

# **Human Biology**

Advanced GCE **A2 H423**

Advanced Subsidiary GCE **AS H023**

## **Reports on the Units**

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**June 2010**

**HX23/R/10**

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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.

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**Advanced GCE Human Biology (H423)**

**Advanced Subsidiary GCE Human Biology (H023)**

**REPORTS ON THE UNITS**

<b>Unit/Content</b>	<b>Page</b>
Chief Examiner's Report	1
F221 Molecules, Blood and Gas Exchange	6
F222 Growth, Development and Disease	11
F223 Practical Skills in Human Biology	16
F224 Energy, Reproduction and Populations	24
F225 Genetics, Control and Ageing	28
F226 Extended Investigation in Human Biology	33

## Chief Examiner's Report

This is the first session when the full A level was awarded and the new A\* grade available. There is a significant increase in the number of candidates who are eligible to aggregate with over 1400 candidates (compared to 951 candidates in June 2009). There has been a noticeable improvement in performance particularly among more able candidates and the number of candidates achieving the A grade was considerably higher than that of the legacy specification. The new 'A' star grade was achieved by over 4% of the A2 cohort and reflects an outstanding performance on the part of these candidates. Candidates achieving these grades have an in depth knowledge of the specification but they are also capable of thinking for themselves and transferring principles taught into new context. Centres are to be congratulated for developing these skills in the context of the Human Biology specification.

No reports were received regarding access to the pre-release material for F222 and there was clear evidence that most Centres had prepared candidates well. Candidates included material in their answers from their background research around the pre-release topic but the most noticeable difference was the ability of candidates to offer good answers to the 'suggest' questions. These tend to be higher order questions which require a more synoptic approach and these observations suggest that the training candidates receive on the pre-release material is good practice for a more synoptic approach to the learning outcomes. While F222 itself is only synoptic within the unit, 20% of marks on F224 are synoptic with AS material and 20% of F225 are synoptic across F224 and the AS. Centres need to provide opportunities for integrating learning outcomes across the A2 much as the pre-release material does in F222 and some suggestions for overarching 'themes' are given in the section on F225. However, in developing the specification, efforts were made to incorporate synopticity through the inclusion of closely related learning outcomes. For example, in F221, 1.2.3 (a) requires the terms *tissue* and *organ* to be explained and F222 2.2.2(f) requires explanation of the multicellular nature humans and the organisation of cells into tissues and organs. F224 looks at reproductive organs and F225 has learning outcomes on nervous system, endocrine system and excretory system. Explanations of the terms *tissue* and *organ* were asked in both F221 and F222, both in a contextual setting (AO2) and could be asked in either F224 or F225.

### Understanding and answering the questions

Some of the issues highlighted in the January papers are still very much in evidence such as inability of some candidates to recall or define specific terms or names from the specification. This was evident on F221 Q1(b) (tissue and organ), F222 Q1(b) (PEFR and FEV1) and Q4, F224 Q5(a) (multiple pregnancy and multiple birth) and F225 Q2(a) (gene and allele).

#### Teaching Tip:

'Bingo' is a useful starter even for Y12 and Y13 students. Display a list of 10 to 15 'terms' from across the specification and ask student to write pick 4 or 5 at random – making sure they choose a slightly different list to their neighbour. Call out definitions at random (keeping a list of definitions yourself) and the winner is the first one to cross off their terms. Check periodically 'Has anyone got 'pyruvate' and not crossed it off because that one has gone!' – very good Assessment for Learning!

There was evidence across all four units of candidates not addressing the question being asked. For example in F221, Q2, candidates were asked for similarities or differences in *structure* but responded in terms of the *function* of the blood components. In F222, Q5, candidates gave the causes of Type 2 diabetes in Q2(a) rather than explaining what it was. In F224, Q5(c) it was risks to the mother that were required, not risks to the baby. On F225, it was the advantages and disadvantages of different sources of organs that were required, not the reasons why organs for donation are in short supply.

