

Human Biology

Advanced GCE **A2 H423**

Advanced Subsidiary GCE **AS H023**

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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OCR REPORT TO CENTRES

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Overview

In this session there was evidence of a slight drop in performance at both A and E grades at AS while at A2 there was an improvement at A and A* and no significant change at grade E compared to June 2012.

Most students starting Human Biology begin with cell ultrastructure and biochemistry. Successful candidates retain their knowledge and understanding of these learning outcomes and can apply this to related topics in later units. Weaker students get by but their knowledge is not secure. The evidence for this could be seen when comparing performance on **Q1** and **Q2** on **F221** with **Q2(a)** on **F224** and **Q3(a)** on **F225**. On **F221**, most candidates scored reasonably well. By the time candidates arrived at **F224** and **F225**, there was confusion about cell structure and biochemical molecules with responses referring to 'cytoplasm of the mitochondria' or glycogen being added to protein to make glycoproteins. On **F225**, even good candidates were confused on the role of the Golgi apparatus. With a single examination session now at AS and at A2, teachers will need to revisit and consolidate material covered earlier in the course. This could be of real benefit to candidates, particularly if the habit continues with AS material being refreshed as they proceed through A2.

Figures used in this session appeared to cause candidates some difficulty – the karyotype on **Q3a** on **F222**, the photosynthesis diagram on **Q4a(i)** on **F224** and the pedigree on **Q3b** on **F225**. In each case, weaker candidates had clearly glanced at the figures briefly and did not register the key elements such that relatively straight forward questions based on these figures were not answered well. On the other hand, good candidates used some means of highlighting on the diagram – for example, underlining the sex chromosomes (**F222**) or putting in gender and genotype on the pedigree (**F225**). As they benefit from underlining command words in questions, candidates should also be encouraged to highlight the key features on images and diagrams. Teaching materials should seek to expose candidates to as wide a range of illustrations as possible.

Centres are advised to note carefully the comments of the Principal Moderator regarding what is permissible regarding teacher guidance to candidates on practical skills in both units **F223** and **F226**. Where there is evidence that candidates have been 'coached' in the requirements of the mark scheme or have colluded with each other or where work has been redrafted, this will be investigated as potential malpractice. The number of Centres which have been flagged up as potentially in breach of the coursework regulations has risen this year. Centres should also take careful note of the guidance on the reasons why practical work is sometimes returned to a Centre for remarking as this has led to confusion. There are still relatively few Centres taking advantage of the free coursework consultancy which is available.

Understanding and answering the questions

The importance of identifying the actual requirement of questions has been mentioned in previous reports. Yet again candidates are writing excellent human biology but failing to score any marks as their answer does not address the question. Examples of this can be seen on **F221 (1b)**, **F222 (2aii)**, **F224 (1c)** and **F225 (2ci)**. There are other examples mentioned in each section of the report.

There are several examples across the written papers of careless use of terminology or omission of terminology leading to marks being dropped. This is seen, for example, in responses to **F221 (4a)** (electrolytes), **F222 (2ci)** (constriction / contraction), **F224 (2b)** (electron acceptor) and **F225 (6bi and 6e(i))** (buffer). The **QWC** marks for correct use of technical terms were generally achieved at AS (**F221**) but less frequently awarded at A2 (**F224**). Teachers are very conscious of all the new terms candidates have to master at AS and good literacy strategies are embedded into teaching but these strategies clearly need to be continued into the A2 units.

Candidates were much better at signposting where they had used the additional answer sheets provided.

Dealing with Data

All the papers contained questions which required interpretation of graphs. While candidates are much better at spotting the difference between questions asking for explanations as opposed to descriptions, careless use of data to support descriptions led to marks being lost by even the most able candidates. This was particularly true of **Q(1ci)** on **F222** and **Q(1c)** on **F225**.

Some **A03** questions were answered well (**F224 Q3**), while others requiring candidates to understand what constituted the independent, dependent and control variables (**F225 Q6**) were less well answered. Given the proportion of **A03** marks on each of the written papers, it would be sensible to incorporate the use of these terms more frequently in teaching rather than limit their consideration to **F223** and **F226**.

Mathematical Requirement

Although the calculation on **F221** proved as demanding as expected, on the other units, calculations proved to be accessible to even less able candidates. Very few candidates failed to attempt these questions and, where marks were lost, it was frequently for errors in rounding or failing to read what level of precision was required in the answer (**F225 Q4b**). Centres should be commended for instilling more confidence in their students. However, although some types of calculations have appeared on several occasions (notably percentage changes) examiners are not limited to these and Centres should continue to refer to the mathematical requirements of the specification.

A level Reform

In Autumn 2013, Ofqual announced that there would be no January A level examination session from 2014. AS and A2 examinations would be available only in the summer examination period. In the current specification, it will only be possible to re-sit an AS unit at the end of a two-year A level course. For the A level units, there will no opportunity for candidates to re-sit without entering a third year.

Starting in September 2015, new AS and A level specifications are scheduled to start. 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>.

F221 Molecules, Blood and Gas Exchange

General Comments

This question paper appeared to be accessible to the majority of candidates and examiners reported that candidates appeared to make good use of the allocated time and very few candidates offered ‘no response’ to questions.

Once again, the overall performance of the candidates showed a normal distribution of marks with stronger candidates able to demonstrate their understanding of the content and contextual nature of the specification. Candidates of all abilities are demonstrating a good knowledge of standard procedures and this was evident in **Q1(e)** which required candidates to describe the procedure for staining a blood sample for viewing leucocytes and **Q4(c)(i)** which required them to outline the procedure for taking an ECG; both questions scored highly.

There has been little change in the rubric used by examiners in recent years and candidates now appear well prepared for the different question commands. However, AO2 style questioning is still proving challenging for weaker candidates and appropriate scientific terminology (with correct or unambiguous phonetic spelling) is often lacking in their responses.

The majority of candidates found the trace in **Q5(a)(i)** difficult to interpret and it is recommended that Centres continue to encourage candidates to practice interpreting traces and graphs when undertaking practical tasks. It was pleasing for examiners to note that, in **Q2(a)**, provided candidates had measured the length of the palisade mesophyll cell on the micrograph correctly, the majority of those candidates were then able to calculate its actual length. However, a substantial number of candidates are still unable to perform this basic calculation, with the conversion of millimetres to micrometres being the main challenge.

It was encouraging to see that many Centres had heeded the advice on the January 2013 report and examiners noted an increase in the number of candidates who had annotated their scripts to indicate clearly that they had used the additional space to continue with their responses.

Comments on Individual Questions

- Q1** This question was generally well-answered and the differing styles of each part question enabled candidates across the ability range to settle into the examination.
- (a)** Knowledge of the biochemistry of carbohydrates was required in this part of the question and the majority of candidates were able to score a minimum of three out of the five marks available.
- (b)(i)** This part of the question specifically targeted the importance of branching in glycogen in terms of its role as a storage molecule. Few candidates formulated responses that answered the question appropriately and examiners noted that many candidates gave responses that covered any structural property of glycogen that they could recall, for example, it being insoluble or compact or not affecting the water potential of the cell. Whilst not factually incorrect, these responses did not answer the question being asked and did not receive credit.
- (b)(ii)** Generally well-answered, although examiners commented on the number of additional cell types used in incorrect responses, the most common being ‘kidney cells’.
- (c)** This part of the question was generally well-answered by the majority of candidates. Some candidates gave an example of a stain, for example, Leishman’s stain, rather than the **type** of stain, which was not credited.

