

Biology

Advanced GCE **A2 H421**

Advanced Subsidiary GCE **AS H021**

OCR Report to Centres

June 2013

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates 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.

OCR will not enter into any discussion or correspondence in connection with this report.

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Overview

As has been highlighted in previous Reports to Centres, teachers are reminded of the individual requirements for the assessment of each unit when preparing candidates for the examinations. Candidates should be prepared for the way in which the questions will be asked and should understand the relative weightings of each of the Assessment Objectives in each unit of assessment. The differences in the relative weightings of the Assessment Objectives give each unit examination a distinctive feel. Reference should be made to previous Reports to Centres, available on the OCR website, to view a table that sets out the weightings of Assessment Objectives for Units F211 to F215.

It is clear that if a candidate's preparation for their examinations has been based mainly on simple recall of facts (AO1) or memorising their revision notes, they may approach the examinations with a false sense of security. It is quite likely that they will score highly in AO1 questions but may then find themselves unable to perform well in questions involving AO2 (and, for the A2 units, synoptic elements) and AO3 assessments.

A common theme reported by examiners is the apparent reluctance of some candidates to read carefully the information provided in the stem of the question and in the question itself. All too often, good candidates concentrate on a few key words and provide good biological information which cannot be credited as it does not answer the question asked. Candidates have sometimes provided information that is contradicted by the information supplied in the text. This, again, suggests that they have not taken the time to read the whole question.

Candidates need to be able to demonstrate general mathematical skills, such as manipulating formulae and substituting numerical values into formulae (see Mathematical Requirements in the Specification Appendix), in addition to the specific mathematical skills detailed in the specification for each unit. While these latter skills might be expected to feature regularly in the assessment of each unit, calculations will also be set that require candidates to demonstrate general mathematical skills.

It is encouraging to see that more candidates are indicating when their answers stray beyond the answer spaces allocated. Typically, examiners only see the answer space displayed in their marking screen. If an answer ends in mid sentence, then an examiner will realise that it is likely to be continued elsewhere and will look for it. The problem arises when it is not obvious that an answer is continued elsewhere, or where it is to be found, whether it is located on the same page or on additional lined sheets. Candidates should always indicate clearly when and where answers are continued.

It is clear that some candidates are not using scientific terms which are appropriate to AS or A2 level. The correct use and unambiguous spelling of such terms will frequently be required in order to be awarded a mark and discriminates well between candidates. Centres are encouraged to study the reports for individual units in order to identify commonly misused terms.

Some aspects of the subject are challenging for some candidates. Centres are advised to consult the reports on individual units, which highlight the issues that are particularly relevant. For those mentioned in the reports for AS units, misunderstandings and misconceptions may well continue into A2 and this is evident in synoptic assessment. One example is the misconception that as an organism increases in size, its surface area to volume ratio increases. Another is the mode of action of enzymes, in particular the use of the term 'active site'. Biochemistry features strongly at A2, particularly in F215, and it is important to re-emphasise the relevant basics from AS when teaching A2.

It is pleasing to note that many Centres are following the guidelines that have been given in previous reports and that the candidates are benefitting from more finely focussed advice when being prepared for the written examinations. It is also pleasing to note that many Centres are carrying out the administration and marking of the practical tasks well.

There are, however, a number of issues concerning units F213 and F216, and Centres are advised to take careful note of all the information supplied in the separate reports for these units. Some of the common aspects are summarised below. This information would appear to fall into three distinct categories:

- Preparation

Centres are reminded that **all** tasks (other than the set of practice tasks that are available on Interchange) remain **confidential** for the **life of the specification**. Candidates must **not** have access to the mark schemes and 'instructions to teachers' documents at any time. Additionally, candidates should only be given the tasks once and under controlled conditions. All regulations relating to the tasks must be adhered to (e.g. candidates must not have access to an Evaluative task before attempting the corresponding Quantitative task) and candidates must be supplied with all the documentation that they will require in order to complete the task (e.g. any identification chart and, for the Evaluative task, the Specimen Experiment Sheet (to which many of the questions in the task will refer)).

- Administration

Centres are advised to take on board all the recommendations outlined in the unit reports for submitting the samples of candidates' work.

These include: the way in which the work is presented to the moderator; the importance of moderation within the Centre; the importance of clerical checks; the inclusion of Centre trial data; the inclusion of email responses to queries or reports from OCR consultancies. Attention to detail in these areas reduces the chances of work being returned to the Centre for checking or revision and can allow the moderator to support the marking decisions made by the Centre staff.

- Marking

It is essential that the tasks are marked according to the published mark scheme, taking the Additional Guidance fully into account. Teachers are expected to use their professional judgement to decide whether the candidate's answer is close enough to the mark point, but not to credit points that do not feature on the mark scheme. If there are any queries, then these should be checked using the tasks email address

GCEscicetasks@ocr.org.uk. It is important that the work of all the candidates is marked to the same standard, not only within the Centre but also across the whole cohort.

Moderators are, therefore, looking for the mark scheme to be closely adhered to in order that there is confidence that there is consistency in marking.

Before marking and/or submitting the final marks, a check should be made on Interchange to see whether a clarification to the mark scheme has been published. Signing up for email alerts will allow you to receive indication that new information relating to the specification has been published.

Internal moderation is vital, as it is assumed that all the marking within a Centre (or within a Consortium) is of the same standard. Clerical checks are also very important in ensuring that candidates are awarded the correct mark. If these activities are not carried out effectively, then it is likely that the rank order of your candidates will be changed and the work will be returned to your Centre for further clerical checks and/or remarking. This obviously causes delays in moderation.

A level reform

In Autumn 2012, the Regulator, Ofqual, announced that there would be no January A level examination session from 2014. AS and A2 examinations will be available only in the summer examination period. In the current specification, it will only be possible to resit an AS unit at the end of a two-year A level course. For the A2 units, there will no opportunity for candidates to resit without entering a third year.

In September 2015, new AS and A level specifications will be available for first teaching. Centres will receive further information over the next two years.

September 2015 promises to be a significant month for exam reform of both A level and GCSE qualifications, with concurrent changes taking place for the National Curriculum. Further details of the timeline for examination reform are available from the OfQual website:

<http://ofqual.gov.uk>.

GCSE and GCE/A level Science development, tell us your thoughts...

OCR is currently in the process of re-developing GCSE and GCE Science specifications for first teaching from September 2015. To assist with this work we would welcome your feedback regarding anything you would like to see changed or included as part of the new qualifications. If you have any comments/questions regarding GCSE or GCE Science developments please e-mail ScienceDevelopment@ocr.org.uk or join the OCR Community (www.social.ocr.org.uk) to be kept updated.

In summary,

GCSEs are being re-developed for first teaching from September 2015.

- The courses will be linear with separate Science (Biology, Chemistry and Physics) and a Double Award Science;
- There is no Single Award Science as part of the DfE Programme for Reformed GCSEs in Science.

For more details see <http://www.ocr.org.uk/ocr-for/teachers/newsletters/agenda/>, <http://www.education.gov.uk/schools/teachingandlearning/qualifications/gcse/a00221366/gcse-reform> and <http://ofqual.gov.uk/news/ofqual-launches-consultation-on-gcse-reform/>

GCE/A levels for Biology, Chemistry and Physics are also being revised for first teaching from September 2015. (Other Sciences will be developed in a later phase.)

- AS is to be a standalone qualification that does not count towards the A level, covering half the content of an A level and delivered over one or two years;
- The AS could be designed to be co-teachable;
- The standard of the AS is to remain broadly as it is now;
- A level is to be a fully linear, fully synoptic, two year course.

For more details see www.ofqual.gov.uk/news/ofqual-publishes-a-level-reform-correspondence/

Developers

During September, OCR will be advertising for Developers to assist with the drafting of new qualifications for Science. It is expected that adverts will be posted to the OCR website and TES and a notification will be posted on www.social.ocr.org.uk. Alternatively if you register your interest *via* e-mail to ScienceDevelopment@ocr.org.uk, we can send you more details when Developer roles are advertised.

F211 Cells, Exchange and Transport

General Comments

Examiners were pleased to see that all parts of this examination paper were attempted and that there was no indication that candidates ran short of time. Each of the questions worked well and the examination was able to discriminate effectively. Able candidates scored well while all but the very weakest candidates were able to score respectable mark totals. Certain questions tested Assessment Objective 1 (AO1) and the majority of candidates demonstrated that they had learnt their facts very thoroughly. However, those questions testing Assessment Objective 2 (AO2), again, revealed the weakness seen in many candidates of middle to lower ability. This assessment objective tests the ability of candidates to apply their knowledge. To do this effectively, the candidates need to stop and think through the information they are given and work out what part of the knowledge they have learnt will help them answer the question. It is important that candidates are prepared for questions testing AO2 and expect searching questions that make them think.

While fewer candidates needed to use the additional pages this session, examiners were pleased to see that more candidates are now using the additional pages correctly and are indicating on their response that there is more of the answer to follow. Examiners also noted that the QWC questions were well answered and the majority of candidates used enough suitable terms to be awarded these marks.

Comments on Individual Questions

- Q.1** This question was a straightforward starter question testing mostly AO1 – recall of knowledge. The majority of candidates were able to demonstrate a good level of knowledge.
- (a)** **(i)** Component A was correctly identified as the nucleus by the majority of candidates. Common misconceptions were that it was only the nuclear membrane, despite the bracket indicating that the label line referred to the whole organelle, or that it was the nucleolus, although this was shown clearly within the organelle on the diagram.
Not all candidates realised that the distinctive membranes within component B, along with its size, was the key to recognising this component as a chloroplast.
- (a)** **(ii)** Most responses correctly gave the function of C (the mitochondrion), as producing ATP or being involved in respiration. Unfortunately, many candidates still make the basic error of describing energy as being ‘produced’, preventing the mark being awarded.
Component D (smooth endoplasmic reticulum) and its role in lipid metabolism was not always correctly recognised, often being confused with the Golgi body.
- (b)** This question discriminated well between candidates by testing their understanding of the concept of resolution as opposed to magnification, since the emphasis in the question was the lack of clarity when viewing component C. The best responses concentrated on the limits of the resolution of a good light microscope and the ability to clearly see a component as small as C. Examiners did not accept a simple statement of the resolution of a light microscope unless it was made clear that this was not sufficient. Responses stating that the mitochondrion is too small also gained credit, while the explanation that the wavelength of light is too long was rarely seen. References to magnification were irrelevant.

- (c) The advantages of staining specimens to be viewed microscopically usually referred to making structures visible, while some references to increasing contrast were also seen. Few responses could describe any further advantages, such as the ability to identify organelles, different cell types or different compounds.

Q.2 This question involved the concept of surface area to volume ratio and an experiment to investigate the effect of surface area to volume ratio on the rate of diffusion. It was evident that many candidates still have difficulty with the concept that surface area to volume ratio decreases as size increases. It was also evident that many candidates had not had the opportunity to carry out this very simple practical technique even though it is one of the suggested pieces of practical work in the specification. Many of the marks lost in this question were due to this fundamental lack of understanding and experience.