## *Reports on the Units taken in June 2010*

As in previous sessions, some candidates still 'explain' where they should 'describe' – see individual papers for more details – and candidates need to understand that that the instruction to 'compare and contrast' requires comment on similarities and differences (see F225, Q5 b(ii)).

Questions on biochemistry generally prove difficult for AS candidates (Q4, F221) and hence these learning outcomes need reinforcing through the A2 units – less than 25% of F225 candidates could identify the bond in inulin as a glycosidic bond despite the information given. More worrying were the alternative responses – hydrogen bond being the most common. Human Biology candidates need to realise that solid lines on molecular diagrams represent some form of covalent bond – it was evident on the January F222 paper that many candidates mistakenly think that hydrogen bonds are formed by condensation reactions and broken by hydrolysis reactions and the fundamental differences between different types of bonds are not recognised.

There was evidence across several of the papers of candidates using terminology carelessly or not appreciating the full implications of a term. For example, clotting and agglutination were used as if they were interchangeable terms and candidates had respiration producing energy or needing ATP (both on F225). Centres should also note the comments on F224 Q4 where candidates wrote in terms of converting rather than reducing NAD to NADH. Osmosis was explained in terms of concentration (F225) despite candidates having access to a Task which demonstrated that solutions of the same concentration can have different water potentials.

The area which exposed the most frequent misconceptions was that of immunity. F222 learning outcome 2.3.2(j) asks for the role of antibodies in ABO and Rhesus incompatibility to be explained. The origin of, and type of, antibody is different in the case of ABO and Rhesus blood groups. Anti A and Anti B antibodies are IgM antibodies. They are produced early in life and are therefore present in the blood plasma long before any potential exposure to a 'foreign' blood group. They are possibly produced in response to enveloped viruses which acquire human A or B antigens from the cells they invade. These antibodies do not cross the placenta. The anti – Rhesus (anti-D) antibody is an IgG antibody which is produced in when a Rhesus negative mother is challenged by Rhesus positive blood. These antibodies do cross the placenta leading to haemolytic disease if the baby is Rhesus positive. This formed the basis of a synoptic part of question 2 on F225. Immunity is an area that lends itself to synoptic questions and needs to be revisited over the A2 units.

### **Information, Figures, Tables and Graphs**

The examiners were concerned at the poor responses to the two questions which used photomicrographs as source material. In both cases, the learning outcome being tested (1.2.3 (d) on F221 and 5.3.3 d on F225) clearly states that diagrams or photomicrographs need to be interpreted. While it is appreciated that teaching good microscopy skills is often not possible in the time available, the internet has some excellent examples of images and candidates do need some exposure to these and also to the idea of scale (see feedback on F221). On questions where graphs or tables of data were provided, candidates do seem to be better at giving the required units at A2 but this remains an issue at AS. Q4(a) on F224 indicates that some candidates are still not aware of the convention whereby the X axis shows the independent variable. Interpreting oxyhaemoglobin dissociation curves continues to prove a challenge to some candidates although the calculation based on this was well done.

### **Mathematical Requirements**

The use of scale bars to calculate magnification remains a problem for some candidates (F221) and only half of the candidates could calculate the percentage difference (F222). On F225, the calculation proved very accessible with over three-quarters of candidates getting the correct answer. The most common mistake was to incorrectly round from 4339.5 and the frequency with which candidates round incorrectly on the Quantitative Tasks suggest that this is a skill which Centres cannot take for granted.

## **Presentation**

The Human Biology specification contains several terms which are difficult to spell and while phonetic spelling is credited in most circumstances, this is not necessarily the case where the term forms part of a QWC mark. The QWC marks in all the papers proved to be discriminating marks which only the better candidates were getting. Weaker candidates are losing out when it comes to spelling and structuring their answers to address the question being asked. Candidates should also be aware that it is the mark tariff and not the space allocated which is the best guide to the answer required. On the whole, the space allowed for the candidate answer is generous and candidates who were tempted to fill every available line (and more besides!) tended to find that they ran out of time on later questions - which was certainly the case with F225.