- (d) This part of the question proved a discriminator between candidates of different abilities. Weaker candidates stated that the stain shows the cells as a whole or made non-specific references to cellular structures and organelles. Candidates who were able to recall that Leishman's stain is taken up by the nucleus were usually then able to apply this knowledge to the concept that different leucocytes have different shaped nuclei and were awarded both marking points.
- (e) The majority of candidates were able to recall the stages in the procedure for preparing and staining a blood sample. Examiners were specifically looking for events that occurred in the correct sequence and, for the most part, candidates did not contradict themselves and were able to gain maximum three marks for this part of the question.
- Q2** This question allowed candidates to demonstrate their knowledge of cell ultrastructure with reference to plant cells, which is a requirement of the Human Biology specification.
- (a) Calculations still prove to be problematic for some candidates, and examiners would encourage Centres to continue to encourage candidates to practice the basic mathematic skills essential to the experimental biologist. Common sources of error included: inaccurate measurement of the length of the palisade mesophyll cell, incorrect manipulation of the formula, incorrect rounding and not giving the answer to one decimal place. The most challenging aspect of this type of calculation appears to be in converting millimetres or centimetres into micrometres and many responses were seen to be incorrect by a factor of ten.
- (b)(i) The majority of candidates identified that, either, chloroplasts, mitochondria or vesicles were missing from the labelled diagram of the palisade mesophyll cell. Some of the more frequent incorrect responses seen by examiners included lysosomes and centrioles, which are not generally found in plant cells and were therefore not worthy of credit.
- (ii) Few candidates gave 'nucleolus' as the correct response to this part of the question, with many candidates incorrectly stating rough endoplasmic reticulum.
- (iii) Generally well-answered by the majority of candidates.
- Q3** This question gave candidates another opportunity to demonstrate their knowledge of biochemistry, in this case specific to the protein, haemoglobin. Candidates were also required to respond to 'How Science Works' style questioning in parts (c)(i)-(iv).
- (a) This part of the question generated a spread of marks across the ability range and examiners reported that many candidates made good use of Figure 3.1 as an aid to their responses. Weaker candidates were unable to discriminate between the oxygen carrying capabilities of haemoglobin as a molecule and erythrocytes as cells, and described haemoglobin as being biconcave and having no nucleus. Figure 3.1 directed candidates towards haemoglobin having 4 polypeptide chains (of two different types) and four prosthetic haem groups, as these were clearly visible, but weaker candidates found difficulty in naming these parts of the molecule despite the diagrammatic prompt. Many candidates omitted the term "molecules" when describing oxygen, which was not credited by examiners. Good responses correctly identified the parts of the molecule and then went on to describe that the haem group contains iron ions, thereby also achieving the QWC mark. Candidates who were able to link structure to function were then able to describe how oxygen molecules are carried within the haem groups, but, to gain credit, candidates needed to understand the 1:1 binding relationship between oxygen molecules and haem groups. Stronger candidates were able to describe the cooperative binding ability of haemoglobin and how haemoglobin changes shape to enable further oxygen molecules to bind to the same haemoglobin molecule, with some candidates also stating that oxygen-bound haemoglobin is known by the term oxyhaemoglobin.

- (b) Whilst some candidates understood that the oxygen could be transported in plasma, few candidates stated that it was 'dissolved' in plasma which was a discriminator between the stronger and weaker candidates.
- (c)(i) Generally well-answered by the majority of candidates. Examiners were encouraged by the fact that the ability of candidates to interpret data in 'How Science Works' style questions appears to be improving. This part of the question proved to be accessible to most candidates who were able to describe various aspects of the graph and used data points to back up their descriptions.
- (ii) Few candidates gained credit for this part of the question. Many candidates either repeated the stem of the question saying that the spread of data was much greater at two minutes than at one minute or confused reliability with validity or accuracy.
- (iii)-(iv) Examiners were pleased to report that all candidates had attempted part (iii) of the question. Often this type of question is overlooked on account of there being no dotted line available for the response. Whilst many candidates correctly identified the data set at five minutes, giving a reason for their choice in part (iv) proved more challenging and only the stronger candidates were able to provide responses that identified that, either the data must be at the top end of the range, or that there must be one very low value to cause the anomaly.
- Q4** This question was designed to enable candidates to demonstrate their knowledge across various learning outcomes ranging from the properties of water to the procedures for taking an ECG with electrolytes as the common theme.
- (a) The gap-fill was very accessible to the majority of candidates who demonstrated a good knowledge of the properties of water typically achieving three to four marks on this part of the question.
- (b)(i) Examiners were looking named electrolytes, and therefore to gain credit, correctly stating a named cation eg sodium ion(s) or named anion eg chloride, was essential. Where candidates understood the term electrolyte, they were generally able to earn both marks, usually by stating calcium ions, potassium ions and sodium ions as the most common answers. Stating the element name without 'ion' was not considered precise enough to be worthy of credit.
- (ii) The most common credit-worthy responses seen by examiners made references to the regulation of water potential in the blood, or an appropriate description of how too many or too few electrolytes would affect osmosis. Few candidates were able to gain a second marking point to achieve maximum two marks for this part of the question, although stronger candidates were able to extend their description of water potential and state that a high concentration of electrolytes would **lower** the water potential of the plasma.
- (c)(i) Generally well-answered, with the majority of candidates gaining at least one marking point.
- (ii) Generally well-answered. Examiners did not credit coronary heart disease, heart murmurs, angina or cardiac arrest as these are not generally **diagnosed** by an ECG.
- Q5** Overall this question proved accessible to the majority of candidates who were required to apply their knowledge of blood vessels to AO2 style questions. Part (a)(i) proved challenging and few correct responses were seen to this part of the question.

- (a)(i) The graph in Figure 5.1 showed the blood pressure in different vessels of the circulatory system. Candidates were then directed to the rise and fall of the trace and told that this corresponded to contractions of the heart, and specifically asked to explain the rise and fall of the trace in the arteries and arterioles. Unfortunately, candidates often repeated the sentence in the rubric just above the question or discussed why the overall pressure decreases, which did not answer the question as this was not specific to the rise and fall of the trace. Stronger candidates made reference to the fact that the amount of elastic tissue was less in arterioles or recognised that the blood flow was being smoothed out.
- (ii) Generally well-answered by the majority of candidates.
- (b) For this part of the question, candidates were given a diagram of a vein and asked for the role of named tissues. For the endothelium, some candidates gave insufficient detail and described how the thin layer of endothelium allowed for the diffusion of small molecules, which was not relevant to the flow of blood. Candidates often confused elastic tissue with smooth muscle and talked about contraction rather than recoil, which was considered contradictory and could not be credited. Similarly, insufficient detail was given by some candidates who stated that elastic tissue stretches but omitted to state the key fact that it recoils to return to its original shape in order to maintain some pressure in the vein. Overall, many candidates understood that collagen fibres offered protection from damage, although some candidates described its role in attracting and activating platelets, which was not relevant to the role of the collagen fibres in maintaining blood flow as required in this case.
- (c) Generally well-answered by the majority of candidates who recognised that blood could either flow backwards or ‘pool’ in the veins.
- Q6** Knowledge and understanding of enzyme activity and the effect of pH and temperature were required for candidates to respond to this question. The majority of candidates who interpreted the question stems of (a) and (b)(i) correctly were able to gain credit.
- (a) Many candidates gained at least two marks for this part of the question by stating that ‘enzymes in the blood would be denatured’, thereby achieving marking points one and four. Examiners commented that for some candidates, their knowledge was lacking in depth and few went on to describe the effect of extremes of pH on ionic and hydrogen bonds within the proteins. Stronger candidates who were able to recall such detail gave good responses and secured the QWC mark for using appropriate terms.
- (b)(i) Many candidates understood that this question required them to apply their knowledge of enzyme reactions to the scenario of blood clotting and it was pleasing for examiners to see a number of good responses to this part of the question so close to the end of the examination. Weaker candidates could recognise that the blood would clot faster and some were then able to link this to an increase in the number of enzyme-substrate complexes formed. Good responses described the effect of increasing kinetic energy on the likelihood of enzymes and substrates colliding successfully and increasing the rate of reaction.
- (ii) The majority of candidates answered correctly with 4°C.
- (c) There were many correct responses seen to this part of the question that referred to the removal of calcium ions. As the idea for removing calcium ions from the blood prior to storage is a learning outcome on the specification, candidates were not credited for suggesting that sodium citrate acted as an enzyme inhibitor.