- (a) (i) The majority of candidates were able to carry out this simple calculation accurately. A few failed to complete the division after identifying that 600:1000 was the correct ratio, or did not reduce the ratio to the correct figures, leaving it as 3:5. A small minority of candidates calculated a ratio of 1.6 : 1 as they calculated volume divided by surface area.
- (a) (ii) Whilst many candidates stated correctly that the rate of diffusion increased as the surface area to volume ratio increased some candidates stated that the rate of diffusion increased as the SA:Vol ratio decreased. It was clear that some candidates did not understand the concept of a rate and statements such as 'it's faster, because it goes up from 0.02 mms⁻¹ to 0.013mms⁻¹' were quite common. Some candidates also described the effect of SA:Vol ratio on the time taken for decolouration rather than rate of diffusion. Many candidates missed out the units for the second mark point. Very few candidates commented that the second value in the table was a higher rate than the first value, even though the SA:Vol ratio was lower.
- (a) (iii) This question was generally answered poorly. Surprisingly few candidates recognised that large plants will have a small SA:Vol ratio, thus making diffusion far too slow to meet their needs. Answers were often couched in terms such as 'large plants have a big surface so diffusion is fast'. A few candidates recognised that large plants could have an increased surface area for gas exchange by, for example, having lots of thin leaves or that they could increase the rate of supply of water or minerals by having transport systems such as xylem and phloem.
- (b) (i) Most candidates recognised that the rate of diffusion had been calculated by dividing the length of the side by the time taken for the colour to disappear.
- (b) (ii) In contrast to part (b)(i), very few candidates recognised that the centre of the cube was only half the cube's length from the surface. Most candidates answered in terms of the need to take account of the SA:Vol ratio in calculating the rate of diffusion.
- (c) Most candidates answered this question well. Some candidates lost marks because they stated that the large number of alveoli increase the SA:Vol ratio rather than increasing the surface area. Marks were also lost by referring to diffusion gradients rather than concentration gradients. A few candidates were confused by the third point and answered in terms of the blood supplying oxygen to tissues or rapidly removing CO₂ rather than increasing the concentration gradient by bringing in CO₂ or removing oxygen from the exchange surface.

- Q.3** This question managed to link a number of learning outcomes from different areas of the specification. All parts of the question were connected by their application to plants and growth of plants.
- (a)** **(i)** Most candidates were able to name the type of nuclear division correctly as mitosis. Some candidates suggested 'budding' or even 'meiosis'. Incorrect spelling of mitosis such as 'miosis' could not be accepted as it could be interpreted as a mis-spelling of meiosis.
- (a)** **(ii)** Again the majority of candidates scored full credit here and were able to draw four chromosomes in a line and show each chromosome as a pair of chromatids. Common errors were to draw early anaphase where the chromatids had already separated or to draw the chromosomes at random positions around the cell.
- (a)** **(iii)** Most candidates were able to draw arrows indicating the correct direction of movement of water between the cells in the diagram. However, some candidates drew arrows in the wrong direction or omitted to draw one of the arrows – usually the arrow from R to T.
- (b)** A large number of candidates described the cambium or the phloem as being 'in the bark'. Candidates should be aware of the distribution of xylem, phloem and cambium in the vascular bundles and should be aware that the vascular bundles are found between the medulla and the cortex of the stem and not 'around the outside' of the stem. Candidates could gain credit by describing the position of the cambium correctly (under the bark or near the edge of the stem) or by stating the functions of the xylem, phloem or cambium that are essential for growth – i.e. cambium can produce new cells, xylem provides water or phloem supplies assimilates – all of which are needed for growth.
- (c)** This is a common question which is often asked in terms of 'where does mitosis occur in plants'. Examiners were looking for any response that indicated a part of a plant that contains a meristem – root tips and shoot tips were the most common correct responses. As in previous years, many candidates failed to gain credit because they wrote 'roots' or 'shoots' without specifying that growth occurs at the tips.
- (d)** This was a typical AO2 question where candidates needed to apply their knowledge to answer a question set in an unfamiliar context. They were given a hint in the stem of the question, which mentions diffusion of gases. The majority of candidates described carbon dioxide entering the plant for photosynthesis. The plant shown in Fig. 3.2 had no leaves and the bark is not obviously green – so these candidates had not considered their answer very carefully. All living things must respire so it would be more appropriate to expect oxygen to diffuse into the stem. Only the most able candidates spotted this. Candidates should also know that plants do not transport (much) oxygen in their transport systems but that animals do – therefore animals can bring oxygen into their bodies at one site and transport it to all the tissues – plants cannot do this. Those candidates who considered this last point often made sweeping statements such as 'plants do not have a transport system' which suggest that they have not studied the section in Module 2 entitled 'Transport in plants'.

Q.4 Transport of oxygen and dissociation curves are topics that many candidates find difficult. The concept of affinity and the effect of changing partial pressures of oxygen on the percentage saturation always prove to be difficult to describe.

(a) **(i)** All but a few candidates stated that fetal haemoglobin has a higher affinity for oxygen than adult haemoglobin (mark point 3). A few were caught out because they were not comparative in their answers – they stated “high” rather than “higher” – this is an important distinction because both types of haemoglobin can be described as having a high affinity for oxygen. A large proportion of candidates gave extended explanations of what “higher affinity” meant without hitting the other mark points which explained how this higher affinity allowed the fetus to gain oxygen. A number of candidates went on to write about the fetal haemoglobin needing to gain the oxygen in some way from the mother’s blood. However, few were able to pick up many marks as their descriptions were often confused or so poorly phrased that it was not possible to interpret. Many weaker candidates seemed to think that having a higher affinity means that the partial pressure of oxygen is increased and while some knew that the placenta has a low pO_2 , few connected this with the dissociation of adult oxyhaemoglobin.

(ii) This part of the question was very discriminating as only the more able candidates gained marks. It was surprising how few candidates included mark points 1 and/or 2 (fetal haemoglobin less likely to crystallise and red blood cells less likely to change shape) as these would seem the easiest and most obvious way to gain marks. Many lost credit by failing to mention that fetal haemoglobin can pick up more oxygen at low pO_2 or failing to point out that more oxygen could be transported.

(b) For candidates to gain full credit in this question they needed to include both hydrostatic pressure pushing fluid out of the capillaries and diffusion in their answer. However, when candidates described both mechanisms, their descriptions were often confused or clearly inaccurate – many seemed to believe that diffusion is caused by high hydrostatic pressure rather than by a difference in concentrations. Candidates should be able to appreciate the difference between movement by diffusion and mass flow of fluid caused by a hydrostatic pressure gradient. The term membrane was often used inappropriately - as in “capillary membrane” meaning capillary wall, and many candidates seemed to think that glucose is moved by active transport out of the capillaries. A significant proportion of candidates (including many of the more able ones) used much of their answer to describe the return of substances or fluid to the capillaries at the venous end of the capillary - this was beyond the scope of the question. Osmosis also played a big part in many answers.

Q.5 Most candidates generally managed well in this question about cell membranes.

(a) As ever, the emboldened ‘two’ meant that only two responses will be considered – so those candidates who gave three or even four responses have not been sufficiently well trained. Many candidates gave suitable responses including ‘control what substances enter the organelle’ and ‘separation of organelle contents from the cytoplasm’. Other suitable responses were seen more rarely. A significant number of candidates gave responses referring to the functions of the cell surface membrane – presumably these candidates had not read the question carefully.

(b) The more able candidates gave clear concise responses which were well structured – sometimes using bullet points or leaving a line blank to indicate that they were starting on their second component. This question discriminated well as less able candidates usually gained two or three marks but only the better candidates gained full credit. The majority of candidates described phospholipids as being in a bilayer but fewer were able to state clearly that this bilayer allowed only certain substances to pass through the membrane – some detail was required here and examiners were looking for an accurate description of what type of molecules could pass through the bilayer or which were prevented from passing through. Many candidates accurately described cholesterol as being between the phospholipid tails and stated that the cholesterol stabilises the membrane or reduces its fluidity. Carrier proteins were frequently mentioned and a suitable function given. Fewer candidates gained marks for describing the arrangement of glycoproteins or glycolipids as they failed to make it clear that these molecules must be on the surface of the membrane. The functions of these molecules were well understood.

(c) (i) Many candidates knew that the phospholipid bilayer becomes more fluid as the temperature increases but were not sufficiently precise in their response - examiners were looking for the idea of the bilayer becoming more fluid rather than simply the 'phospholipid'. Frequent incorrect responses included 'cholesterol'.

(c) (ii) Most candidates gave a correct response as 'protein' or 'glycoprotein'.

(c) (iii) Many candidates found this applied question more taxing and failed to link the potential damage to membranes caused by freezing with the release of the contents of the peroxisomes. The more able candidates spotted that ice crystals might damage the membranes releasing the catalase to increase the rate of reaction. Some candidates incorrectly suggested that the freezer had 'preserved the enzymes better' or that the 'enzymes in the refrigerator had denatured' or 'decomposed'. However, too many candidates gave responses suggesting that they had not read the information in the question thoroughly – these included:

- the two samples had not been returned to the same temperature
- the enzymes in the refrigerator had worked slowly all night so that in the morning there was less hydrogen peroxide left to break down.

Any candidate who had read the fourth bullet point in the question would realise that both these responses are clearly incorrect. Another unexpected response was the notion that as the frozen liver warmed up from a lower temperature the greater increase in temperature gave the enzymes some form of momentum that enabled them to move more quickly than those that had been in the refrigerator.

Q.6 This was a relatively straightforward question that allowed many candidates to score well.

(a) The majority of candidates have learnt that transpiration is the loss of water vapour from the aerial parts of the plant. However, some still forget that it is 'loss of water vapour' or 'evaporation of water'. A few candidates describe 'loss of water' or 'evaporation of water vapour'. The meaning of the term 'transpiration stream' is not as well understood and candidates should be aware that water moves up the xylem in a continuous column or by mass flow. Some candidates confused this response with descriptions of the symplast and apoplast pathways.

(b) Most candidates were able to work out that xerophytes would have the lowest number of stomata, the smallest leaf surface area and the thickest cuticle. A few candidates fell into the 'smallest, smallest, smallest' trap presumably because they did not read the information thoroughly.

- (c) Most candidates fared well here. Typical errors included:
- stating 'sugars' instead of sucrose under phloem in the first row
 - describing a continuous column rather than a lack of cross walls which is the most appropriate comparison to perforated cross walls in the second row
 - in the fourth row, some candidates referred to pores rather than 'pits' or 'bordered pits' for the xylem.

F212 Molecules, Biodiversity, Food and Health

General Comments

It was pleasing to note that most candidates attempted all questions and the number of 'No Responses' appeared to be low. There was no evidence that time was a constraint for candidates and those who were clearly prepared were able to perform well across the range of topics covered. There were fewer answers that candidates continued outside the answer lines and the majority of candidates who extended their answers onto the additional pages made clear references to this within the allocated response area for the question. This suggests that candidates have taken on board guidance given in previous reports. It also hints that candidates are becoming more proficient at using the mark tariff for a question to guide the length of their response. It is interesting to note that even when candidates did use the additional pages to extend their answer, they had often been awarded the maximum mark tariff for the question already and so, an extended answer was rarely necessary.

There was some evidence to suggest that candidates had taken on board advice, previously offered as a teaching tip, to read the question rubric carefully and to underline the command words. Consequently, questions such as 3(c)(i) were well answered, with clear comparisons between years rather than patterns within years or explanations.

Candidates generally dealt with the 'suggest' questions well and gave responses mainly within the scope of the mark scheme, suggesting that the question structure and rubric was appropriate and lead candidates in the right direction. The main exception to this was the final question, 8(c), where a small number of candidates went down the route of linking their answers to classification systems not being developed, garden habitats not being available or evolution of water bears occurring in the last 300 years. There was also evidence that some candidates had not studied the insert closely or the information given at the start of the question when answering this part, as they implied that water bears were a larger organism rather than an invertebrate or even a type of bear.