## **Practical Assessment**

Centres are strongly advised to read and act on the feedback given in the moderator's report which is sent as a separate document with the results. The feedback from some Centres at INSETS indicates that this does not always reach the teacher it most concerns. On F223 and F226, the number of clerical errors seen was much too high – one moderator reported over 50% of Centres seen had at least one error and, in some cases, several. These will be spotted by a moderator but only in the sample seen, suggesting that there are many candidates out there who are not being credited with the correct mark.

Detailed feedback on F223 and F226 is provided later in the report. However, in general terms, on F223, tasks do need to be trialled in advance and the results included with the sample sent for moderation. Lack of annotation was an issue on both F223 and F226 – particularly on F226 where extended writing on the part of the candidate can lead to different 'strands' of the mark descriptor occurring in different paragraphs of the work. Annotation can make this clearer to the moderator and assist the teacher in making sure that the descriptor is fully met before the mark is awarded. Centres are reminded that coursework consultancy is free and available to Centres – only a small proportion of Centres used this service as opposed to the large number of Centres who used the equivalent service on the Biology specification. Similarly with INSET courses – the take up on these was much lower on Human Biology with several being cancelled due to lack of interest. Many Centres have moved on to the current Human Biology specification from the legacy specification and, while the Extended Investigation is common to both, the assessment model is different. In the absence of a hierarchical mark scheme discrimination relies on some descriptors being more difficult to access than others. Many Centres were generous in awarding some descriptors – particularly A10 (which needed to address both precision and accuracy), A12, C4, C13 and C14.

As a consequence of the issues raised above, several Centres may experience large adjustments this year. The difficulties experienced by Centres as a result of a 'new' format have been taken into account in setting the grade boundaries on F226.

On F223, several Centres assumed their marks had been adjusted last year when, in fact, this was not the case and the low uniform mark achieved by candidates was due to narrow range of marks between the E and A grade. This led to some candidates scoring far fewer UMS marks than raw marks. While this still can occur with low scoring candidates, a broader range between A and E has been achieved this year which should minimise this effect.

In conclusion, it is expected that Centres will train their candidates prior to carrying out the tasks to assess their practical skills. However any temptation to 'coach' candidates rather than train them should be resisted – moderators are instructed to look for key indicators of malpractice and, where there is evidence of these, OCR does not hesitate in initiating malpractice proceedings against Centres.

## Upcoming INSET events in 2010/2011

### **OCR AS/A Level Human Biology (H023/H423): Get started - guidance for first delivery (OSCL8)**

This is a *register your interest* course.

This **full day** course will:

- Answer questions from teachers linked to the teaching of the standards
- Review the support and resources we offer
- Explain the administration procedures
- Enable delegates to network and share ideas for best practice.

Note: This course is an updated version of the sessions that ran in previous years.

**Course dates** – We would like to run this course if there is sufficient interest from customers. Please visit EventBooker or e-mail [training@ocr.org.uk](mailto:training@ocr.org.uk) to register your interest. We will contact you with details as soon as we confirm a date and location.

**Note: this course is an updated version of the sessions that ran in previous years.**

**Fee** – £182 including refreshments, lunch and course materials. £215 if you book within 7 days of the course date.

### **OCR AS/A Level Human Biology (H023/H423): Get ahead - raising standards through exam feedback (OSCL9)**

This **full day** course will:

- Consider post-summer results documentation, such as question papers, reports and mark schemes
- Consider the step up from AS to A2
- Discuss approaches for preparing candidates for the external examination
- Demonstrate standards for the internal assessment of coursework and externally assessed components
- Allow delegates to share good practice and ideas on new approaches.