F222 Growth, Development and Disease

General Comments

Some excellent answers were seen and those candidates who had thoroughly researched the pre-release material performed well. AO3 questions proved a challenge for many candidates on this paper but the free-response questions were accessible to the majority of candidates and discriminated well.

Candidates do not appear to have seen certain questions in the paper resulting in some unusually high omit rates eg question 1(a)(i). A good example of exam technique is to cross through the mark tariff at the end of a question to prevent this type of oversight.

In general, the weaker candidates wrote un-developed answers and used non-scientific terms. Several candidates did not always use the information, diagrams, graphs or figures included in the questions to support their answers. The stronger candidates, however, had a clear grasp of the questions and developed their answers using the correct scientific terminology.

Comments on Individual Questions

- Q1** This question was based on the pre-release material and tested a range of abilities. Candidates achieved higher marks if they had thoroughly researched the material provided. This question assessed AO1, AO2 and AO3 skills. For AO3, evidence in support of a conclusion had to be extracted from graphical information.
- (a)(i)** A high proportion of candidates did not attempt this question as it appears they did not realise it was a question which required a response on the diagram, despite the instruction being present. Those who did attempt it almost always answered it correctly.
- (ii)** Candidates who lost marks on this question did so mainly by describing complementary base pairing and not going on to describe its importance. The most common correct answer was the idea of mutations in the DNA being prevented.
- (b)** Most candidates did not know what a proto-oncogene does. Very few made the link that the gene **coded** for a protein, or that it was triggered by growth factors. This question was designed to operate at an E/U grade, but was operating at a higher level.
- (c)(i)** Most candidates could describe a similarity between the incidence of melanoma in males and females. Marks were lost when describing the differences by making general statements and not referring to a specific age. Several candidates did not use the correct units in their data quotes, or multiplied out the numbers. Some candidates lost marks by talking about the risk of melanoma rather than incidence.
- (ii)** Candidates sometimes forgot to look back at the graph to source their answer. Several gave a suitable reason for the similarity, although vague answers about carcinogen exposure (rather than talking about UV or sun exposure) did not gain credit. Some candidates did not give an age reference in their reason for the difference. They just talked about men working outdoors more often with no reference to ‘young’ or ‘older’. Several candidates thought that oestrogen had a preventative role.
- (d)(i)** Many candidates could correctly identify protein as the receptor or that the receptor was a complementary shape. Few gained both marks.

- (ii) Some candidates answered this in terms of the gene rather than the protein, and others thought that the pathway would be stopped rather than be permanently activated. The most common answer was that the pathway would continue in the absence of growth factors, but few could describe the effect on proteins 3 and 4.
- (e)(i) Several candidates restated the question that the drug would target the altered BRAF protein, but could not describe why **only** the altered protein would be targeted. A minority stated that normal cells would not be affected. Some talked about the drug causing a change in the internal conditions (eg pH or temperature), or the production of antibodies.
- (ii) Many candidates talked generally about enzyme inhibition, but only some went on to gain credit by describing the effect on the active site and failure of the substrate to bind.
- (f)(i) This was usually answered well, but the most common error was talking about people rather than patients being recruited. Description of double-blind trials was quite common.
- (ii) Many candidates could describe a randomised trial, but again several described a double-blind trial, the use of placebos and participants knowing which group they were in, indicating that they had not read the question properly.
- Q2** This question was based on the pre-release material, and candidates achieved higher marks if they had thoroughly researched the material provided. This question was a good discriminator.
- (a)(i) Most candidates could successfully describe a chronic disease.
- (ii) Candidates did not read the question carefully and several gave chronic respiratory diseases as examples. Chronic heart disease was also a common error. Some candidates offered AIDS as an answer. AIDS could be described as a chronic disease in a developed country but as most sufferers are not found in developed countries, it is predominantly an infectious disease.
- (b)(i) This was a high demand question and did operate as such. Many candidates gave vague answers restating the definition of a DALY, or talking generally about reliability. Only the more able candidates gained marks here.
- (ii) This was a standard demand question, but was operating at a lower level than this as most candidates performed the calculation correctly and Centres should be congratulated on training their candidates well. A few did not correctly round the answer.
- (iii) Several candidates made a correct statement comparing the level of smoking in the two countries, but also made vague statements about pollution levels without specifying their cause. There were many general statements about differences in health care available, but these were not always linked to poverty.
- (c)(i) Most candidates gained some marks for describing changes to the bronchioles during an asthma attack. Marks were lost for describing constriction rather than contraction of muscles, and changes to the bronchiole or the wall rather than to the muscle, lining or membrane.
- (ii) Candidates who had learned this topic scored well and this was 'signposted' clearly in the case study. Several candidates mixed up the two types of drug and only scored a mark for the method of administration.

(d) Many candidates scored here for various strategies to reduce smoking. Fewer described methods of reducing air pollution or safer working practices. A common error was to describe better diagnosis or treatment of the condition, showing that candidates did not read the question correctly.

Q3 This question mainly addressed AO1 but had some elements of AO2.

(a)(i) A relatively high proportion of candidates thought that the karyotype showed Turner's syndrome, possibly because of the way in which the karyotype was set out. Some candidates thought that it showed Down's syndrome.

(ii) Based on their initial identification in (i), several candidates thought there was a chromosome missing. Having an extra chromosome was accepted as a correct response as this was a general karyotype question.

(b) Many candidates started their response with a long description of performing amniocentesis or chorionic villus sampling, and spent little time describing how to prepare the cells for karyotyping. A common error was to think that dilute salt solution was added to make the chromosomes swell rather than to lyse the cells.

(c)(i) Candidates usually correctly identified the position of non-disjunction, but not the diploid cell.

(ii) In their explanation, many candidates described how non-disjunction took place, but answered in general terms rather than specifying that sister chromatids or homologous chromosomes failed to separate. Only some candidates talked of the consequences in terms of the X chromosomes, and so did not fully answer in terms of the karyotype shown.

Q4 This question again had elements of AO1 but mainly addressed AO2 objectives. It was a good discriminator.

(a) Most candidates routinely scored at least 3 marks from the 5 available here. The most common errors were for the first and fourth blanks. The question asked for the most suitable term to be inserted. This meant that the correct answer for the first blank space was 'endothelium' or 'Tunica intima'. A common error was to put 'epithelium'. A common error for the fourth blank was to put 'cycle' instead of 'muscle'.

(b) Almost all candidates scored at least 1 mark and often 2 here, as the question was targeted at lower ability candidates.

(c)(i) This was generally well-answered. A common error was to talk about stopping breathing. Some candidates talked about a weak pulse rather than no pulse.

(ii) This question discriminated across the ability range. Most candidates made an attempt and scored at least some marks. Candidates who had learned the details of this technique scored well, and were precise in the details of the treatment. Candidates generally went into a lot of detail about defibrillators instead of discussing other treatment which might be carried out by medical practitioners. Examiners are mindful that techniques such as CPR and the use of defibrillators are frequently updated and every effort is made to allow for the discrepancies that can occur between textbook descriptions and the updated ones.

Q5 Similar numbers of AO1 and AO2 marks were available in this question.

(a)(i) Most candidates knew that the answer was MMR.