The on-going confusion by some candidates between immunity and resistance, and about the relationship between selective breeding and mutations, was still evident in question 7 despite this being raised in previous reports. The use of imprecise terms such as 'amount' frequently led to candidates losing marks in 4(a)(ii), 5(d) and 6(a)(i). Teachers should advise candidates that this word should be avoided in the construction of exam answers as it is rarely considered creditworthy. Candidates were often indecisive about the use of key terms. When discussing polypeptides, chains, strands, filaments and fibrils were often used interchangeably; there seems to be less confusion when discussing polynucleotides. Chain is the preferred term for a polypeptide, while strand is preferred for a polynucleotide. Polypeptides, and polysaccharides, can occasionally form fibrils but this term should be used in the correct context.

Comments on Individual Questions

Q.1 This question proved more challenging than expected and only those with a clear understanding of protein structure approached full marks.

(a) **(i)** Half of the candidates correctly wrote 'primary structure'. Some candidates wrote 'polypeptide', which did not really answer the question that was asked.

(ii) This was gratifyingly well done by most candidates who more often than not drew the full displayed structure rather than simply NH_2 and COOH . A high percentage gained full marks and few failed to score. Common errors at the carboxyl end were substituting H for OH and having a single bond between C and O. At the amine end, NH_3 was the most common incorrect response.

- (b) (i)** This was well answered by most candidates who usually gained the mark for the idea of strength. A significant number included explanations about the need for strength despite the command word 'state' and only being provided with one answer line.

(ii) This sub-question was quite challenging and acted as a good discriminator with only the very best candidates gaining full marks. The structure of collagen can be confusing – its secondary structure is atypical, it lacks any real tertiary structure and the ambiguous treatment of its structure in many textbooks does not help. However, the mark scheme was such that strong candidates should have been able to gain full marks despite a little reasonable confusion. Many lost marks because hydrogen bonding and covalent crosslinks were attributed to the wrong structure. Another problem highlighted by this question was the misunderstanding of the term alpha helix (and beta pleated sheet). There is a vast array of helical structures in biology but candidates seem to think that any helix is an α -helix. Able candidates were aware of the unusual left-handed helix in the secondary structure of collagen and gained credit for displaying this knowledge.

Most candidates gained the marking points for the three polypeptide chains coiling to form the triple helix. Some stated that amino acids are joined by peptide bonds and a similar number mentioned the unusually high proportion of glycine, although very few mentioned that glycine has a small R-group. Some also realised that the covalent crosslinks (between collagen molecules, not between the three polypeptide chains) helped to form the fibril and that these crosslinks were staggered. Many candidates discussed the role and physical properties of collagen despite the question asking for *structure*. A few candidates realised that collagen's insolubility was due to the lack of hydrophilic groups on the outside of the molecule. Some candidates erroneously thought they were being asked to discuss the structure of cellulose.

Teaching tip- On the internet there are some excellent structural diagrams of collagen showing the primary, secondary and quaternary structures.

- (c) (i)** This was a well answered question with the vast majority knowing that haemoglobin transported oxygen.

(ii) Around half of the candidates gained at least 2 marks, with a fair number gaining full marks. Most were able to identify haemoglobin as a globular protein but the other marking points were less commonly seen. As in part (b)(ii), candidates often preferred to discuss function or properties rather than structure and so, gained no marks. As ever in haemoglobin questions, some candidates confused α and β subunits with α -helix and β -pleated sheet, and some confused the latter with α and β glucose. As a result, marking points 4 and 5 were often contradicted by a candidate's lack of understanding. Some candidates stated correctly that collagen was made up of about 35% glycine but unfortunately they failed to go on to state that haemoglobin had a wider range of amino acids.

Q.2 Most candidates showed some understanding in this question and it differentiated well between the relatively wide range of ability.

- (a)** Over three-quarters of candidates answered correctly, but a minority responded too generally with 'protein' or 'catalyst'.
- (b) (i)** This question was attempted by the vast majority of candidates and showed quite an even spread of marks between zero and the maximum. Good candidates used their understanding of enzyme action and specificity to good effect, with clear

and concise accounts that showed their understanding. Weaker candidates were able to describe competitive inhibition but failed to use the figure as instructed. Common errors included attempting to use the figure but focusing on the elements present rather than the shape. The OH group was sometimes described as a molecule. Weaker candidates often thought that DEG was a dipeptide. It was disappointing to note that some candidates still omit a reference to 'active sites' when answering an enzyme question. Teachers clearly need to keep practising and reinforcing the use of key terms from this topic.

(ii) This question discriminated well between strong and weak candidates. The majority of the responses failed to achieve full marks. The option of ORA did allow weaker candidates to gain some credit, with most being able to suggest a decrease in either DEG breakdown or toxic breakdown product at high ethanol concentrations. It was also noted that standards of written communication, particularly amongst weaker candidates, often prevented those with some understanding from gaining credit. As in part (i), many responses failed to refer to the 'active site' or to the 'enzyme-substrate complex'.

Q.3 This question gave candidates who had learnt their work carefully the chance to benefit from it, including the weaker ones.

(a) **(i)** Surprisingly, fewer than half of candidates got this mark. Those who did not, nearly always put B or C. Perhaps they were reluctant to put down two letters for one mark even though the option is given in the question stem.

(ii) There was much defining of primary defence rather than actually answering the question. Many candidates failed to make the point that the secondary response occurred once the pathogen had entered the body.

(iii) This was quite well answered but weaker candidates sometimes failed to get the mark because they did not use the term pathogen (or bacteria etc.) but went for 'molecule' or 'antigen'.

(iv) This topic is poorly understood by candidates. Many candidates attempted to describe movement through blood vessel walls but often failed to specify capillaries or mention pores. Surprisingly few mentioned a lobed nucleus or shape change. Where candidates mentioned histamine and leakiness they often failed to follow it up with a reference to capillary walls. A minority seemed to be describing tissue fluid formation and a worrying number thought that phagocytes moved by diffusion, active transport or even osmosis.

(v) This was generally very well answered showing a lot of accurate knowledge about the action of phagocytes. Candidates seemed confident when answering and answers tended to be clearly expressed with points made in a logical order. Strong candidates scored full marks and even weaker ones were able to score some marks. There was the occasional confusion between lysosomes and lysozyme and some confused lysosomes and enzymes. When a very low score was given it was often because a candidate had described the specific immune response in considerable detail - emphasising the need for careful reading of questions.

(b) **(i)** A little less than half of candidates gained this mark. Just 'bacteria' (or even virus occasionally) was a regular response as was a variation on the word 'tuberculosis'. Some candidates thought that the generic name was *Microbacterium*. There was a scattering of 'HIV' or 'plasmodium' answers, as well as a misunderstanding of 'infective agent' resulting in reference to droplets, sneezing and exchanging bodily fluids.

(ii) This question was answered very well - most gained both marks, usually for droplets and coughing. A few mentioned unprotected sex or dirty needles.

(c) (i) Candidates have become used to questions asking them to describe graphs so it was pleasing that most were able to transfer this skill to describing a table. The majority correctly followed the instruction to compare the two years and did not waste space describing trends within one year. Having been used to gaining a mark for a data quote with figures many candidates enthusiastically reproduced the figures from the table. However, as the data in the table were so simplistic this did not merit a mark on this occasion. Most candidates gained full marks for noticing an increase, a decrease and no change in three correct groups. Stronger candidates often commented on the relatively small overall change but had usually already scored full marks by that point.

(ii) Most candidates gained at least two marks, commonly for references to lack of available healthcare, overcrowding, poor health and poor diet. Frequent non-creditworthy responses included poor hygiene, poor sanitation and poor education. When describing overcrowding many candidates failed to get the mark because they discussed overcrowded working conditions or public transport.

Q.4 Candidates found the first part of this question the most approachable. Perhaps reflecting the discomfort of some science candidates with the principles and definitions of ecology.

(a) (i) The clear layout of the table enabled most candidates to successfully attempt the Simpson's Diversity Index calculation. Most candidates gained full marks. A minority made a mistake calculating n/N or $(n/N)^2$ but 'error carried forward' meant they only lost one mark. Almost no one failed to calculate N correctly but some gave answers to an incorrect number of decimal places.

(ii) Candidates have struggled with this topic in the past and many continued to do so here. The question was deliberately phrased to credit candidates who both understood species richness and species evenness and were aware that the word 'amount' is not helpful when precisely defining biological concepts. Only a minority of candidates seem to understand that species evenness describes the number of individuals in *each* species. Frequently, otherwise strong candidates stated 'number of individuals in a species' and were not credited.

(iii) There was some evidence of improvement in candidates' answers since the last time this learning outcome was tested and almost half gained one mark, but few got both. Most candidates repeated the stem of the question in different words. Many candidates could describe the idea of a dominant species but most struggled with the precision of language to explain the implications of this further. Some candidates thought that a low Simpson's Index means that there is nothing to eat in the habitat, or the organisms there would not be able to find a mate, or that it is ripe for development. Disappointingly, some suggested that things would not be able to evolve.

(b) Random sampling was the most abundant response and the marking point was achieved by nearly all. Some candidates suggested sampling at different times of year and fewer suggested the use of a key. The question stem mentioned fifteen quadrats and calculating a mean in the hope that candidates would avoid discussing doing more quadrats and calculating a mean. Unfortunately many candidates did just that. Many suggested repeating at different times of day – which might be useful when counting butterflies, but is unlikely to help when counting plants. Candidates are reminded to answer the question they are set, rather than repeating a mark scheme from a similar, but clearly not identical, question.

Q.5 Generally, candidates seemed to find this topic easier to learn and express.

- (a)** **(i)** This was generally well answered. A minority of candidates simply stated 'base' or 'C' and were not credited. Weaker candidates occasionally labelled the nucleotide as a nucleic acid.
- (ii)** Most candidates gained at least one mark and almost half gained both. Despite the reminder to draw bonds on the diagram, a minority failed to answer the question.
- (iii)** This was well answered, although most put 'protein' rather than the preferred 'polypeptide'.
- (iv)** This was generally well answered. However, the question asked how RNA would appear different from the DNA in Fig. 5.1. A minority correctly stated that the sugar would be different but, as this would not change the diagram, their answer could not be credited. Candidates are reminded to read the questions very carefully.
- (b)** **(i)** It was a challenge to gain both marks on this question. Around half of candidates were able to describe the idea of one old and one new strand but many struggled to add any more information to match the marking tariff for the question. As usual, a minority of candidates were let down by sloppy language, e.g. describing the replicated DNA as being 'half old and half new'.
- (ii)** Many candidates gained one mark for describing the need to produce identical copies of DNA. While a minority mentioned mutations, only the strongest made the link with hydrogen bonding. The commonest problem was with candidates jumping forward to describing the effect on translation and how amino acid sequences and protein structure would be affected.
- (c)** Applying understanding of DNA replication in the context of a historical experiment proved difficult for candidates, and only one in five gained both marks. Often candidates who got a mark for part (i) were totally off the mark with part (ii), suggesting that their correct answer to part (i) may have been a guess.
- (d)** This question attempted to get candidates to list some variables that were particularly relevant to a given investigation and not just to use the usual 'temperature/pH' type of answers. In this regard it was quite successful and the question elicited a good range of suggested precautions which displayed understanding of experimental design. It was rare for a candidate to be unable to think of at least one valid suggestion. As expected, the use of the word 'amount' cost many candidates marks, and when volume was mentioned, the volume of DNA was often given. Some candidates clearly did not understand the meaning of 'validity' and many wrote about repeating the experiment. Centrifuge time and speed were commonly awarded, often in the same sentence.

Q.6 As ever with environment questions, many candidates' vague wording and imprecise use of technical terms cost them marks.

- (a)** **(i)** Although most candidates had a general idea of what biodiversity is, answers often lacked enough precision or AS-level terminology to gain credit. Many candidates achieved one mark for 'number of species'. Fewer candidates gained a further mark for understanding the importance of variety of genes or habitats.