**Course dates** – Friday 15 October 2010 (London). We would also like to run this course in Birmingham if there is sufficient interest from customers. Please visit EventBooker or e-mail [training@ocr.org.uk](mailto:training@ocr.org.uk) to register your interest. We will contact you with details as soon as we confirm a date and location.

**Fee** – £182 including refreshments, lunch and course materials. £215 if you book within 7 days of the course date.

### **OCR A2 Level Human Biology (H423): Get ahead – improving delivery and assessment on Unit F226**

This **full day** course will:

- Address enquiries concerning the requirements of the qualification
- Demonstrate standards for the internal assessment of coursework and externally assessed components

## *Reports on the Units taken in June 2010*

- Discuss strategies for developing the research and report writing skills of candidates
- Allow delegates to share good practice and ideas on new approaches.

**Course dates** – Monday 18 October 2010 (London) and on Tuesday 30<sup>th</sup> November (Birmingham). We would also like to run additional courses in London and Birmingham if there is sufficient interest from customers. Please visit EventBooker or e-mail [training@ocr.org.uk](mailto:training@ocr.org.uk) to register your interest. We will contact you with details as soon as we confirm a date and location.

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## F221 Molecules, Blood and Gas Exchange

### General Comments

It was agreed by examiners that the paper in this session was comparable to those of previous sessions. The questions seemed well differentiated and appropriate for the ability and range of candidates. Candidates were able to complete all questions in the time available and most attempted every section.

It was pleasing to see that the majority of candidates had been prepared in the use of command words at the start of questions and could offer appropriate responses when asked to *describe*, *state*, *explain* or *suggest*. However, calculations of scale or magnification are still proving difficult for candidates and there is a relatively high omission rate for Q1(d)(ii) on this paper compared to other questions.

The overall performance of candidates showed a relatively normal distribution of marks. There was certainly a wide range of ability and attainment with a proportion of candidates retaking the unit. More able candidates demonstrated the ability of applying their knowledge and attained very high marks. It was noticeable that less able candidates showed less skill in application of knowledge, but were able to gain marks where straight recall from the specification was required.

### Comments on Individual Questions

- Q1 This question was designed to provide an easy introduction to the paper and was generally well answered.
- (a) The majority of candidates were able to correctly identify organ X as the trachea, although some candidates did state 'lungs' which could be due to the fact that they did not consider the trachea to be an organ.
- (b) This part of the question required candidates to be able to recall a definition and apply this to the organ identified in question 1(a). Many candidates did not give the definition of an organ when asked to explain why the trachea is an organ, but incorrectly gave the definition of a tissue. Some of these candidates repeated this definition of a tissue for part (c)(i) of this question so were able to access one mark.
- (c) (i) It was pleasing to see that the majority of candidates were able to correctly define a tissue, even those who had difficulties with part (b) of this question.
- (ii) The vast majority of candidates showed good knowledge of cells lining the respiratory system, correctly naming 'goblet cell' as the type of cell present and most were able to gain both marks for then stating the function of the goblet cell. A small number of candidates failed to gain marks due to incorrect spelling of 'goblet' and whilst examiners accepted phonetic spelling, references to 'goblin' or 'globular' cells were not considered worthy of credit.
- (d) (i) The identification of the cells on the photomicrograph of a section through lung tissue was variable. The majority of candidates were able to identify the erythrocyte (cell Y) but there was a wide range of answers offered for the squamous epithelial cell (cell Z). Examiners accepted that cell Z could be identified as a macrophage in this micrograph, but reference to other white blood cells did not receive credit.

**Teaching Tip:**

Centres are recommended to make use of some of the photomicrographs available from Science Photo Library on [www.sciencephoto.com](http://www.sciencephoto.com).

