking a blood sample and were visualising this method as a radioactive procedure. Many candidates wrote about the increased chance of inheriting the gene without realising that it is the mutated gene that is relevant, as everyone inherits these genes. The importance of the BRCA genes should not be restricted to their mutated forms and breast cancer.

Q4(a)(i) was well answered but with a few candidates stating nitrogenous base only for A.

Many candidates achieved full marks for **Q4(a)(ii)**. Errors appeared to be random and showed some candidates did not read the heading of percentage and that each row had to add up to 100.

Q4(b) was well answered with most candidates appreciating that complementary base pairing referred to the hydrogen bonding between bases. Some answers discussed DNA replication without focusing on the role of hydrogen bonding.

For Q4(c) most candidates achieved mp5 as a clear description of cancer development. Many candidates discussed this in terms of mutations in tumour suppressor genes or proto-oncogenes.

In **Q5(a)(i)** most candidates realised that the vaccine contains antigens although it was often stated as attached to the pathogen, not the idea of purified antigens. Some candidates confused this with booster vaccines. Few candidates appreciated that this was antigens from different strains of bacteria.

Candidates struggled with **Q5(a)(ii)**. Most candidates stated that the pathogen could not cause disease but failed to elaborate on what that actually means. Candidates should realise that pathogens cause disease by being able to replicate and then release toxins/destroy cells.

In responses to **Q5(a)(iii)**, most candidates showed a good understanding of antigens being similar but often stated between meningococcal infections without stating bacteria. Candidates should appreciate that structural features, like antigens, should be discussed in the context of an organism not in the context of a possible consequence of that organism. Few candidates related antibodies to binding to the antigens, instead the secondary response was discussed in general terms only or antibodies were mentioned as being more effective, without reference to binding or recognition.

Q5(b) was generally not well answered with many candidates failing to appreciate the relevance of herd immunity, not mentioning vaccination and just discussing immunity in general with many stating all the population being immune. The candidates that gave a clear description of an epidemic often achieved high marks as they related it well to protecting those un-vaccinated individuals and preventing the spread of a pathogen. Very few candidates discussed the risks of vaccination.

The calculation in **Q6(a)(i)** was correctly worked out by the majority of candidates. Marks were lost for quite high P_{50} values, particularly for the anaemia curve.

There appeared to be 2 interpretations for **Q6(a)(ii)**. Those candidates that felt BPG increased Hb oxygen affinity described the relevance of this to a drop in haemoglobin levels in anaemic patients with a sensible, logical pattern. However they had not related the shift in the curve to the

Bohr shift and thus a decrease in affinity. Candidates should be reminded that the affinity of haemoglobin for oxygen is relevant when oxygen needs to be released as well as needing to pick up oxygen. Candidates that understood the decrease in affinity then followed through with clear, logical answers.

Approximately 40% of candidates achieved the mark for **Q6(b)(i)**. A lot of candidates stated the correct term but did not state the relevance of the actual term used.

For **Q6(b)(ii)** the majority of candidates achieved mp2. Many candidates discussed slowly increasing the magnification or a better method for spreading the blood across the slide. Candidates did not appreciate that the improvement should be pertinent to observing osmotic effects. Candidates should focus on the relevance of the procedure, i.e. the student is trying to compare the solutions to 'find the one that caused' an osmotic effect, thus counting or measuring cells is the focus not how to apply the sample in the first place. A few candidates referred to adding a dye to visualise again without appreciating the osmotic relevance and thus the leakage of any dye from the cell.

Q7(a)(i) was well answered. A few candidates stated cell membrane only and a few candidates stated G as the rough endoplasmic reticulum as well as H.

Although the majority of candidates realised that H was the site of protein synthesis in **Q7(a)(ii)** they struggled to think of a second relevance and confused this with the function of the Golgi Body. Most candidates recognised and stated the function of J although a few discussed this in terms of proteins.

Candidates struggled with **Q7(b)(i)**. Many candidates correctly stated K and L but did not relate this to the level of fluorescence. Candidates that started with K as the nucleus failed to appreciate that the fluorescence would only manifest itself when the protein is produced even though the stem of the question clearly referred to the protein tagged with fluorescence.

Candidates seemed to randomly pick numbers for their answers to **Q7(b)(ii)** with only the minority giving a correct answer.