- (ii) Several candidates seemed to try to guess the name of the diseases from the initials, rather than draw on their knowledge. Polio, diphtheria and tetanus were the most common correct answers, and TB, HPV and hepatitis were common errors.
- (b)(i) This question was a good discriminator. Candidates did not take note of the instruction to *outline* the response, and many went into great detail about the primary immune response instead of describing how vaccination provides immunity. Vague answers about second responses being quicker, or antibodies staying in the blood rather than memory cells failed to gain credit. Candidates wrongly stated that it was the disease which was injected rather than the antigen/pathogen. More able candidates did give a good, balanced account.
- (ii) Candidates generally found this question to be more difficult than expected. Most talked about the baby's immune system as being weak, or babies being more likely to catch the disease. Some did realise that the mother's antibodies would no longer give protection.
- (iii) Most gained credit for talking about the risk of side effects.
- (c) Several candidates gained a mark for the body being unable to produce antibodies or lymphocytes, but most talked in terms of lack of energy rather than lack of protein.

Q6 This question had equal numbers of AO1 and AO2 marks.

- (a) Many candidates either described mitosis, or described the different types of cells in the respiratory system without going on to describe tissue or organ formation. Most described the differentiation of stem cells correctly.
- (b) Very few candidates scored full marks here. The most common error was putting protein instead of phosphate for DNA. The wrong vitamin was often used for blood clotting and healthy skin. Most candidates correctly knew calcium for strong bones, and many knew calcium for blood clotting, Vitamin C for healthy skin, and iron for haemoglobin.
- (c) While some candidates did understand that they could not be made by the body, most candidates just stated that the essential fatty acids and amino acids were needed for healthy development.

F223 Practical Skills in Human Biology

Once again, the panel of Moderators reported commendably on the work and effort that was evident in the majority of scripts submitted for moderation. Annotation and Centre data supplied by some Centres made the task of moderating easier, which was appreciated.

Centres are reminded that the Tasks remain live for the **entire** life of the specification and hence it is not possible for comments to be made on specific questions or Tasks. The following report, however, aims to cover general areas in which Centres can improve. It is also essential, therefore, that no Tasks are used as practice tasks or shown to pupils at any time.

Centres that received adjustments this session fell, in the main, into two categories:

- misinterpretation of the published Mark Schemes eg awarding marks where mark points have not been fully met
- awarding double marks in some cases where ‘**OR**’ statements were present
- awarding marks for answers not listed on published Mark Schemes, which is not permissible in any skill area or Task.

Mark submission and Sample requests

1 Submission date

Teachers are reminded that all Coursework marking and internal moderation must be completed in good time before the submission of marks to the Moderator (on Form MS1) and to OCR. The Moderator must be in **receipt** of the Coursework marks (on Form MS1) **no later than 15 May**. Centres are urged to submit their marks earlier, if at all possible.

Please note: if ten or fewer candidates are entered, please send **all** of the work, along with the MS1 form, to the Moderator, to be received by 15 May.

2 Sample requests

All Centres should note that moderation samples will be automatically generated once the MS1 or EDI submission has occurred. The sample request will be generated electronically and emailed to the contact email address supplied by the Centre. It is therefore imperative that the Centre email is checked regularly and also forwarded to the appropriate person within the Centre. Delays in the moderating process can lead to the publication of results being delayed in August.

It is beneficial for both OCR and the Centre if marks can be submitted by EDI. This will also ensure that the Centre is informed of the candidate sample request much sooner and enable more time within the Centre for organising and collating the sample.

3 Sending the sample to the Moderator

Centres should send work to the Moderator as detailed below:

- Each candidate’s work should be sent with all 3 skills attached using a treasury tag in the top left hand corner of the work.
- Each candidate’s work should have a completed cover sheet attached – clearly stating the candidate number and Centre Number, the 3 skill totals and final total.
- Candidate’s work should be collated in the order as detailed in the sample request email.
- A Centre Authentication Form’ **must** be submitted with the sample.
- A copy of the MS1 must also be sent to the Moderator.

It is strongly advised that work is sent using a traceable service.

Feedback on marking issues:

As with last session, there was an increase in the number of Centres with clerical errors and, again, these fell into 4 main categories:

- incorrect addition of marks within the Task
- transcription errors from the question to the front cover (leading to an incorrect total on the script)
- addition errors across the three Tasks
- transcription errors from the Task paper to the coversheet and/or onto the MS1.

Other administration errors were also more common this year, including:

- failure to send all three Tasks for one or more candidates within the sample
- failure to send the correct Tasks for one or more candidates
- sending inappropriate Tasks for moderation.

Request to remark coursework

After the Moderator has checked all the samples submitted by a Centre, there are occasions when an invalid order of merit occurs i.e. the Moderator marks are found to generate a different rank order than that submitted by the Centre. This can be as a result of one or two candidates' work which has been marked more leniently than the others or by an accumulation of marking errors which have not been flagged up during internal moderation. It is possible that this invalid order of merit could result in a larger adjustment than is necessary and so the work is returned to the centre, with guidance, for remarking.

It is very important that Centres do not misunderstand this process. In essence, the Centre has been given an opportunity to re-visit their marking and that they should take the Moderator's comments into account. It is not a requirement for the Centre to change the marks if they do not agree, but that they should do as much as they can in light of the Moderator's comments. If an adjustment is then applied, the Centre can request a re-moderation after the results are published in August.

Candidates who wish to resubmit work for F223

Tasks **must not** be repeated, at any time by any candidate. If a candidate wishes to re-sit F223, centres will need to submit the best overall mark (out of 40) for one Qualitative Task, one Quantitative Task and one Evaluative Task. Candidates must **not** re-sit a Task from any previous session to enable them to improve on previous performance. If the same Task is available over two consecutive years, a student cannot repeat the same Task, e.g. if the same Evaluative Task is offered in 2011/2012 and in 2012/2013, a student must **not** repeat that same Evaluative Task in 2012/2013.

However, following moderation, a Centre may wish to re-mark the initial work, and send it in for moderation for the following year. It is essential if this is the case that the:

- candidate does **not** receive their work back **nor** make any amendments to the work
- Centre informs the Moderator when it is submitted that the work has been re-marked following the feedback provided by the Moderator's report to the Centre.

Centres should also note that only up to **two** Tasks per candidate can be re-submitted per year. For example, a student may have performed well in their Quantitative and Evaluative Tasks in June 2012 and re-submit them along with a 'new' Qualitative Task in June 2013. It is recommended that the re-submitted Tasks are reviewed in light of any comments from the original moderation and re-marked if necessary according to the original Mark Scheme.

Centres should retain Tasks securely until it is clear that candidates do not wish to re-submit work to OCR in future sessions. The work must **not** be handed back to the candidates. All work should be securely destroyed when no longer required by the Centre, as all Tasks remain live for the duration of the specification.

Training candidates

Under **no** circumstances can any candidate see the Tasks ahead of completing them, and they should not see the Mark Schemes on any occasion. The Tasks should be undertaken in highly controlled conditions. On occasions where the answers of candidates appear to “match” to wording, phrasing and order of Mark Schemes, the work will be raised as suspected malpractice and investigated.