- (d) (ii) Few candidates were able to calculate the magnification of the photomicrograph. The majority of candidates ignored the scale bar on the photomicrograph which would have aided their calculation. More able candidates who recognised the significance of the scale bar and used this in their calculation were able to gain both marks for this part of the question.
- Q2 This questioned the ability of candidates to recall their knowledge of blood components and blood clotting, but also tested their ability to use their knowledge in a *suggest* style question.
- (a) The vast majority of candidates were able to gain at least one mark for correctly stating the function of the platelet; with many achieving full marks. It was pleasing for examiners to see that although only a single response was required for the function of a lymphocyte, some candidates offered correct responses for both T and B lymphocytes.
- (b) (i) This part question was generally well answered by the majority of candidates.
- (ii) Many candidates correctly referred to 'granular cytoplasm' which was required, although a number of candidates failed to gain credit for simply referring to the presence of 'cytoplasm' with out reference to granules. Less able candidates mistakenly offered responses stating similarities in function rather than structure which was not worthy of credit.
- (c) (i) The diagram shown in this part question is common to those seen in many texts referring to the clotting process involving the enzymes thromboplastin and thrombin. Candidates who had a sound knowledge of the clotting process scored well. There were a few candidates who wrote answers either alongside or on the arrows rather than in the spaces provided. As such responses lacked clarity, they failed to gain credit and candidates should be encouraged to write answers in appropriate spaces as indicated in the question.
- (ii) This part of the question was poorly answered, although examiners saw a number of responses in which the candidates had correctly expressed the idea that protein clotting factors could be denatured. Any references to calcium ions were ignored in this case as the question stem referred to a 'protein' clotting factor.
- Q3 This question tested the ability of candidates to apply knowledge in context and also their ability to recall techniques and procedures when acquiring blood samples.
- (a) The haemocytometer was correctly named by the vast majority of candidates.
- (b) (i) Many candidates were able to state the correct cell count as 15, although there was an array of other responses offered where candidates did not have an understanding of how to use the haemocytometer grid correctly.

## Reports on the Units taken in June 2010

- (ii) Two marks were available for this part of the question and although candidates correctly referred to the importance of using the North-West Rule when counting cells, they failed to achieve a second marking point; many simply restating the reverse argument rather than offering a statement which referred to the fact that the trainee must therefore have counted all of the cells in view.
  - (b) (iii) Many candidates failed to gain credit for this part of the question on account of vague statements. For example, some candidates referred to the need to 'count more squares' but failed to state the fact that the count should be in at least three squares. The most common correct answer seen by examiners referred to 'dilution', although few candidates mentioned the dilution factor of 1 in 200 which was worthy of two marks available for this part of the question.
  - (iv) This part of the question was generally well answered with anaemia the most common response offered. Vague references to blood loss were not deemed worthy of credit and more detail such as 'severe blood loss' or 'injury' were required for this marking point.
  - (c) (i) Responses to this part of the question were varied. Some candidates understood the need to make leucocytes easier to see, but there were a few candidates who misinterpreted the question and described why the erythrocytes burst when placed in the diluting fluid rather than suggest why the diluting fluid is used to burst them.
  - (ii) This part of the question was poorly answered by the majority of candidates. Many responses seen referred to the need to make cells easier to see and lacked reference to the idea of a differential stain providing contrast between structures within cells and allowing identification of different leucocytes 'in this case' by staining the nuclei.
  - (d) The majority of candidates had good recall of the procedure for preparing and staining a blood film and many received full marks for this part of the question.
- Q4 This question tested both straight recall and application of knowledge of the biological molecules, glycogen and glucose.
- (a) This section required candidates to complete a passage about glycogen by choosing the most appropriate words. The majority of candidates achieved at least three marks, but on the whole, only better candidates managed to achieve the full eight marks for this part of the question. Few candidates correctly used the term *alpha* glucose as the molecule that makes up glycogen.

### Teaching Tip:

Candidates should be encouraged to learn key terms and improve biological vocabulary for use in questions requiring recall from the specification. It is recommended that candidates design their own glossary of terms.