For **Q7(c),** many candidates appreciated that vesicles require microtubules to move but could not follow through with the relevance of M disappearing. A few candidates discussed microtubules moving proteins directly. Some candidates felt that Golgi body would not be formed or vesicles would not be formed as microtubules were required for their production. It may be helpful to stress the structural features of certain organelles so it is clear what they are composed of and thus what would or would not be required for their production. Some candidates discussed spindle fibre formation, or lack of it, as this is obviously the context in which they associate microtubules.

H422/03 Practical skills in biology

General Comments:

The paper was an appropriate level of difficulty and generated a good spread of marks. There was a good range of question types, including questions testing simple recall of practical skills, which were expected to have been experienced in the PAG assessments, and some longer questions testing the ability to describe practical methods and evaluate scientific processes. There was evidence that some candidates are unsure of how to answer evaluation questions; for example in **Q1(c)** candidates needed to provide a positive use of ultra sound scans as well as a statement detailing their limitations.

There was evidence that candidates were writing excessively on some questions with many candidates using both the pages provided at the end of the question paper (page 15 and page 16) as well as additional pages. Some centres provided their candidates with extra sheets rather than instructing them to use the additional space provided at the back of the paper. The instruction to use the space provided is given clearly on the front of the examination paper. Giving candidates the instruction to read the examination paper thoroughly should include reading the front page. Candidates should be reminded to focus their responses on each individual question and make good use of the time available to answer all the questions.

Comments on Individual Questions:

Question 1
In **Q1(a)** many candidates calculated the growth rate by taking the single value at 31 weeks and dividing by the period of time. In accordance with the Maths Skills handbook, a tangent should be drawn by hand and eye to approximate the instantaneous rate of change at a particular point. While aligning the ruler, make sure that in the vicinity of the point none of the line of the curve is covered by the ruler. The aim is to have the entire curve visible as the line is drawn, otherwise the tangent will not be accurate.

Some candidates found the formatting of the units difficult with answers such as 'mm per week^{-1}' and 'mm/weeks' not gaining credit.

The majority of candidates found **Q1(b)** difficult and few achieved the mark. Candidates either related their answers to the 'health' of the fetus or made no reference to the 'three sets of data'. Whilst the question emboldened 'three sets of data' some candidates misinterpreted this and provided answers referring to calculating a mean. Responses should refer to the range of growths that fell between the values and how that could indicate abnormal growth.

In **Q1(c)**, as referred to above, many candidates provided two useful statements about USSs and as such did not interpret the command word appropriately. Descriptions of the actual methodology itself were not credited as this is not evaluative.

Question 2
In responding to **Q2(a)** some candidates were able to give comprehensive methods providing excellent details of serial dilutions. Many candidates, however, did not provide details of how to dilute the stock solution to provide a range of concentrations of gibberellic acid. There was evidence of a large number of candidates writing at length on this question which was not required. The command word 'outline' should be differentiated from 'describe'. There was some evidence that in some cases this may have hindered candidates later in the paper in terms of time.

For **Q2(b)** candidates needed to be able to construct a table and record both raw and processed data. The number of candidates who did not draw borders around the outer part of the table, used incorrect units or gave readings to different numbers of decimal places was higher than expected. This is a skill that should be developed whilst completing practicals in the 12 PAG groups. Given the variation in how the radicle could be measured there was a range of acceptable values. Candidates should recognise that in this context the appropriate level of precision is +/-0.5 mm and as such should record values to this level. The majority of candidates gained 2 or more marks.

Question 3

For **Q3(a)(i)**, given the question states 'Give one...', only the first response is considered. Several candidates gave answers including the terms 'accurate' and 'precise' which was not credited due to a lack of clarity in the understanding of the terms. Centres should ensure candidates can distinguish between accuracy and precision as well as repeatability and validity.

Similarly for **Q3(a)(ii)** only the first 2 answers were considered due to the stem of the question. Many candidates referred to the species of the fish but this was already given in the question. Some candidates were vague in their answers referring to just the 'water used'.

Q3(a)(iii) was a difficult question with only a few candidates gaining credit here for references to recalibrating the apparatus being the most common correct answer. Many candidates referred incorrectly to (unqualified) debris or differences in oxygen content of the water.

In **Q3(b)(i)** candidates were not confident in expressing the null hypothesis: many did not refer to both the 'significant' difference and the 'mean' in their answer. Several candidates incorrectly implied in their answer that the test was assessing the difference in the temperatures (rather than the mean metabolic rate).

Some candidates seemed to find **Q3(b)(ii)** difficult and did not appreciate they had to square the value.