Areas which candidates need training on are detailed below. These skills can be taught during **non-assessed** class practicals:

a) Teacher Check list for Drawings

- All drawings **must** be in pencil – a sharp 2H pencil will give the best lines.
- Clear continuous lines should be drawn.
- An accurate record of exactly what is observed – not what is remembered.
- 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 is covered in both dimensions.
- No shading or colouring of any kind.
- Low power plans – no individual cells should be drawn.
- High power diagrams – usually no more than 5 cells in each area should be drawn.

b) Teacher Check list for tables

- Tables must have a complete outer border for all 4 sides drawn using a ruler.
- Clear and informative column headings within the table borders.
- Correct SI units within the column headings only – ie no units in the body of the table.
- Independent variable (IV) must always be in the first column.
- Dependent variable (DV) must always be in the columns to the right of the IV.
- Headings must not repeated within the table.
- Observations recorded clearly within the table.
- 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 – all times recorded in whole seconds because of human reaction times. 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 rule for processed data.
- Anomalies used or not in processed data.

c) Teacher Checklist for Graphs

- IV on the X axis with appropriate units.
- DV on the Y axis with appropriate units.
- Check the labels are correct e.g. if the mean data is being used ‘mean’ must be used as part of the label – not ‘average’ as this could infer mean, mode or median data.
- Both axes to be correctly scaled with equidistant intervals.
- Axes start at the origin or at a higher value to fit the paper provided correctly or can use a broken axis if the correct indication on the scale is used.
- **Plots** should cover 50% of the graph paper in both dimensions to avoid inappropriate scaling.
- Plots must be accurate to within +/-1mm (Saltire cross or St George’s or circled dot).
- Lines drawn should not be so thick that they generate an error of +/- 0.5mm.
- The trend line should be joined by plot to plot ruled line.

- No multiple lines should be drawn; if both point to point and line/curve of best fit are used, both must be correct or the mark is lost as it is a contradiction ie the marker is being asked to choose.

Advice on implementation and marking of tasks

Centres can also seek advice on the implementation and marking of Tasks in future sessions by e-mailing GCEsciencetasks@ocr.org.uk. Please include your name and Centre number, state clearly which Task your query relates to, and describe which points of the Task, Technician's Instructions or Mark Scheme you would like to receive clarification for.

Re-moderation requests

Any queries with marks awarded **this** session (June 2013) should be raised through the results enquiry service (details are available from OCR interchange). A Centre may apply for a re-moderation of coursework in accordance with procedures set out in OCR's Results Enquiry Service.

Queries in future sessions

Any enquires regarding F223 (and F226) can be addressed to OCR using the free coursework consultancy service. Centres can receive free advice on future practical skills in two ways:

- 1 Using the coursework enquiry form which is available from the OCR website:

http://www.ocr.org.uk/Data/publications/forms/GCW264i_AS_A_Level_GCE_Human_Biology_Units_F223_F226_Coursework_Enquiry_Form.pdf

This form should be completed at sent to OCR at the address stated. This service is free of charge and can be used for guidance and feedback on the accuracy of marking tasks ahead of the submission of marks for moderation. For example, Centres can send in photocopies of up to 3 students' work for (each) separate Task and gain feedback on the accuracy of marking, which can be useful ahead of internal moderation within the Centre, or indeed before the submission of final marks to OCR.

- 2 Contacting OCR via email

Centres can contact OCR through email at OCR.GCEScienceTasks@ocr.org.uk

Centres should clearly state the following information

- Centre number
- Specification and unit
- Personal contact details (name, position and email address)
- Task and category concerned eg milk, qualitative
- Specific details of the enquiry (see below)

Although it is hoped that replies will be quick, Centres should allow at least a week for a response, especially at busy times of the year.

Areas in which Centres may wish to use this service may include:

- clarifying details of the practical Task eg procedure
- requesting permission from OCR to make **minor** changes to the procedure (please note that permission should be sought before the Task is completed, as in cases where changes are not approved by OCR, candidates marks may be reduced)
- clarification in the interpretation of the Mark Scheme
- checking the accuracy of marking within the Centre by submitting the **photocopied** work of 3 candidates for feedback by a senior moderator ahead of the submission date. Centres should allow 6 weeks for OCR to respond and hence submit the work in plenty of time ahead of the 15th May.

Further detailed feedback on F223 (and F226) will be provided at OCR INSET meetings held in the Autumn term. Details can be found on the OCR website.

F224 Energy, Reproduction and Populations

General Comments

A lot of very good responses were seen by examiners, particularly concerning eutrophication and spermatogenesis. However, the biochemistry questions seemed to prove challenging to most candidates. It is important that at A2 level, candidates are able to both state information that they know and also use that information. They should be taught to be able to understand the requirements of a question from the way that it is worded.

Comments on Individual Questions

- Q1** This question primarily tested candidate's ability to apply their knowledge by explaining or suggesting answers (AO2) and, with that in mind, it was answered quite well.
- (a) A very straightforward question which involved the candidates having to put various stages of IVF treatment in the correct order. Most candidates gained all three marks. The most common mistake was to get 'embryos were allowed to develop for three days' and 'after 16 – 30 hours oocytes checked for fertilisation' the wrong way round.
- (b) With part (b) it was important that candidates stated what the embryos were going to be used for, not just that they were kept to be used again. The majority of candidates managed to get the first marking point for a reference to future pregnancies. Those who failed to get this mark made vague references to 'use later in life' or references to terminally or chronically ill women where future pregnancies would not be an option. Lots of candidates also got the second marking point for embryo donation. The third marking point for stem cell research was not given so often due to unqualified references to scientific or medical research, or references to embryos being used as a source of stem cells for treatment of diseases.
- (c) This was about the objections to IVF; some candidates wrote about the dangers of IVF and gained no credit. Most candidates gained the mark for suggesting religious beliefs. Few went on to gain other marks with reference to the destruction of embryos being given most frequently. Comments regarding money being spent elsewhere were only seen rarely as were comments on the rights to know the biological father. Vague statements referring to playing God, adoption and designer babies were frequent and could not be credited.
- Q2** This proved to be challenging, with very few candidates scoring full marks for this biochemistry question.
- (a) FAD was rarely seen. For substrate level phosphorylation, few gave both cytosol and matrix, although many candidates identified one of the two. A common mistake was the mention of "cytosol of mitochondria". Many candidates lost marks by including cristae with a correct answer.
- (b) Few candidates correctly identified the role of oxygen in the electron transport chain for part b(i). Statements that oxygen is 'the final hydrogen acceptor' was commonly seen but not credited. Many candidates had no idea at all. This was a straightforward 'state' question (AO1) so there should have been more correct answers. For part b(ii), the majority of candidates calculated the answer correctly, which was good to see.
Teaching tip: explain chemiosmosis as a process necessary to produce ATP, which is fundamentally the same in both respiration and photosynthesis. Emphasise the different coenzymes and final electron acceptors involved in respiration and photosynthesis.