(ii) The stem to this question required careful reading because the candidate was being asked to put themselves in the place of a national government and then to be specific about both their reasons and the local locations being considered. Answers were frequently too general (e.g. to maintain biodiversity; because they are aesthetically pleasing; so that they would not become extinct; they have a right to life; potential future medical resource – the latter being puzzling in the context of squirrels) and failed to take into account the national or local dimension. The most frequent successful answers were the economically utilitarian (to attract tourists to help the local economy) or were heritage based (red squirrels are native to Britain, grey squirrels are not). That the population was nationally significant was encountered very rarely and the idea of protecting a neighbouring population was never seen.

(iii) This question received an interesting variety of answers, most of which gained the mark, but the majority were variations on the sanctity of life or animal cruelty. Some of the weakest candidates did not qualify their answer further than a generic nod to ethical or religious reasons, and were not credited.

- (b)** This question often gained full marks through common sense answers based on the information provided about the opportunities each species presented for being seen. Some candidates did not appear to realise that a sampling procedure does not have to uniquely identify each member of a population to gain an idea of relative numbers. All marking points were seen at least once.
- (c)** Although few candidates failed to gain at least one mark in this question, few gained all three. This was usually because they gave two or three answers that addressed the same aspect of an E.I.A. rather than looking at the broader themes of environmental sensitivity, potential impact and possible mitigation. Marks were widely achieved for the idea of assessing the impact of the development and for the idea of assessing the environmental sensitivity. Few candidates mentioned assessing the size of development or strategies to minimise impact. A minority gave incorrect answers based upon aesthetics, the feelings of the local human population or the economic benefits.

Q.7 Candidates found this question more challenging than expected.

- (a)** **(i)** A surprising number of candidates had problems with describing how limited genetic variation would contribute to the spread of a particular disease. Frequent mistakes involved answering in terms of the likelihood of mutations occurring in a genetically uniform population or the inability of such a population adapting to diseases. Several candidates lost credit through referring to diseases in general, rather than this specific disease. Some demonstrated poor biological understanding as they were referring to 'immunity'; this is an area to look at in teaching to ensure they do not confuse resistance with immunity.
- (ii)** Candidates had to describe alternative reasons as to what would cause a variation in crop yield from year to year. This was generally well answered although a few candidates attempted to find genetic answers to the question despite the information given in the stem. Candidates were generally able to link the impact of an environmental factor and give one or two examples for which the additional marking point could be awarded. Some candidates did not achieve the mark due to the basic nature of their answers, making reference to 'nutrients' in the soil, rather than 'minerals'.
- (iii)** Most candidates were able to correctly recall that mutations are the main contributing factor to genetic variation and achieved this mark. Those that did not, tended to refer to the effects of natural selection rather than to mutation specifically.

- (b) This question discriminated well across the ability range. Most candidates tended to focus on the short-term aspect of the question but could not relate long-term aspects back to selective breeding and, as such, the QWC was often missed. Candidates tended not to link selective breeding to the idea of preserving genetic diversity and marking points for long-term considerations were awarded far less often.

Most candidates understood the principles of selective breeding and gave good descriptions of the initial short-term process. Some weaker candidates confused carrying genes for resistance with carrying the disease, or made vague references to selecting plants with the "desired characteristic" without stating 'disease resistance'. Only the best candidates discussed testing the offspring for resistance. Vagueness in statements referring to 'repeating this process over a period of time' rather than stating 'it should take place over many generations' often lost marks. The drawbacks of inbreeding and the methods that could be employed to retain genetic diversity were often carelessly expressed or not mentioned.

A few candidates failed to read the stem of the question properly and immediately sought to increase disease resistance by genetic engineering or the micro-propagation of a resistant plant. Some candidates were confused by the wording, referring to the use of pesticides as a short-term method of allowing plants to resist the disease and then discussing selective breeding as the long-term method.

Q.8 Overall this question differentiated well between candidates.

- (a) Many candidates scored full marks. Weaker candidates offered the species name instead of the genus name. The correct kingdom was usually identified but the domain had a variety of wrong offers. Despite the question stating the family and class at the appropriate point in the paragraph, weaker candidates could not complete the passage, showing either a lack of knowledge of taxonomy or an unwillingness to deduce the answers from their often correct list of taxonomic ranks in the margin.
- (b) Candidates were not comfortable with this topic. Moderate to strong candidates were usually able to state that phylogeny is about evolutionary relationships but were unable to extend their knowledge further. Around 20% of candidates mentioned the *closeness* of these relationships. Many, usually stronger, candidates then made some attempt at explaining that the more closely related species would be placed in the same taxonomic groups but many were let down by lack of precision and clarity of language. Weaker candidates treated phylogeny as synonymous with classification and a few attempted to define and discuss the term 'phylum'.

*Teaching tip: Sharing a common ancestor does not imply a close evolutionary relationship. Species with a shared phylogeny share a **recent** common ancestor.*

- (c) This was generally well answered. The majority of candidates correctly realised that these water bears were very small and the invention of the microscope was needed to see them. Sadly many candidates did not mention an acceptable viewing device, such as a microscope, but referred vaguely to a lack of technology. The most common error was the idea of speciation or the water bears having evolved recently. There were some errors in length measurement despite the generous leeway of $\pm 0.1\text{mm}$. The words 'household gardens' misled some candidates who suggested that this habitat was not around 300 years ago. One candidate thought they had suffered from competition with the other bears that had died out 300 years ago.

F213 Practical Skills in Biology 1

General Comments

This year, all tasks were of a comparable level of demand to those in previous sessions. There are differences between the individual tasks, but in general they are of equal demand for each skill type. Centres are to be reminded that the Evaluative task cannot be completed before the Quantitative task of the same type.

Although the majority of Centres are marking the scripts well, using the mark scheme closely with good reference to the additional guidance and to the OCR consultancy service for queries, moderators have noted a sharp increase in the examples of poor marking this session. In a few Centres there were also indications of too much coaching of the candidates.

Many Centres are carrying out the clerical aspects of the marking correctly, which is appreciated. However, a number of Centres still have marking and clerical issues that need to be addressed.

Clerical Issues

Each Candidate's script (of three tasks) should be secured together in order, with a treasury tag and a front sheet summarising the three tasks, the mark break down and total mark for the Candidate. Centres should be encouraged to use this method rather than folders or plastic wallets.

A number of Centres are still not using internal moderation correctly to verify the marks awarded and to help identify clerical errors, which are occurring increasingly. Internal moderation is required to ensure that there is consistency in the marking across a Centre and, as part of this internal moderation process, Centres are asked to check for clerical errors such as incorrect additions. A final check is vital to ensure that the total marks are correctly transcribed onto the MS1 or the electronic EDI for submitting to OCR. This reduces delays in the moderation process.

A number of Centres are not ensuring that Candidate numbers are written on all the scripts and in some cases, the marks awarded are not being transferred to the front page of the task either, making it extremely difficult to identify both the candidate and the marks awarded. In some cases, it was not possible to moderate the work until it had been correctly collated by returning the sample scripts to the Centre, which caused further delays.

Centre trial data, for all Qualitative and Quantitative tasks carried out by the Centre, is important to help support marks awarded by the Centre, especially where the results obtained differ from the mark scheme's expected results. Additional annotations on the scripts are also important to help support the Centre's marks where there are such differences. Marks cannot be agreed by the moderator unless these points are presented as part of the sample package.

This session, there was a surge of missing tasks where an individual candidate was missing one of the three task skills being relied upon for the total mark. In some instances, parcels were sent to the wrong moderator e.g. F213 work being sent to the F216 moderator, or scripts were misplaced at the Centre before being sent off. All these issues cause delays in moderation.

Centres are also reminded that if a second-year GCE candidate wishes to re-sit the F213 unit, there must be at least one task from the current session, otherwise the mark is simply carried forward from last year.

Marking Issues

As occurred last year, there were a few misinterpretations of the rubric, as for example where candidates did not appreciate that ‘use the data’ means that any data quotes must include correct units and at least two pairs of data sets. Some did not understand the difference between error and limitation and so the marking point was not matched (for example Evaluative task 1, Q2 requires errors, and Evaluative task 2, Q4 requires limitations). In addition, some candidates had not read the question carefully and so the answer given, although correct biology, did not in fact answer the question asked. A common example of this is Qualitative task 1, Question 3 and Evaluative task 1, Question 3b and Question 4b.

There was an increase in Centres using marking point indicators or labels, e.g. mp1, to identify the marking point being credited on a particular question. This practice is to be encouraged as without this the same marking point is frequently awarded twice, because the candidate may have written the same point in two different ways. It is recommended that markers use a single tick together with the marking point or bullet point awarded, which should be placed on the script where the response has matched that marking point. The total numerical mark awarded for the question should then be written in the ‘*For teacher’s use*’ column. This avoids confusion as well as ensuring that the correct marks are awarded by both the Centre and the Moderator. This session, there were some Centres that did not write in the marks and used only a tick, whilst others used no ticks at all but only noted the total question mark awarded. Neither of these methods allows the moderator to understand which marks are being awarded and why. Further annotations may be necessary to support marks that do not match the marking points exactly, but these may be kept to a minimum.

There is an increasing minority of Centres that do not appear to be using the mark schemes correctly. In some instances, marks have been awarded when there has been no match between the response given and the mark scheme, and even when the response has not answered the question at all. Professional judgement, when awarding marks, can only be used within the mark scheme demands and is to be used for giving marks for alternative wording providing that the idea or sense of the response *is correct* and *answers the question*.

Some Centres appear to be ignoring the additional guidance in the mark schemes and are adding their own marking points. Where this is seen, a Centre’s marks will be adjusted unless evidence can be provided to show that OCR’s prior approval has been given for a special case e.g. by the attachment of the e mail and/or consultancy advice given. The additional guidance column is an important part of the mark scheme and it is vital that this column is consulted during marking, as additional information is provided to ensure that marks are consistently and fairly awarded. This session, moderators found that the rubric instruction ‘Do not credit’ appears to have been ignored in a number of cases. Where this rubric is given in the additional guidance, the mark must not be awarded for that response. The rubric ‘Ignore’ in the additional guidance column indicates that whilst the point cannot be given credit, neither will it be penalised.

Where a candidate has provided two answers to a table, graph or question, or attempted the question again during the task session, the original answer must be clearly crossed through by the candidate and not by the marker. If the candidate has failed to cross through the original answer and has provided a second response, Centres are reminded that neither the marker nor the moderator can make the choice; the mark will not be awarded if one of the answers is incorrect. If both responses are correct, then standard examination rules will apply i.e. the first answer will be marked, even if this will gain fewer marks than the second answer. If in any doubt about the application of the mark schemes or the interpretation of the mark scheme rubrics, Centres should use the Task email query service: GCESciencetasks@ocr.org.uk

Centres must be reminded that the mark schemes must not be used in *any way* other than to enable authorised teaching staff to mark the scripts. Data may not be given to candidates, nor may data be shared between candidates. Please see FAQ 24 for further amplification of this point:

https://interchange.ocr.org.uk/Downloads/40_Biology_FAQs_F213_F216.pdf?downloadId=2443

5. Centres are also to be reminded that any second attempt at an answer, including tables and graphs, can only occur if the candidate requests it *at the time of completing the task* and not at a subsequent date. Candidates may not revisit a task once it has been examined, or sit the task papers in any way other than permitted by the exam board.

Using questions from a task on another practical as a training exercise is not permitted. There is a process of penalties that are imposed when any of these practices are identified. OCR has provided a set of Practice Tasks, available on Interchange, in order to assist in training and feedback to candidates. **No other tasks must be used for this purpose.**

Completed tasks must be kept securely until any possibility of re-sits has passed for those candidates involved. At that time, the tasks may be securely destroyed because these tasks will remain live throughout the life of the specification.