Many candidates gained full marks on **Q3(b)(iii)**. However common mistakes were: not squaring the SD to give the variance in the formula; rounding too early; and not giving the answer to the specified three decimal places. As stated in the Maths Skills Handbook rounding should only occur in the final step of a multi-step calculation. There was evidence that some candidates did not understand the significance of the modulus symbol (noted in the question paper erratum) despite adding this to their written paper.

Responses to **Q3(b)(iv)** showed that few candidates could calculate the degrees of freedom correctly; in these cases error carried forward was applied to give a maximum of 2 marks. Candidates were not confident in their expressions referring to the $t_{calculated}$ and $t_{critical}$ values. This is an area where candidates would benefit from more practice and training when completing PAG assessments. Candidates should appreciate that statistical tests do not prove/disprove a hypothesis. Likewise hypotheses are not correct/wrong/invalid; instead the terms accepted or rejected should be used appropriately.

The most common answers for **Q3(c)** were either the small sample size (10 fish) or only one species of fish being investigated. Some candidates also referred to acclimatisation period. Again candidates should appreciate that they need to only provide 2 suggestions given the wording of the question and it will be the first 2 responses that are marked (not selected from an extensive list).

Question 4

Q4(a)(i) was generally answered well though some candidates did not read the data correctly and as such calculated the median incorrectly (especially for 68-75 years). Some candidates stated the interval (upper and lower values of the range) rather than the range. This was not credited as the question stated 'calculating' and as such required data *processing* to be undertaken.

Candidates found **Q4(a)(ii)** difficult with some misinterpreting the command word 'evaluate' and/or concentrating on either the mean or the median. Some candidates gave generic comments relating to both and did not distinguish between the mean or the median e.g. 'they are averages', 'they show the central tendency of the data'.

Q4(a)(iii) was generally answered well by higher achieving candidates but weaker candidates were let down by difficulties in expressing their ideas clearly.

Q4(b) saw few candidates gaining full marks with the most common mark point awarded being MP1.

Q4(c) was generally answered well but again there was evidence of some candidates writing excessively. This often led to the communication mark being deducted within the level as the candidates often referred to irrelevant content such as references to placebos and blind/double blind trials. Those candidates that did not score above level one did not generally provide any positive comments for testing on either animals or humans i.e. the answer focused purely on the negative aspects of any form of drug testing.

Question 5

Q5(a) was a straightforward calculation and the majority of candidates gained the mark here. Some however did not quote their answer to the correct number of decimal places and/or had rounding errors.

Q5(b)(i) proved to be a challenging question as candidates were not confident in selecting the appropriate data to anlayse. Candidates were expected to calculate the % of smokers and % of non-smokers in the study and use these percentages to then determine whether the actual observed numbers/% were in-line with, or different from, the expected values. Again errors were seen with candidates referring to the null hypothesis being wrong/invalid/disproved/incorrect rather than rejected/not supported.

Few candidates gained the mark for **Q5(b)(ii)** with the most common answer incorrectly being a *t*-test. Candidates did not appreciate the need to test whether the observed values were significantly different from the expected values.

Candidates who gave the incorrect answer to **Q5(b)(ii)** were unable to gain the mark for **Q5(b)(iii)** and often did not give the appropriate reason as to why the test would be appropriate.

Some candidates did not read **Q5(c)** carefully and cited primary defences that could not be seen in the photomicrograph e.g. skin, hydrochloric acid. Most candidates correctly identified cilia or goblet cells. Some candidates just referred to epithelium cells unqualified.

Q5(d) was well answered in the main. Some candidates however were unable to provide appropriate apparatus and/or give even the most basic of descriptions of serial dilutions. Some candidates described serial dilutions but did not give appropriate volumes to generate the concentrations of the antibiotic required e.g. gave dilutions of 50%, 25% etc. rather than by diluting by factors of 10 in each case.

In **Q5(e)** to obtain full credit candidates needed to work through all three steps of identifying E and F as equally effective in this test, a reason for preferring E over F and a clear statement that E was the most appropriate.

About OCR

OCR (Oxford Cambridge and RSA) is a leading UK awarding body. We provide qualifications which engage people of all ages and abilities at school, college, in work or through part-time learning programmes.

As a not-for-profit organisation, OCR's core purpose is to develop and deliver general and vocational qualifications which equip learners with the knowledge and skills they need for their future, helping them achieve their full potential.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553