- Q3** Candidates were again expected to use their knowledge (AO2) rather than recall facts (AO1) for parts **(a)**, **(b)** and **(c)**, which is probably the reason they did not do so well here, particularly on parts **b(ii)** and **(c)**.
- (a)** This required that a tissue should be named. Good answers were seen but some responses identified organs for example intestines, leg muscles, or stomach.
- (b)** On **b(i)** most candidates gave the correct percentage saturation. It was very rare to see correct responses to **b(ii)**. Most candidates misunderstood what they had been asked, which was not why the % saturation of haemoglobin is high or needs to be high but why it *remains* high in the blood in arteries and arterioles. Candidates wrote about newly oxygenated blood running through arteries, or oxygen still to be delivered to tissues. The mark point for exchange occurring in the capillaries was given occasionally and the ‘thickness of wall’ mark point very rarely.
- (c)** Part **(c)** was also not answered well by most candidates. Again, this question was generally misinterpreted. Answers should have referred to why there is still enough oxygen and not how they have adapted. The best candidates had the right idea that 80kpa is still high enough to saturate haemoglobin with oxygen, since 96% saturation is achieved at only 12kPa. References to EPO and increased number of erythrocytes were seen quite regularly. There were lots of references to VO_2 max, cardiac output and affinity of haemoglobin for oxygen.
- (d)** For part **d(i)**, most candidates scored both available marks. A few curves were drawn to the left of the line but the most common error was to finish the line below 80% saturation. Most candidates got the mark for part **d(ii)**. The most common error in part **d(iii)** was to make it clear that *more* oxygen is released rather than just that oxygen is released or that it is released more rapidly or more easily. Quite a number of candidates stated that the haemoglobin had increased affinity and so picks up more oxygen.
- (e)** The majority of candidates know that myoglobin acts as an oxygen store.
Teaching tip: explain the significance of the sigmoid shape of the oxygen dissociation curve.
- Q4** The biochemistry again proved challenging in this question but eutrophication is clearly generally well understood.
- (a)** The most common incorrect answer was reduced NAD for **a(i)**. The majority of candidates could identify the condensation reaction in **a(ii)**. In **a(iii)**, approximately half the candidates answered this correctly. There were often references to the Calvin cycle or to stores of energy.
- (b)** In **b(i)** a minority of candidates gained the mark for disulphide bridges and there were very few references to sulphur containing R groups. Candidates need to think more about what they were being asked as these were questions requiring use of knowledge rather than just recall. Most candidates incorrectly answered **b(ii)** in terms of inorganic molecules or complex carbohydrates (cellulose and starch) as molecules that require nitrates but not sulphates. Few candidates mentioned chlorophyll, nucleotides or ATP.
- (c)** While eutrophication itself is not on the specification, many candidates do know this topic and it is relevant to the learning outcome being tested in part **(c)** and was credited as such. The question did not require reference to eutrophication to gain full marks but many candidates answered it in this way and some very good responses were seen by examiners. Only the best candidates got the QWC mark.

- Q5** Part **(c)** on this question required use of knowledge again and candidates tended to lose marks on these sections.
- (a)** Even when candidates confused the name of the cells and the type of division, they still managed to get the marks for the correct number of chromosomes. The QWC mark was more difficult to get for the reference to haploid/diploid.
- (b)** The majority of candidates got part **b(i)** correct. A few gave receptors as a response. A receptor is not a component. Most candidates got this mark for the term 'digestive' in **b(ii)**.
- (c)** The majority of the candidates got a mark for **c(i)**, but lost a mark for **c(ii)**, often through referring to reliability. On **c(iii)**, 'randomisation' was the most common answer and the double blind mark was rarely seen. The most common mistake was a reference to dividing people into groups according to age or sperm count. However, **c(iv)** was not well answered by most candidates. Reduced motility was the most common mark awarded. The side effects mark was only given rarely. Levels of testosterone were the most common incorrect answer, followed by number of pregnancies produced in partners.
- (d)** This was usually very well answered. Most candidates managed to get the increased muscle size mark, then the increased competitiveness mark. References to longer or harder training were less frequent. Only a minority of candidates scored a mark for part **d(ii)** about how testosterone gets through cell membranes.
- Q6** Candidates generally lost marks in this question for being too vague, particularly in part **a(iii)** where medicines was one of the most common suggestions. Given the context of infectious disease, it should have been clear that 'antibiotics' was a better suggestion.
- (a)** Few candidates gained the comparative figures mark in part **a(i)**, with most candidates attempting the question but often failing to quote correct figures, units or omitting units altogether. In **a(ii)**, responses which could not be credited included references to famine, natural disasters and lack of healthcare.
- Part **a(iii)** was not answered well, with only a minority getting one mark – mostly for the mention of vaccines. The antibiotics and NHS marks were rarely given. Most responses included vague references to better healthcare/medication, better nutrition and safer roads.
- (b)** This was accessible to most candidates, although some candidates did refer to carbon or greenhouse gases. Carbon is soot and water (vapour) is also a greenhouse gas. Most candidates managed to gain one mark for **b(ii)**, mainly for the reference to public transport and to the carbon credits/carbon offset schemes.

F225 Genetics, Control and Ageing

General Comments

The paper discriminated well overall, with marks ranging from the low 90s down to the low teens. Some excellent responses were seen where correct terminology was used to provide full and detailed answers (for example, responses to **5(b)** and **6(e)(i)**). Data handling on question **1(c)**, which required interpretation of a graph, was not done well on this paper. On the other hand, the calculation was successfully completed by the majority of candidates and Centres are commended for training their candidates in this skill.

Yet again, many candidates made extensive use of the additional page at the end of the paper and additional answer sheets. However, some candidates are still not making it clear that their answer continues on these pages. Some answers that were continued were not given a clear identity eg with **(iii) or Q5** written against the additional writing without any indication of exactly which section this referred to. Candidates continue to write at the bottom of a question, such that it overlaps with the next or they write at the bottom of the page. Examiners are instructed to mark any material which is written but Centres should be aware that such material is at an increased risk of being inadvertently overlooked as often the writing is too small to be clearly legible.

Comments on Individual Questions

- Q1** This question tested AO1, A02 and AO3 objectives but did not discriminate particularly well as many otherwise able candidates did not give the units on the graph correctly.
- (a)** Most candidates could describe continuous but fewer could describe how this was different to combined HRT, with some weaker candidates assuming that it contained different hormones or that continuous required small doses where big doses were required for combined. The question was about differences between the two forms rather than differences in the uses of the two forms.
- (b)** Most candidates spotted that a placebo was used. Weaker candidates suggested it was because the symptoms of these conditions would not be observable.
- (c)** While many candidates did obtain full marks, even good candidates failed to handle the units on the graph correctly. Some ignored the fact that it was a rate that was given and ignored the 'per year'. As on previous papers, some candidates 'multiplied out' and were talking in terms of 150 000 cases rather than 15 cases per 10 000 per year.
- (d)** There was confusion as to which part of the female reproductive system was removed in a hysterectomy, with many referring to ovaries. The procedure was also confused with mastectomy. Good answers did have the idea of confounding variables invalidating the investigation but some then contradicted themselves by listing 'invalid' with 'unreliable' or 'inaccurate'.
- Q2** This question assessed AO1 and AO2 objectives. There were some synoptic links to F221 (cardiac cycle and membrane structure). The diagram of the neurone was not one commonly used but candidates were able to interpret it well.
- (a)(i)** Most candidates answered this correctly. Common mistakes included reference to the ion pumps, myelin and phosphorous).

- (a)(ii) Most candidates referred to the absence of the myelin sheath or presence of sodium/potassium pumps. Where channels were mentioned, some candidates did not point out that ions were entering and leaving via these.
- (b) This was an AO2 question requiring candidates to use the information on the diagram to describe the changes at the node of Ranvier during depolarisation and repolarisation. The terms candidates needed to use were already present in the table and relatively few candidates deviated from these.
- Many candidates completed the first two rows successfully but struggled on the remaining ones with a surprising number thinking that the ATP driven Na^+/K^+ pump would be inactive during repolarisation.
- (c)(i) Many candidates failed to appreciate what the question was actually asking and just described the refractory period. This was an AO2 question and where candidates did attempt to explain why no depolarisation was possible, most did so in terms of sodium ion channels being closed and the inability of sodium ions to enter. Some noted the distribution but did not go on to link this to the lack of a gradient for diffusion of sodium ions. References to ions diffusing into the membrane were seen and could not be credited.
- (c)(ii) Many candidates gained one of the two marks available for either referring to the direction of the nerve impulse or to limiting the frequency.
- (d) This was a stretch and challenge question and was synoptic with F221. While many candidates identified that filling of the chambers would occur during this period, few linked this to diastole. There were many misconceptions regarding nerve impulses making the heart contract and the need for neurones to recover. Some candidates went on to describe how the ventricles would need to be full for efficient blood flow – a good answer as to why atrial and ventricular diastole occurs at different times but not relevant to this question.
- (e)(i) The question was about testing for complete regeneration of a neurone so some reference to a test of the speed of conduction was required. Common incorrect responses included the blink test, pupil response test and knee jerk response but had reference been made to the speed of this then credit could have been given.
- (e)(ii) This question was done well with the commonest answers referring to glial scars and fibrinogen as an inhibitor.
- Q3** This question covered a range of learning outcomes and had synoptic links with F221 and F224.
- (a)(i) While many candidates located the gene in the nucleus, this was an AO2 question with candidates linking haemophilia to sex linkage and therefore locating the gene on the X chromosome. A range of different chromosomes were given by candidates. Some candidates failed to read the question and gave the location of Factor VIII rather than the gene for Factor VIII.
- (a)(ii) This was a synoptic question. While more able candidates gained both marks, the production of secretory vesicles was referred to most commonly. Some candidates referred to excretory vesicles or confused exocytosis with endocytosis. Weaker candidates incorrectly described the role of the Golgi as protein synthesis. Some candidates suggested that this was where the Golgi modified the glycoprotein rather than the protein or polypeptide, or they described the modification as the addition of glycogen.