The Practical Skills Handbook, FAQs and OCR's Consultancy service are all available for further guidance.

Qualitative Tasks

Many candidates have not mastered either drawing skills or the requirements for correct drawing up of results tables. Candidates either performed well at these two skills or appeared to have no idea at all of how to tackle them. Drawings should represent accurately the observed specimen and not be diagrams remembered from a text book. A clear, sharp line should be used for the drawing, and ruled lines for labels and annotations. Tables should be correctly drawn up with complete borders, a single table with the independent variable in the first column, informative headings and with no units within the cells of the table. See the additional guidance provided on this skill.

All three tasks were popular this session.

Task 1

Several consistent errors were found by the moderators:

Table 1 was frequently awarded marks for observations with no reference to the X either in the header or within the cells.

Candidates' own tables on page 5 were frequently marked correctly although there were units within the body of the table, and candidates seemed to find it hard to label the dependent variable correctly and clearly. The headers frequently included 'milk and trypsin' or just 'mixture' to indicate the final observation, and a surprising number had not followed the instructions and so had not included a column for the initial observation. Frequently, the skilful practice mark was still gained although the observations were incorrect indicating the procedure had been incorrectly carried out.

This task benefitted more than the other two from the provision of Centre data when the results obtained were not as expected. Teacher annotations were also important here.

In Question 1, vague responses were credited without any reference to the X becoming visible once the trypsin had been added. Question 3 was frequently misunderstood and answers were given credit for responses that indicated that candidates did not understand the question. The observation required is of what happens once the tube has been removed from the water bath

and is therefore warming to room temperature. Answers that described the slow catalytic nature of the enzyme in the cold water bath could not therefore be given credit.

Task 2

In this task, a number of candidates used incorrect terms to describe the clearing of the albumin in Table 1. This was especially seen in tube E, which frequently did not match the mark scheme expected or the Centre data, where this was supplied. If the Centre provided further annotations to explain why the mark had been awarded, this frequently helped the moderator to agree the award of this mark.

In Table 2, there were a large number of variations in answers, which were difficult to moderate without Centre data or annotations. Frequently, Centres had not followed the guidelines for marking this trend and so marks were awarded incorrectly, despite a clear table to assist marking being provided in the additional guidance column. In Question 3, many marks were awarded when only one part of the response had been made, for example, 'denatured' without an explanation referring to its use in medical practice. In some cases, marks were awarded for describing how a denatured protein is affected, without any reference to the actual question asked. The question asks for both a 'suggestion' and an 'explanation'. However, overall there was a big improvement on the marking of this task from last year.

Task 3

In task 3, the leaf drawings were frequently marked incorrectly, with poor lines that were not clear and continuous throughout the drawings being awarded marks. Little annotation made judgements on this task particularly difficult. However, on the positive side, the diagrams were generally of a better size than in the past. For Question 3, there were many cases of a waxy cuticle being awarded a mark, although the emphasis is for a thick waxy cuticle. In Question 4, the arrows and annotations were often not of a good enough standard to allow the marks to be awarded.

Quantitative Tasks

There were fewer mathematical calculations this year and those in Task 3 were generally easily achieved. The biggest discriminator in the Quantitative tasks this year was the drawing of graphs. However, calculation errors, a lack of understanding of correct rounding and incorrect decimal places were common errors for all tasks. It is expected that all calculations in a column will be correct and be rounded correctly. Any guidance on the use of decimal places must be followed or in the absence of guidance, two decimal places is considered the norm. Calculated data should show the same number of decimal places or one more decimal place than the raw data. However, when an error has occurred, Centres are encouraged to allow an error carried forward (ecf) for any further columns showing the same error.

The quality of the graphs in Tasks 1 and 2 was poor this year, as was the Centres' marking of the graphs. Issues with basic graphing skills, which seemed to be poorly understood, were a common theme, with errors such as incorrect lines when drawing lines of best fit. Incorrect scaling, including covering 50% of the available paper and scales that were not equidistant and ascending were frequently awarded marks incorrectly. In addition, incorrect labelling or incorrect units were often given credit, both of which are clearly detailed in the mark scheme and additional guidance.

When an area of the graph occupied by the plots (or the line) is less than 50% of the available paper, Centres should not be crediting the scale mark. When a line is close to 50% of the available paper it should be considered whether it is possible to reliably extract intermediate values and if not, the mark should not be awarded.

Centres are advised to consult the additional guidance or the consultancy service for guidelines concerning data recording, scaling graphs and good use of graph paper.

In Quantitative Task 1, inconsistent decimal places or too many decimal places were frequently awarded marks. Question 5 was poorly answered as the majority of candidates did not realise the need to discuss the different effects occurring at high or low concentrations, and simply discussed the effect of halving in general. Where figures were given, these frequently did not have units and so the mark could not be given.

In both Quantitative Tasks 1 and 2, the graphs were often poorly drawn and yet credit was frequently given. Common problems were very poor lines of best fit or plot to plot lines drawn without a ruler. Lines frequently extended beyond the plots or plots were ignored without identification as an anomaly. Many x-axes were incorrectly scaled, with non-equidistant axes being given credit, and the axes labels were often incorrect even though the mark had been awarded.

In Task 2, Question 2, marking point 3 was frequently misunderstood and any data quotes were given credit. However, the point required the data quotes to support marking points 1 or 2.

Question 3 answers were frequently credited without units although the mark scheme includes this point clearly.

Quantitative Task 3 was generally well completed and well marked by Centres following the mark scheme closely.

Evaluative Tasks

Generally this skill was the biggest cause of mark adjustments as candidate responses tended to be weaker and teachers were marking more generously.

The terms 'limitation' and 'error' were frequently confused. Suitable explanations and modifications for either limitations or errors should be correctly linked to the limitation or error and should not be awarded if this link is not apparent. An 'error carried forward' mark may be awarded for a correctly linked explanation or modification when the first marking point is not awarded the mark. Other terminology was also frequently misinterpreted by candidates.

Evaluative Task 2 was the most popular of the three tasks with Task 3 being the least popular.

Evaluative Task 1

Question 1b, mark point 3 was often incorrectly awarded a mark for reference to 'collisions' when the response required the idea of more chance of collisions as the concentration increased. The emphasis is on the effect of increasing the concentration. Question 2 required *both* the error and the explanation for the mark to be awarded. This was frequently missed by the teacher marking the scripts and so marks were awarded without a correct explanation linked to the limitation. Some candidates gave answers that were actually errors. Question 3b was frequently marked correct for responses on accuracy and not reaction times and precision. Question 4 was rarely correctly awarded more than marking point 1, with marking point 3 the most common error in marking. Marking point 2 was often seen as a general reliability response but it is the reliability of the mean that is required. Marking point 4 was hardly answered at all. In Question 6, a number of Candidates failed to see that only responses relating to the change of temperature were relevant to the question.

In Evaluative Task 2, Question 2 was frequently awarded a mark for using the word 'substances' which is insufficient for the mark. Molecules, ions or correct examples of either would gain the mark.

Question 3 was often generously marked and some Centres had not noticed the clarification of the mark scheme that was posted in November. It is important to keep checking Interchange for updates and to sign up for the email alerts to updates (GCESciencetasks@ocr.org.uk). Candidates found some of the marking points in Question 4 difficult to access and Question 7a mark points were also frequently limited to marking points 3 and 5. Few candidates used any of the other responses.

In Evaluative Task 3, some of the Questions were found to be challenging. For example Question 2 marks were difficult for candidates to access. Mark point 1 was the one most likely to be given, though both marks were awarded in some cases. Question 4b was frequently generously awarded, although the additional guidance states 'do not credit working with a partner' without a clear explanation. Question 8 was very generously marked with either unclear biology or inaccurate biology being given credit.

Some questions caused problems for the Evaluative Tasks since there was no recognition by candidates that the questions referred to the task carried out on the SES (Specimen Experiment Sheet) and indeed in some cases, the SES does not appear to have been used at all.

F214 Communication, Homeostasis and Energy

General Comments

Some excellent answers were seen this session and those candidates who had been well prepared, particularly with reference to AO2 and synoptic material, performed well.

Certain questions on this paper required candidates to *comment* on or to *explain* data or information given in the stem of the question. For these questions (such as 1(b), 2(c)(i), 3(a), 3(c), 5(c)(i) and 5(c)(ii)), it was not appropriate for candidates to simply restate information or to quote figures and expect the examiner to read an explanation into their answer. Such questions require a different skill to simply describing a trend or giving a straightforward account that has been prompted by stimulus material.

In some cases, candidates were answering a question with information that was more suitable as a response to a later sub-part. Candidates are, therefore, advised to read through the complete question before starting to answer any of its sub-parts. They can then use their time and efforts more effectively by giving the most appropriate information in each response.

In order to be awarded the QWC marks, it is essential that examiners are able to see that the required scientific or biological terms have been used appropriately, with correct spelling. In some cases, the poor handwriting with ill-formed letters meant that it was not possible for examiners to be certain that the spelling was correct. Candidates should ensure that their handwriting is clear and legible. This should also be a priority where it is necessary to spell words accurately and correctly in order to avoid any ambiguity.

Comments on Individual Questions

Q.1 This question was designed to be an accessible start to the exam.

- (a)**
- (i)** This was a straightforward introductory question and one in which the majority of candidates managed to gain marks. Few, however, realised that A was cytoplasm, most, instead, giving myelin or myelin sheath as the answer even though the Schwann cell had been labelled on the diagram. B was usually correctly named as neurone or axon. C was often given as nucleus although some misinterpreted it as a mitochondrion, possibly due to its ellipsoidal shape in the diagram.
 - (ii)** The vast majority of candidates correctly identified this as the node of Ranvier. A few, however, suggested synapse instead.
- (b)** Candidates were asked to use the information given at the start in this question to explain the difference in speed of conduction of an action potential along myelinated and non-myelinated neurones. The vast majority correctly stated that the speed is greater in myelinated neurones and many, too, remembered that saltatory conduction occurs. The difficulty came when the information given had to be used to explain why this was the case. Those who simply repeated statements from the question stem failed to pick up additional marks. They were required to go further and relate the information to the action potential itself. Similarly, those who decided to show their knowledge and describe in detail what happens during an action potential rarely gained further credit. As the question asked for explanations of the difference in speed of conduction, comparative points were necessary. Candidates, therefore, needed to use words that reflected this e.g. 'only' or those ending with '...er', as appropriate. Credit was not given for a statement such as

'ion movement occurs at the nodes' without saying 'only at the nodes'; similarly, references to 'long local circuits' in myelinated neurones failed to gain a mark without referring to 'longer circuits'. Poor use of language sometimes let candidates down when discussing saltatory conduction too. It was not acceptable to describe this in terms of the action potential jumping 'across the nodes' as this is clearly incorrect.

(c) **(i)** The majority of candidates correctly named the process as exocytosis, but there were some who suggested diffusion or active transport.

(ii) A variety of answers were acceptable here and most gained the mark. A few missed the request for a part of a neurone to be named and simply gave 'presynaptic neurone'; others incorrectly gave the 'synapse'.