- (b)(i) While many candidates completed the genotypes correctly, some placed alleles on Y chromosomes and some candidates used **XX** for all three responses despite two of them being males on the pedigree.
- (b)(ii) Most candidates used a Punnet square as part of their answer but then incorrectly gave the probability as 25% as they failed to recognise that it was only the female offspring that needed to be considered. Where Punnet squares were used, many were frequently not annotated to indicate which parent was which. Good candidates used the pedigree and gave succinct responses eg “50, as mother (2) is a carrier so her daughter will either be **X^HX^h** or **X^HX^H**.”

The genotype of carriers was often given as **X^hX^H**. This was not penalised but it is not the convention that is normally used.

- (c)(i) Some candidates gave one similarity for type 1 and one for type 2 despite this being a 3-mark question.

Teaching Tip – Adopt 'Literacy in Science' strategies such as **RE-BUGG** - REad the question, Box the command word, Underline key words, Guage the mark tariff, Glance back at your answer.

While type 1 diabetes does have a heritable component, it is not a single gene mutation and the statement referring to mutations was treated as a 'contradiction' so candidates who did not select their statements could not gain full marks.

- (c)(ii) This was a stretch and challenge question and was synoptic with F224. Despite being told the mutation was on mitochondrial DNA, most candidates answered this in terms of sex linkage and gained no marks. One misconception from some candidates was that some form of placental transfer of the mutation had taken place. Where candidates did understand the link, some excellent responses were seen but it was more common for them to get one mark for pointing out that all mitochondria come from the oocyte.

Q4 This question was accessed easily by candidates across the mark range.

- (a)(i) Most candidates gained full marks here. Mistakes included identifying A as the pupil or the suspensory ligaments. A few candidates gave C as the retina. Several candidates gave an incorrect spelling of 'lens' with an 'e' on the end.

- (a)(ii) Most candidates scored at least one mark here with reference to refraction with relatively few using the term 'reflection'. The question asked *why* vision was affected not *how* vision was affected, and answers which went on to talk about blurry vision did not gain credit. A common misconception among weaker candidates was that the amount of light entering the eye would be reduced.

- (b) The calculation was done well by most candidates. Where the answer was incorrect, some candidates had rounded to the nearest whole number.

Q5 This question again addressed AO1 and AO2 objectives.

- (a) While most candidates could give a concise definition of homeostasis, a surprising number produced vague answers. Reference to the term 'constant' required more elaboration of the idea of 'between limits' or 'around a set point'.

- (b) This part of the question discriminated well. There were many excellent answers and it was not uncommon to award 9 marks, with many candidates going on to obtain the QWC. However, it was clear that there are some misconceptions regarding the stimulus

for thyroxine release, with several candidates stating that this was low thyroxine in the blood plasma and describing a negative feedback system with no reference to low temperature as the stimulus. Alternatively, some gave a rise or change in body temperature as the stimulus. Other candidates described the response to thyroxine as shivering. There was confusion regarding TRH and TSH and the roles of the hypothalamus and the pituitary.

ADH was described better on the whole, although again some candidates confused the stimulus and stated that this was low blood volume or low blood pressure. Some candidates attempted to link this to renin. Weaker candidates assumed that both ADH and thyroxine were involved in the control of water potential. Another common mistake was to mix up the anterior and posterior pituitary.

- (c)(i) This was well-answered generally with reference to oedema and to proteins in urine being the commonest responses. Some candidates wrote about creatine when they meant creatinine or stated that there would be high levels in urine when they meant high levels in blood plasma. General references to back pain or fatigue were ignored as too vague. References to glucose were ignored as this would be a problem with reabsorption rather than ultrafiltration.
- (c)(ii) Again this question was answered well by most candidates. General references to 'infections' were ignored. Some candidates were confused between polycystic kidney disease and cystic fibrosis.
- (c)(iii) This question was meant to be straight forward but some elaboration of the nature of the living donor was required.
- (d) This was a stretch and challenge question. Candidates had been told earlier in the question that red blood cells would be present. They were expected to recall that in diabetes insipidus, the urine would be dilute and then deduce that the red blood cells would burst. Many candidates gained the first mark point but not the second. Some said the cells would simply be too few to see in the large urine volume. Many ignored the information given earlier in the question stating that the cells were too big to be filtered out.
- Q6** This question was the most discriminating on the paper, with marks being distributed almost equally across AO1, AO2 and AO3.
- (a) The majority of candidates correctly identified the complementary bases. A small number of candidates misread the question and wrote the number 7 as the answer.
- (b)(i) The term 'buffer' can also be used in the context of the electrolyte solution used in electrophoresis and some candidates clearly thought that was the purpose here. Many candidates did answer in terms of control of pH but failed to gain a second mark as they assumed it prevented the DNA being denatured. A few candidates had clearly not come across the term in the context of either of the above and described its role in terms of protecting the DNA (in the sense of a shock absorber).
- (b)(ii) Despite the question asking for a further reason (other than as building blocks for the molecules) most candidates answered in terms of adding the strands. Possibly the term 'monomer' was not understood. This was a stretch and challenge question and relatively few candidates appreciated that the phosphorylated nucleotides would act as ATP acts ie as an energy source.

- (c)(i) While most candidates appreciated that hydrogen bonds needed to be broken, few realised that it is the number of these in each molecule of DNA that means high temperatures are required. The commonest misconception was that hydrogen bonds are strong bonds. Some candidates contradicted themselves and wrote about breaking the sugar phosphate bonds. Some candidates referred to peptide and ester bonds needing to be broken.
- (c)(ii) This question was synoptic with F221 and protein structure. A number of candidates deduced that stronger bonds must be holding the tertiary structure but only a small number could correctly identify disulphide bonds. Several candidates contradicted themselves by listing all the bonds found in tertiary protein structure and some included peptide bonds in their list. Some references to the source of the enzyme being a bacteria adapted to hot springs were seen but even here, some candidates were stating that the enzyme was found in the hot water. A common misconception was that the enzyme had been genetically modified.
- (d)(i) This question was answered well, with many candidates appreciating that there would be more hydrogen bonds and being able to give the numbers. Some candidates contradicted themselves by saying that AT bonds were between pyrimidines and GC between purines. Some candidates tried to answer in terms of palindromic sequences, indicating, again, that there is still confusion regarding the various types of DNA technology covered by the learning outcomes.
- (d)(ii) Many candidates do not understand what is meant by a control variable and the commonest answer given to this question was 'temperature' despite the fact that this was the independent variable and that this was re-inforced again in the next question. Many candidates went on to get (d)(iii) correct having identified temperature as a control variable in this question. Good responses were seen but relatively few candidates could explain why time or number of repeats had to be controlled. The question stated clearly that factors other than the reaction mix were required, so all references to pH and concentration were ignored.
- (d)(iii) Most candidates scored at least 2 marks on this question with the commonest mistake being to omit the units from the first column heading.
- (e)(i) Some excellent answers were seen on this question and it was not unusual for even weak students to score 4 marks. Common mistakes included getting the charge on DNA wrong or the direction in which it moved. It was not uncommon to see candidates trying to use technical terms such as anode and cathode but getting these the wrong way round. A common misconception is that the distance moved is proportional to the length of the DNA – it is inversely proportional with shorter pieces moving the greatest distance. Another misconception is that stains or dyes are added to the wells with the DNA rather than the gel being stained at the end.
- Most candidates used the term electrophoresis. Phonetic spelling was credited but not if what was written was too close to another term such as electrolysis, for example.
- A small number of candidates wrote about karyotyping or genetic engineering.
- (e)(ii) This was a stretch and challenge question. Many candidates correctly set up the grid and then failed to spot that in all but 1 square, there were two different numbers and hence there would be two bands. One mark was awarded to these candidates but in some cases the numbers were multiplied together, in which case no mark could be given.