(iii) As a 'stretch and challenge' question, this discriminated well. Some candidates clearly found the diagrams difficult to interpret and struggled to make sense of the interactions between the proteins; they made few relevant comments in their answers apart from saying that the impulse would not progress further. A surprising number failed to absorb the information given in the first sentence. They ignored the fact that the botulinum toxin is a protease and jumped, instead, to ideas of inhibition or denaturation. The assumption then was that the VAMP protein could not bind with the SNARE complex because its binding site was blocked or that its shape had changed. A mark was not awarded in this context. Others failed to absorb the fact that they had been asked for the effects of the toxin once it has entered a neurone. They then, mistakenly, went on to discuss possible effects it might have on the released acetylcholine or on receptors present on the surface of the post-synaptic neurone. Several candidates gained the first available marking point by saying that the vesicle would be unable to fuse with the cell membrane and that acetylcholine would not be released as a result. Good responses, however, did give full consideration to the effect that a protease might have and these gained full credit.

Q.2 **(a)** **(i)** The hypothalamus was generally well known and this had been designed as an straightforward introduction to the question.

(ii) Thermoreceptor was usually offered as a correct answer but peripheral temperature receptors were not often seen. Common answers which lacked precision, and therefore did not score, included peripheral receptors or sensory cells. Inappropriate receptors such as Pacinian corpuscles were occasionally seen.

(iii) Negative feedback was the most common answer, with thermoregulation only appearing occasionally.

(b) **(i)** Surprisingly few candidates gained a mark here. Common errors were to include shivering (which generates rather than conserves heat) or omitting one of the responses - most often that of curling up, followed by contraction of erector pili muscles.

(ii) This was more frequently answered correctly than part **(i)**. The most common error was the omission of finding shade.

(iii) This was generally answered correctly, with some candidates giving both L and J.

(iv) This was, again, reasonably well-understood but O was the most common incorrect response seen.

- (c) (i) Most candidates answered in the context of heat loss and by far the most common marking point to be awarded was that for large surface area. Many candidates recognised the importance of blood and heat being radiated away but fewer went on to clarify that thin ears mean blood (vessels) close to the surface to aid the process. Many candidates recognised the fanning effect of the large ears but most only referred to air movement over the body or face of the elephant rather than specifying the skin or surface of the body. A significant number of candidates described the ears as parasols shading the elephant from the sun. Sweating was often mentioned, which was not considered to be relevant, and the term “evaporating heat” was mentioned by a few.
- (ii) The purpose of the shunt vessel was not understood by the majority of candidates. Where candidates grasped the idea that this was in order to conserve heat they were rarely able to word the response in a way that was creditworthy. Many failed to gain the mark by saying or implying that no blood went to the feet. Others simply said it reduced heat loss from the feet without explanation. Yet others tried to include what they had heard about counter currents.

Q.3 This question related to the kidney and required some thought on the part of the candidates.

- (a) Candidates were supplied with data relating to the content of blood, glomerular filtrate and urine. They were required to *explain* the data and, as such, it was not sufficient for them to simply restate the data – they needed to explain what had happened in order for those figures (or presence/absence) to have been observed. Many candidates achieved at least one mark, with the most common mark achieved being mp1. A significant proportion of candidates achieved 2 marks or more. Many candidates failed to refer to the Bowman’s Capsule in order to achieve mp2, while mp3 and 4 were missed as very few candidates stated that all were reabsorbed from the PCT. Candidates who were awarded mp6 were able to link the increase in concentration with the re-absorption of water. Many candidates ‘missed’ mp5 by talking about ions only in the context of remaining in the filtrate. Some candidates referred to molecules being *filtered from* the glomerulus as a way of describing those that cannot be filtered, or as a way of describing reabsorption. Such answers were ambiguous. Most candidates realised that large proteins would not be filtered but some either referred to erythrocytes as molecules or did not describe the process, merely reiterating the data from the table. Some candidates referred to the increase in urea in filtrate as due to an increased urea cycle and the absence of molecules from the urine as necessary because they are needed by the body, with no reference to ultrafiltration and reabsorption. Some talked about the amino acids being deaminated to account for the fact that there were none in urine. QWC was not awarded easily. Common errors were misspellings of convoluted (convuluted) and absence of the use of the terms endothelium, fenestrations and Bowman’s capsule.
- (b) (i) Few candidates referred to GFR but most stated that there was an issue with *filtration* and linked it to reduced function of the kidney. A minority incorrectly referred to a better function of the kidney but the most common errors resulted from a failure to realise this was an issue with filtration, instead suggesting a general failure of excretion or overproduction of creatinine.
- (ii) This was well answered by most candidates. Some were only awarded one because they had not rounded their answer correctly. The most common issue with the calculation came from using 2.56^2 to divide by, rather than 2.56.

(iii) Those who did not calculate the correct answer for 3(b)(ii) usually selected the correct information from the table for their answer, so a mark was awarded for an error carried forward (ecf). Those candidates who failed to score did not select an appropriate stage of CKD from the table but attempted to discuss it in their own words.

(c) Most candidates achieved at least 1 mark, with approximately 50% achieving full marks. Most candidates stated mp 5 and 6, closely followed by the AVP mark for surviving on one kidney or making a large profit. No candidate stated the AVP of feeling pressurised by a family member. Once again, candidates needed to avoid simply lifting phrases from the stem of the question.

Q.4 This question dealt with the use of nervous and hormonal communication in the body.

(a) This question commonly yielded 2 or 3 marks. The common errors were to confuse endocrine and exocrine, to misspell glycogen (only the correct spelling was credited) and to provide ambiguous or hybrid versions of glycogenolysis, which may have been caused by inaccurate spelling or mis-identification.

(b) (i) Candidates generally answered this part of the question correctly.

(ii) Candidates were expected to describe how the nervous system brings about a reduction in the heart rate. The primary error made which caused the mark not to be awarded was that of mentioning a structure without further detail of how it was involved, e.g. 'vagus nerve' or 'parasympathetic nervous system'. Some used simplistic terminology more suited to GCSE such as 'messages' or 'signals'. It should be noted that these simple terms are not encouraged at A2. Other candidates concentrated on what happened once the SAN had been stimulated, which was beyond the scope of the question.

Q.5 This question dealt with respiration and incorporated some straightforward recall as well as application of knowledge and 'stretch and challenge'.

(a) (i) Most candidates answered this correctly, the common errors being to suggest either 'mitochondria' or 'cytoplasm of mitochondria'.

(ii) Well informed candidates who had thoroughly understood and learned the process were able to provide clear, concise and accurate accounts of glycolysis. As the question had asked for an outline, candidates were expected to refer to phosphorylation of glucose, for example, rather than detailing the conversion of two ATP molecules to ADP and explaining how they are incorporated into the glucose molecule. A key feature of the process is the splitting of hexose biphosphate into two triose phosphate molecules and accounts which linked this stage to the formation of ATP and/or the reduction of NAD were not credited. It was also important to stress that glucose is not converted directly into pyruvate but that pyruvate is formed from triose phosphate, a 3C intermediate. The QWC mark was more readily awarded in this question than it had been in Q3(a).

(b) This question discriminated quite well, with competent candidates giving all four correct answers. The common error was to reverse Y and Z, suggesting NAD for Y and reduced NAD for Z. Ethanal had occasional incorrect spelling. Weak responses seemed to suggest a selection of random compounds.

- (c)** **(i)** The question attached to this table was different from other ‘describe’ style questions in previous exams and this appeared to cause confusion for some candidates. However, as the table not difficult to interpret, it is therefore surprising that so few candidates were able to score full marks on this question. Despite the instruction in the stem to describe the effect of the different treatments on *alcohol concentration*, marks were immediately unavailable for descriptions of numbers of bacteria instead. The instruction to describe the effect of treatments (A, V and C) compared to the control was not fully appreciated and many candidates described data within the treatments or compared data between different experimental treatment groups. Other candidates produced the type of answer required for 5(c)(iii) and explained which treatment would be most effective commercially. Marks were not awarded for giving alcohol concentrations without times and although treatment A was identified by many candidates as having a reduced alcohol content this was not qualified with a reference to all the time intervals or a suitable equivalent statement.
- (ii)** Few candidates were able to formulate a response that could be credited. Many simply referred to the number of bacteria without attempting to relate this to the alcohol concentration. Only the better answers suggested that the bacteria in V were unable to ferment the sugar and produce alcohol while the bacteria in C, with significantly lower numbers, were able to do so. Few references were made to the fact that C might have had more yeast present. Weak responses suggested that the sugar content of the sap was different in the treatments, but this was considered to be incorrect.
- (iii)** In contrast, this part of the question was answered well. Most candidates identified A as the most effective treatment, although some were not awarded the second mark as they did not refer to both the low levels of alcohol and bacteria found with this treatment.

Q.6 This question aimed to test candidates’ knowledge of photosynthesis.

- (a)** This was answered correctly by most candidates.
- (b)** Although this was generally answered well, with one or two of the possible correct answers given, some made the mistake of stating oxygen.
- (c)** This was generally answered well, with one or two of the possible correct answers given.
- (d)** More able candidates were able to identify this compound as amino acid. The common incorrect suggestions were ATP and RuBP.
- (e)** This proved difficult for some candidates who incorrectly suggested a 3-carbon compound or rubisco.
- (f)** While the more able candidates identified this compound correctly, a common error was to suggest water as a product of the light-dependent reaction.

F215 Control, Genomes and Environment

General Comments

This paper contained a broad range of short and long response questions. Some were accessible to all candidates but other parts provided a discriminating challenge. Candidates with a thorough understanding across the F215 specification and beyond to the earlier modules frequently scored marks in the 70s and 80s. Teaching of many of the applications of biology, such as enzyme biotechnology and agricultural applications, and some of the founding principles such as meiosis and gene regulation, was clearly very good, with candidates having been thoroughly prepared. Use of past papers and mark schemes to inform answers was again evident. The main area for improvement could be seen to be questions where knowledge alone is insufficient. Questions requiring candidates to apply their knowledge need to be carefully read in order to frame an appropriate answer, but too often candidates recognise a topic heading and proceed to write down everything they know about the topic, missing the point of the question entirely. This frequently happened with the genome sequencing question (Q5), where disparate ideas had been learnt but not fully integrated together.

Comments on Individual Questions

- Q.1** The first part of the question proved to be challenging for most candidates, though in part **(b)**, marks were picked up easily for methods of immobilisation and its advantages.
- (a)** The diagram showed reduced-lactose milk being produced and candidates were asked how to make it **lactose-free** (bold type). Most gave a factual description of how the immobilised enzymes worked, rather than how to adjust the method to solve the particular problem set (Assessment Objective 2). Of the candidates who answered the question that was asked, most gained a mark for suggesting that the process could be repeated. Fewer candidates suggested reducing the flow rate and only a minority mentioned testing the milk for sugars to confirm that all lactose had been removed.
- (b)** For **(i)** most candidates scored 2 marks, mostly for covalent bonding to an appropriate molecule and for membrane separation. Where marks were lost it was usually due to not saying what the enzyme was bonded to via covalent, or more rarely, ionic bonds or hydrophobic interactions. Adsorption was a common answer, but the ‘absorption’ mistake was made by some.
- In **(ii)** many candidates showed good understanding of the advantages of immobilising enzymes. ‘Purer product’ was seen most often. A significant number of candidates mentioned re-using the enzymes and reduced downstream processing, but failed to link them to reduced costs. Many candidates referred to immobilised enzymes as being more stable but did not refer to higher temperature or changed pH. Also, candidates did not gain marks if they referred to enzymes working at a wider range of temperatures and it was a common misconception to say that low temperatures normally denatures enzymes. Weaker candidates listed the advantages of using enzymes generally rather than using immobilized enzymes. Very few candidates linked the idea of catalysing reactions at higher temperatures to a subsequently faster rate of reaction.

Teaching Tips:

Candidates should be encouraged to distinguish between AO1 questions, such as **(b)**, where writing rehearsed answers from memory will gain marks, and AO2 questions, such as **(a)**, where the question stem and materials provided, such as diagrammatic information, must be thoroughly studied in order to solve a problem.