- Q7** This question contained a lot of information in the stem. While this information needed to be used to answer the questions, some amplification on the part of the candidate was required.
- (a)(i)** This proved more difficult than anticipated with some candidates failing to identify X at all and the omit rate on the question was relatively high. Some candidates wrote 'amylase'. Other incorrect answers included dopamine, myelin and fibrinogen.
- (a)(ii)** Many students correctly identified a possible cause and this proved to be a very accessible question.
- (a)(iii)** Many responses repeated information from the table. Most went on to say that the build up would be over a period of time and hence the gradual onset. Very few candidates went on to score a second mark, with most simply saying that the brain would be deprived of oxygen and die – ignoring the reference to 'sudden steps' in the information. It was rare to see answers which referred to a part of the brain being damaged by each vascular event.
- (b)** Most candidates achieved full marks on this question.

F226 Extended Investigation

As with previous sessions, there was much evidence of hard work both on the part of candidates and teachers in the F226 unit. Candidates and Centres should be commended for producing work which was well executed and presented, and which shows evidence of good transferable skills to take on to Higher Education and later employment.

Disappointingly, there was evidence to show that fewer Centres had made use of the free coursework consultancy service. This service can be used ahead of embarking on the extended investigation to ensure the topic is appropriate (see later comments) and also on the accuracy of marking on a sample of work prior to submission for moderation in May. Those Centres that had used the service and acted on the feedback given were less frequently adjusted.

Centres that used marking grids were also more accurate in their interpretation of the descriptors and this too led to more accurate marking and fewer discrepancies between Centre and Moderator marks.

Suitability of investigations:

It is a significant concern that, again, for this session, the main reason for large-scale adjustments was where Centres had permitted candidates to undertake investigations which were both inappropriate and categorically not permitted by OCR – as stated in the Teacher Support: Extended Investigation handbook.

Inappropriate investigations included:

- 1 any investigation involving Daphnia.
- 2 any investigation involving administering caffeine (and caffeine based substances) paracetamol or similar chemicals/medicines.
- 3 comparison of pollution on different sides of hedges.
- 4 sweat and heat exchange in glass apparatus.

As stated in the Extended Investigation Guidance handbook, OCR does not permit investigations that involve the administration of alcohol, caffeine, nicotine and other similar substances to human participants. No investigation that potentially causes harm to participants should be undertaken (eg exposure to inhaled particulates/air pollution).

It cannot be stressed enough that Centres are strongly advised to have all proposed titles checked and approved **before** embarking on any work on F226. Any queries should be emailed to OCR.GCSEScienceTasks@ocr.org.uk with the Centre Number and nature of the enquiry made clear in the subject field. Likewise, Centres are reminded that there is **no** requirement for all candidates to carry out investigations on different titles. Indeed, Centres where all candidates investigate one topic, show greater consistency in marking.

One requirement for F226 is that the investigation is centred on an **A2 learning objective** from either F224 or F225. The topic should also allow scientific knowledge and understanding from F221 and/or F222 to be used and integrated to enable the prediction to be justified and conclusions explained. Submission of AS based investigations will not allow access to all descriptors including A4 and C4 which will reduce the overall attainment of the candidate(s). Submission of investigations which fail to be centred on any direct aspect of the specification will fail to enable access to A3, A4, C3 and C5 as well as reducing the likelihood of meeting other descriptors. Simple enzyme investigations will not meet this requirement.

All queries relating to F226 can be raised with OCR via email at OCR.GCSEScienceTasks@ocr.org.uk clearly stating the Centre Number and nature of the enquiry.

General administration:

Centres should send work to the Moderator as detailed below:

- Each candidate's work should be sent with all 3 skills attached using a treasury tag in the top left hand corner of the work.
- Each candidate's work should have a completed cover sheet attached – clearly stating the candidate number and centre number, 3 skill totals and final total.
- Candidate's work should be collated in the order as detailed in the sample request email.
- A Centre Authentication Form' **must** be submitted with the sample.
- A copy of the MS1 must also be sent to the Moderator.

It is strongly advised that work is sent using a traceable service.

Request to remark work after submission

After the Moderator has checked all the samples submitted by a Centre, there are occasions when an invalid order of merit occurs ie the moderator marks are found to generate a different rank order than that submitted by the Centre. This can be as a result of one or two candidates' work which has been marked with more leniently than that others, or by an accumulation of marking errors which have not been flagged up during internal moderation. It is possible that this invalid order of merit could result in a larger adjustment than is necessary and so the work is returned to the centre, with guidance, for re-marking.

It is very important that Centres do not misunderstand this process. In essence, the Centre has been given an opportunity to re-visit their marking and that they should take the Moderator's comments into account. It is not a requirement for the Centre to change the marks if they do not agree, but that they should do as much as they can in light of the Moderator's comments. If an adjustment is then applied, the Centre can request a re-moderation after the results are published in August.

Adjustment to centre marks:

In the main adjustments were due to centres:

- choosing an inappropriate task
- misinterpreting the demand and requirements of the descriptors
- marking inconsistently across the cohort – again this was more evident in Centres where candidates had completed many different investigations.

Any centres who wish to gain more detailed feedback regarding this year's moderation, or proposals for next year, via the coursework consultancy service, available free of charge, via the Qualifications Manager for GCE Human Biology.

Centres are strongly advised to mark using marking grids which can be obtained from OCR to ensure all aspects of descriptors are understood and applied consistently across the cohort.

Teacher support

There remain various levels and types of support available for teachers/Centres:

- a) Extended Investigation Handbook
This document is available to download from the OCR website and provides detailed guidance about all aspects of F226.
- b) Email support
Centres can seek further advice on the implementation and marking of the Extended Investigation in future sessions by e-mailing OCR.GCSEScienceTasks@ocr.org.uk. Please include your name and Centre number, state clearly which skill your query relates to, and state which descriptors would like to receive clarification for. This service can be used for enquiries such as:

- title approval
- descriptor clarification
- marking guidance.

c) Coursework Consultancy

Centres are reminded that there is a free Coursework Consultancy service that is provided. This service can be used to seek feedback on the accuracy of marking of candidates work **before** submission of marks and the moderation. To take advantage of this service, work from a maximum of 5 candidates should be photocopied and sent to the Qualifications Manager at OCR. Further details can be requested via email at OCR.GCSEScienceTasks@ocr.org.uk. Work will be returned with feedback in the form of marking grids which can then be used by the Centre for future marking.

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

OCR Customer Contact Centre

Education and Learning

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

www.ocr.org.uk

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Head office
Telephone: 01223 552552
Facsimile: 01223 552553

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