Q.2 This question involved applying knowledge of the functions of areas of the brain to a diagram, recalling the key tissues and their roles in the elbow joint and providing a clear differentiation between the two parts of the autonomic nervous system at a structural and functional level.

- (a) Matching the pictured parts of the brain with specific functions was generally well done. Some candidates confused the role of the medulla oblongata with that of the pituitary gland in parts (i) & (ii). Most knew the role of the cerebellum in the action of walking, while a few realised that the cerebrum could also be involved. A number of candidates did not notice that the elbow was being bent deliberately, requiring the involvement of part **E** (cerebrum), so incorrectly identified **B** (cerebellum) as being responsible.
- (b) A small minority misinterpreted the question in this section, describing the role of actin and myosin in muscle contraction, instead of how three components of the joint interact to bring about hinge movement. Most responses correctly referred to at least two different components, describing the action of the pair of antagonistic muscles, often correctly named, or the functions of tendons, ligaments or synovial fluid. Confusion between tendons and ligaments was a common error, however, while the role of cartilage was often given as simply protection or ‘shock absorber’, when its precise role in the reduction of friction or wear was required.
- (c) When outlining the organisation and roles of both parts of the autonomic nervous system, only a very few candidates omitted to mention the sympathetic and parasympathetic parts. Describing the organisation of where the two neurones met at a ganglion in each case was a relatively weak area of understanding, with very few able to clearly compare the differences in the physical layout of the motor neurones.

Some excellent responses describing the roles were provided, especially when candidates were able to give clear, comparative statements of the action of the two parts of the autonomic nervous system. Most included reference to fight and flight versus relaxation, named the two different neurotransmitters involved, and described the effects on heart and ventilation rates and pupil size. Many candidates attempted to describe the change in blood flow to the gut but failed to mention the sympathetic system diverting it to the skeletal muscle instead. A few references to the reversible conversion of glycogen to glucose were seen but this needed to be explained in the context of the liver.

A common source of error was to describe numerous effects of the sympathetic system without mentioning the corresponding effects brought about by the parasympathetic, leading to some low scoring responses. The worst and fairly widespread misunderstanding that came to light was that some candidates did not realise that sympathetic neurones directly innervate each organ and, when stimulated, release noradrenaline at the target organs directly to bring about changes. Instead, candidates generally attributed the whole spectrum of sympathetic effects to *indirect* causation via stimulation of the adrenal medulla to secrete adrenaline hormone into the blood.

Teaching Tip:

A diagram is useful to show the different layouts of the two sets of autonomic neurones. A distinction must be made between nervous and hormonal means of preparing the body for ‘fight or flight’ and which information a candidate should use depends on the question asked.

Q.3 Meiosis and an opportunity to apply synoptic knowledge to the topic of mutation were tested here.

- (a)** Of the five marks available, some required a fairly easy match of learned material to the question, as in identifying the stage at which the spindle apparatus forms or when sister chromatids separate, while others required more thought, such as when chromosomes rather than chromatids are pulled to opposite poles. Independent assortment caught some candidates out, as many failed to appreciate that it takes place in both metaphase I and II. Plenty of candidates did answer 4 or all 5 correctly.
- (b)** Explaining why meiosis needs to have twice as many stages as mitosis was poorly answered. Many candidates wasted time explaining what happened in mitosis. Frequently, answers concentrated solely on explaining that gametes needed to be haploid in order to restore the diploid number of chromosomes, rather than clearly stating that meiosis was the process that halved the chromosome number. Candidates should be aware of general statements such as ‘cells must have half the number of chromosomes’ since this does not necessarily mean that meiosis is responsible for achieving the reduction. Very few mentioned the need to first separate homologues and then sister chromatids, or that the need for two stages arose because the DNA had been previously replicated. Candidates should be discouraged from referring to cells having 4 sets of chromosomes at the start of nuclear division.
- (c)** In **(i)** the majority of responses were correct, but some candidates referred to bases or nucleotides alone and omitted the important concept that it is the sequence or arrangement of these that is changed in mutation.

For **(ii)** candidates had to think broadly to get all three marks. Many described a mutation altering the primary or tertiary structure of a protein but others simply said it would change the base sequence of the DNA or an amino acid with no reference to the overall protein structure. Most responses included a description of the protein possibly becoming non-functional or used an example, such as an enzyme being unable to form an ESC. Good descriptions were given of the protein being unchanged as a result of a silent mutation. Very few candidates identified a possible change in length of the polypeptide due to a deletion or insertion of bases, and function that was worse than before was a much commoner response than referring to beneficial mutations.

Teaching Tip:

Revision of the AS topic of DNA replication is useful when teaching meiosis and also protein synthesis at A2 level, in order to make links and avoid confusions.

Q.4 This question in general scored well, provided the candidates had read the question correctly, especially in the case of **(c)**.

- (a)** This part of the question scored very highly, with the majority of candidates getting all eight parts correct. Few candidates scored less than five marks. Where mistakes were made, it was generally a case of mixing up reproductive cloning and positive chemotaxis.
- (b)** This was the least well answered part of question 4. A few candidates gained no marks at all, since they simply wrote ‘slowed down’ or ‘stopped’ in the boxes, without naming a biological process. Ripening, respiration or decomposition featured frequently for the first part, although a sizeable number put senescence

here. In line two ‘competition’ alone did not score, as the learning outcome term ‘interspecific competition’ was being looked for. Interspecies was not credit-worthy and intraspecific was obviously wrong in the context described. Line three produced many correct answers, but some candidates misspelt phototropism as phototrophism, and a few wrote phototaxis by mistake. A name was required in all cases, not a description. Line four was poorly answered, with very few candidates correctly naming succession. Most put cloning or vegetative propagation, ignoring that self-sown seedlings are not the same as plants growing from root suckers.

- (c) Some candidates lost all their marks on this question because they wrongly interpreted the question as being about primary producers (crops), rather than primary consumers (livestock). Those who correctly interpreted it generally answered well, with restricting movement, keeping animals warm, using antibiotics and selective breeding being popular answers. Many candidates understood that animals should be slaughtered before maturity, but unfortunately did not make it clear that this was just before maturity. A few candidates scored a mark for a dietary recommendation but others either just stated feeding animals well, or talked about highly digestible foodstuffs, which is correct for monogastrics like pigs but less so for ruminants such as cattle and sheep. Quite a number of candidates wanted to give the animals steroids or growth hormones, but as this practice has been banned in the EU for a number of years this was not an acceptable answer.

Teaching Tips:

Where the specification states that candidates should be able to define certain terms, these terms should be learnt thoroughly and as well as understanding them, candidates should be on the look-out in the examination for opportunities to use the correct term.

Q.5 This question provided a stiff test of understanding of the gene technology part of the specification.

- (a) Most candidates achieved a mark in (i), with scientific knowledge described as improving or increasing. The main error was merely stating ‘changing’ (referenced in question stem) or discussing the answer in the context of plants in the Botanical Garden only, rather than scientific knowledge as a whole. These candidates were unable to generalise from the information given and referred only to progress in genetics or phylogeny.

Part (ii) drew on synoptic knowledge from F212, with candidates mostly achieving 1 mark at least for referring to conservation of endangered plant species. The idea of a gene bank was creditworthy but the garden does not function as a seed bank. Genetic diversity can be maintained but not *increased* by holding a varied plant collection.

- (b) The best candidates were familiar not only with the three techniques themselves but also in their combined interrelated use for genome sequencing work. Most candidates, however, failed to relate the methods to **the sequencing of the genome** and consequently missed mark points and supplied irrelevant material concerning other applications like forensic fingerprinting, gene identification and genetic engineering.

In (i) most candidates achieved the amplification mark but very few related PCR to the chain termination sequencing method where addition of terminator nucleotides result in incomplete copies of many different lengths. Indeed, a mistake that often surfaced in answers to later parts of the question was that candidates think

restriction enzymes cut the different lengths and then a fluorescent base is added. References to crime scenes indicated a candidate who was not thinking about the information given in the question.

For part **(ii)** candidates had to state that the lengths of DNA are lined up in the order of their sizes and many candidates lost the mark by simply saying 'separation by size'. Many candidates were keen to explain how the process worked but did not answer the question and say what the purpose of electrophoresis in sequencing is, that is, to order the end-nucleotide labelled fragments and read off the base sequence.

Part **(iii)** scored poorly as candidates simply recited the information that restriction enzymes cut DNA, often adding unnecessary detail about sticky end formation, but again did not apply themselves to the question about the purpose of the process in sequencing a genome. Some did say 'cut the genome into smaller fragments' but very few mentioned cutting vectors such as BACs in order to form a library of the genome to be sequenced.

- (c)** Most candidates realised that the whole genome is too big to sequence all at once and as well as the expected general statement about inaccuracy when sequencing longer lengths, there were some good examples of the problems involved, e.g. blurring on the electrophoresis gel and limitations on PCR.
- (d)** Most candidates coped well with the unfamiliar calculation in **(i)** and scored both marks.

Similarly most candidates picked out that the genome size of monkey flower was smaller in **(ii)**, though the follow-on 'so it will be easier to sequence' was not acceptable. Candidates need to think about how something is easier in terms of saving money or time. Most candidates also discussed the different chromosome numbers of blueberry, not considering that the same basic genome is represented but in multiples of more than 2.

Most candidates used their knowledge of polyploidy in bread wheat to suggest that polyploidy fruit would be larger, but some simply said 'different size' and others suggested colour, number of seeds or the number of fruit.

- (e)** Candidates continue to have problems with the different approaches to classification, though most know that a key tenet of the biological species concept is that organisms of the same species must be able to interbreed (not interact or reproduce) to produce fertile offspring. General comments about the phylogenetic approach dealing with evolutionary relationships or ancestry failed to score unless common or shared ancestor was mentioned. Few candidates knew the term 'monophyletic group'. A few candidates mentioned the differences in approach to classifying extinct and asexually reproducing organisms.

Teaching Tip:

After teaching the basic process of genetic engineering, electrophoresis and PCR, the sequencing of a genome learning outcome provides an opportunity to bring the different techniques together in a new shared application. Although it begins the specification section on gene technology, it is beneficial to teach this last, summarising the stages as a flow diagram.

Q.6 This probed candidates' understanding of continuous and discontinuous variation and provided an opportunity to display general AO3 skills and ecological and experimental methods in designing an experiment.

- (a) It was surprising that a significant number of candidates failed to score both marks in (i). Some candidates mixed up the terms and some only used two letters, commonly **S** and **R**, but missing out **T**.

Part (ii) gave clear discrimination between candidates and rarely did candidates gain all six marks.

Very few gained the first two mark points for 1 and 8 being in **S** and **T** only – presumably the same candidates who had not identified **S** and **T** as being discontinuous variation. Revision card statement 5 (polygenic) in box **R** only was the most common correct response followed by statement 6 (just two alleles) in **S**. Very few candidates identified species **T** as an example of co-dominance (7). The marking penalised candidates who hedged their bets by putting numbers into lots of boxes. Some candidates failed to use all numbers so missed several marks.

- (b) Many candidates gained three to six marks for this question, but few gained the full seven. The best candidates used the bullet point guidance to structure their answer in line with the instructions, provided sufficient detail at each stage, and so gained the QWC marking point. In order to do well, candidates had to clearly imagine the practical difficulties faced and suggest suitable equipment, for example a sealed petri dish, rather than make sweeping generalities such as 'provide an environment', or impractical suggestions such as 'place fleas in a sealed room'.

For collecting fleas, common sensible suggestions were a pooter, sweep net or comb. Candidates with some experience of field work were at an advantage and in amongst unsuitable suggestions involving quadrats and pitfall traps came up with concepts like random sampling and sufficiently large sample sizes.

The testing stage was the most poorly described. Many candidates did not think through how to contain their fleas or how to apply a flea-killer product in a way that mimics the experience of the insects when living as ectoparasites on a dog. Few considered how to achieve a realistic dose in line with the real dose received by the parasite in situ on the dog. A few mentioned the need for a control but did not always say how this could be achieved.

Most candidates scored at least one mark for data processing though, generally for counting the number of fleas dead or alive. Some referred to a set time period for exposure to the insecticide. Possibly helped by experience of previous F215 questions involving ecological data where percentages were the best way to compare results, a pleasing number of candidates this time said that with different starting numbers of fleas in different experimental set-ups, the raw data should be converted to percentage surviving or resistant - for fair comparison.

Teaching Tip:

Candidates should be shown a variety of examples of discontinuous variation, and relate the range of phenotypes to their genetic causes. Revision of different types of genetic crosses involving multiple alleles, co-dominance, etc, while considering patterns of variation, might help candidates to link the ideas together.

As candidates seem to lack practice in thinking through and setting out a method for an experiment, candidates need to be given chances to work on this skill, and to be reminded of the need to revise their practical skills knowledge. To practise writing

exactly what needs to be done, pairs of candidates can write instructions for a simple procedure, such as drawing a house. They then swap instructions to see whether it is possible to carry out the instructions with no further information and without making any assumptions.

Q.7 The common theme in this question was hormones, but the question ranged widely, from comparing plant and animal hormone modes of action, to genetic engineering of a protein hormone, to the interaction of steroid hormones with DNA to candidates' knowledge of transcriptional control.

(a) The most common correct answer to **(i)** was avoiding abiotic stress, followed by avoiding predation. Those who just used descriptions tended to mention either plants or animals and therefore miss the mark. Candidates who had not learned these ideas from the specification wrote vaguely about survival, reproduction and adaptation.

Part **(ii)** was challenging as few candidates had ever compared plant and animal hormones before and they did not have a sufficient grasp of the overall picture to draw meaningful general comparisons. The commonest correct answers seen were transport alternatively in the blood or in xylem, phloem or by diffusion from cell to cell, and the distinction between endocrine glands and more widespread plant cells or tissues. Some candidates confused endocrine with exocrine. Candidates frequently made one valid point about either plant or animal hormones but did not match it with how the situation differs in the other organism. Poor technique in describing differences has been commented on in previous F215 reports.

(b) Part **(i)** rewarded candidates who have acquired a wide biological vocabulary and are able to choose the most apposite term to get their idea across, here the idea of dwarfism being caused by a mutation or an allele, not just a gene or DNA. The key aspect of genetics is that it is about inheritance, but a great many candidates stuck with molecular explanations and did not have the flexibility to also refer to the way in which this condition is passed from parents to offspring.

Part **(ii)** was well done with most candidates getting at least *gene*, *ligase* and *genetically modified* or an equivalent term, but slightly fewer getting the *antibiotic* and *probe* marks. Wrong answers for the last space included genetic markers, uv light, computers and microscopes.

(c) Candidates came up with a range of answers. The terms non-polar and polar are not well understood. Many candidates referred to a lipid rather than phospholipid bilayer for the cell membrane. Some candidates thought that steroids would pass through pores. Questions that require candidates to remember biochemistry from AS always pose problems and result in a lot of wild guess work, so examination preparation should always include revision of the basics of biochemistry and cell structure.

(d) The paper ended on an upbeat note as most candidates chose to write about the *lac* operon and this was well understood, with many candidates gaining four marks. Mark point 3, however, was often not awarded due to a variety of errors. These included mistaking DNA polymerase for RNA polymerase, translation for transcription and the promoter for the operator, or even the operon for the operator. Those who failed to achieve the first marking point stated repressor molecule, repressor or just inhibitor rather than specifying repressor protein. The detail most often missed out was that lactose binding to the repressor protein changes its shape.

A minority of candidates discussed homeobox genes and here the most major error to surface was thinking that the whole gene is just 180 base pairs long and that the protein product is called the homeodomain. The homeodomain is the 60 amino acid section of the larger protein that is common to all the homeotic protein products, and the homeobox is the 180 base pair section that all the genes share. Candidates know that homeotic genes have a role in determining body plan, though the maternal effect genes mentioned in some text books should not be classed as homeotic genes. The homeotic gene products bind to DNA to control transcription, but the candidates who attempted to discuss this situation rarely gave a clear description.

General Teaching Tips:

Candidates did not seem to be short of time and some filled up the extra time by adding random extra thoughts to their first answers in the additional space at the end of the question booklet. These additions rarely scored and once again, candidates need to be encouraged to think through their initial answer more clearly before writing, in order to maximise performance.

Answers that quoted mark schemes from previous sessions again made an appearance, usually in the wrong context since there is limited overlap between papers in different sessions. Candidates who applied principles they had absorbed from old questions (such as the usefulness of calculating a percentage for comparison in 6b) did well, but simply quoting details about troponin and tropomyosin say in the elbow question was inappropriate, and not a substitute for the real thought and understanding that the examination tries to reward.

F216 Practical Skills in Biology 2

General Comments

The standard of work was again high, with the majority of Centres marking accurately with a minimum of difference with the moderator. However, there remain some areas of concern for a minority of Centres. These are summarised below.

Qualitative Task 2: Observing Tissues in the Mammalian Kidney

A substantial number of candidates were credited with drawings which did not meet the marking points for Question 1. Of particular significance was many candidates' apparent inability to produce a freehand drawing which **closely** matched Fig.1. There were a number of other concerns which are best addressed by using the generic check list below, which is for use when teaching drawing from the microscope.

Teacher Checklist for Drawings

- All drawings in pencil – a sharp 2H pencil will give the best lines
- Clear continuous lines
- Accurate record of exactly what is observed – not what is remembered from textbooks or laboratory sessions
- Label lines drawn with a ruler
- Correct labels or annotations as instructed (generally, a label is a name, whilst an annotation is a description)
- Suitable size given the area available – at least half the available space
- No shading or colouring
- Low power plans – no cells
- High power - detail of usually no more than a few cells

Giving candidates the benefit of the doubt when crediting marking points

A major reason for differences between Centres and the moderator is crediting weak alternative wording to a marking point. If the Centre is in doubt about crediting a response, then it is probably best that it be ignored. Only very convincing 'almost there' wording should be considered for a benefit of the doubt credit, and these must be **fully annotated** by the marker explaining why credit should be given. A tick with BOD alone leaves the moderator attempting to understand the Centre's reasoning behind the decision. This in itself can lead to differing judgements.

Candidates may not imply an outcome in a written response and expect the moderator to fill in the gaps. It is a natural response to do this since one knows one's candidates and what they are capable of. Unfortunately, this is not acceptable in an examination context.

Points which are not on the mark scheme should **not** be credited without first querying it using the email query service.

To ensure that a consistent message is given to all centres and that centres have a printable copy of correspondence that can be **submitted with the work to the moderator**, we strongly recommend that all Task queries are e-mailed to our dedicated Task e-mail address:

GCESciencetasks@ocr.org.uk

Centres are reminded that they may submit up to four scripts for each Task for the free Consultancy service.

General advice not necessarily Task-specific

Where a biochemical test performed has a colour change as an outcome, the observations have to be a description of that colour because they are *results*; any interpretation of the colour is a *conclusion*. An example might be I in KI when mixed with a starch solution, gives a blue/black colour, which indicates the presence of starch. A candidate may not state that the outcome is that starch is present since that is a conclusion not a result. A candidate's statement of 'no change' without qualification is not acceptable.

Where candidates are expected to describe a method they used, in for example, Qualitative Task 1: An Investigation into the Distribution of Photosynthetic Organisms in Relation to an Abiotic Factor (Step 8 on page 7), the text must convey enough information for a third party to be able to repeat the Task without further assistance. For this purpose, a third party is someone sufficiently qualified to understand the text, but who has not met the test before.

General administration points

All Tasks must be individually dated to show which Tasks were completed by which candidates and on what dates.

Where possible, please number mark scheme bullet points in candidates' scripts to assist with internal standardisation and to provide more information for the moderator where a point is divided within a candidate's text.

All candidates' calculations must be checked by the marker and verified during internal standardisation; the moderator will check all calculations.

This year there have been a number of instance of clerical errors being returned to Centres for correction. All marks should be entered in the appropriate position within the Task and all numerical additions completed according to the requirements of the Task. The numerical addition should be checked by a second person before marks are submitted to OCR.

In order to reduce the risk of candidates being unable to carry out a Task correctly or fully, all Tasks are expected to have been trialled before candidates work the paper. In large Centres, this could mean several trials where the Tasks are repeated over several days. A record of this trial data should be sent with any scripts submitted for moderation.

Internal moderation/standardisation should be carried out in such a way that it provides evidence which the moderator can follow and so understand what has been done. This is especially important where two markers in a Centre disagree. The moderator has to be told explicitly which mark to accept.

Each candidate's scripts submitted for moderation should be secured together using treasury tags located in the top left hand corner. Tasks must be openable for working moderation to occur without having to undo or re-secure the tags. Tasks should be fastened in the order Qualitative, Quantitative and then Evaluative. Plastic pockets, staples, or paper clips should not be used.

Candidate skills needed for tables and graphs

Whilst candidates should carry out the below steps in **all** cases, the mark scheme may not test all of these in every Task. Only the Task mark scheme points should be considered when marking a script; if a candidate fails a point listed below, but which is not in the mark scheme, then it should be ignored. In all cases, the mark scheme supersedes this list, Centres should be aware of special requirements within a Task; an example might be an instruction to use three decimal places. Sometimes a specific point may be modified; an example of this might be a field Task where the use of a ruler to border a table would be counterproductive and so is specifically excluded by the mark scheme.

Teacher Check list for tables

- Tables bordered using a ruler
- Clear and informative headings within the table borders
- Correct SI Units within the headings only – no units in the body of the table (Please note that if a Centre's apparatus carries non-standard units printed on it, then the moderator **must** be informed)
- Independent variable (IV) in the first column not in the top row
- Dependent variable (DV) in the columns to the right of the IV
- Headings not repeated within the table
- Observations recorded clearly within the table or a sensible key used and clearly displayed
- Numerical data recorded consistently to the correct number of decimal places according to the instructions or the degree of precision within the apparatus.
- Timing issue – unless otherwise stated in the Task, all times should be recorded either in whole seconds or to 0.5 seconds because human reaction times make more decimal places unreliable. Please read the instructions and mark schemes carefully to see the level required.
- Processed data recorded to the same number of decimal places as the raw data or to one more decimal place (a maximum of 2 decimal places)
- Allow the error carried forward (ecf) rule for processed data

Teacher Checklist for Graphs

- IV on the X axis
- DV on the Y axis
- Both axes correctly labelled with the correct SI units
- Check the labels are correct e.g. if the mean data is being used, mean must be used as part of the label
- Both axes to be correctly scaled
- Axes start at the origin or at a higher value to fit the paper provided correctly. Candidates should use a broken axis where the first value on the scale is greater than zero
- **Plots** should cover about 50% of the paper to avoid inappropriate scaling or size of graph
- Plots must be accurate to within +/-1mm (Saltire cross or St George's cross or circled dot)
- Lines drawn should not be so thick that they generate an error to the order of the above point
- The data plotted must be consistent with the student's own data so again allow ecf where relevant
- Lines are to be joined by plot to plot ruler line or a line/curve of best fit – not a mixture of both
- No multiple lines; if both point to point and line/curve of best fit are used then both must be correct or the mark is lost as it is a contradiction i.e. the marker is being asked to choose

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