- (b) This section was poorly answered with the majority of candidates offering responses that referred to glycogen which examiners did not credit as the question stem specifically referred to the glucose molecule. The Quality of Written Communication mark was rarely awarded as few candidates used the term 'osmosis' or 'osmotic' in their responses which was one of the two terms required. The question required understanding of the fact that glucose is soluble and would thus have an effect on the water potential of cells. Candidates were expected to know that the presence of glucose would lower the water potential inside cells and

cause water to enter by osmosis. Few candidates were able to apply their knowledge in this situation.

- Q5 This question tested knowledge of the role of valves during the cardiac cycle and also had a novel view of the heart to show the valves. Candidates were expected to be able to recognise structures shown.

**Teaching Tip:**

Centres are encouraged to use as many different views of the internal and external structure of the heart during teaching to enable candidates to gain confidence in identifying and labelling structures seen.

- (a) This section was generally well answered. However many candidates failed to indicate that it was the pressure in the atrium that forces the AV valves open and therefore did not receive credit for this marking point. The majority of candidates were able to gain marks for 'ventricular systole' and for the Quality of Written Communication. The QWC mark was for the use and organisation of scientific terms. Candidates were required to use at least two technical terms, in the correct context, and the mark was frequently awarded in this case. Candidates who had learned the material well quickly reached the maximum marks available for this section.
- (b) (i) The majority of candidates recognised that K was an atrio-ventricular valve but as this was in the stem of the previous question, examiners did not consider this worthy of credit. Few candidates stated that K was the 'tricuspid' or the 'right' atrio-ventricular valve which was the required response. Most candidates correctly identified L as a semi-lunar valve.
- (ii) This section was poorly answered and rather than a stage in the cardiac cycle being suggested by candidates, an explanation was frequently given which failed to gain credit. There were also vague answers whereby some candidates who correctly referred to a stage in the cardiac cycle, failed to gain credit as they were not specific about ventricles.
- Q6 The responses for this question required recall from the specification or basic application of the concepts surrounding donation and storage of blood products.
- (a) Two marks were available for this section and examiners were encouraged by the fact that the majority of candidates achieved one mark for correctly naming a stored blood product. However, weaker candidates struggled to state a use for the blood product named and failed to gain the second mark.
- (b) This section was poorly answered. The idea that antigens are added to the blood sample and antibodies present in the blood would bind to the antigens was rarely seen by examiners. Many candidates, however, recognised the fact that antibodies present in the blood sample would indicate the presence of the HIV virus / antigens. Some candidates seemed to refer to ELISA testing but responses in such cases were too vague to be worthy of credit. Candidates who had learned the material well were able to gain both marks available for this section.

*Reports on the Units taken in June 2010*

- (c) (i) More able candidates were able to score both marks for this section by correctly referring to the fact that blood freezes at these low temperatures which results in the formation of ice crystals inside cells. Examiners were concerned that many candidates referred to the fact that freezing 'denatures blood/cells' and would encourage the use and correct application of key terms to avoid misconceptions arising.
- (ii) pH was correctly named by most candidates as another factor that must be controlled when storing blood and it was encouraging to see that some candidates could offer explanations based on the problems that would arise from extremes of pH due to denaturation of enzymes. More able candidates demonstrated their knowledge of the bonds within proteins, but full marks were rarely awarded, the majority of candidates achieving one or two marks for this section.

## F222 Growth, Development and Disease

### General Comments

The paper was of appropriate difficulty and comparable to those of previous sessions. Candidates were able to complete all the questions in the time available and most attempted every section. The overall performance of candidate seems to be in line with the performance in previous years, with a normal distribution of marks. Overall the paper discriminated well between candidates of different abilities. More able candidates had the opportunity to display their knowledge and gain high marks: for example Q3(d), Q5(d) and Q6(d). The less able candidates, although they had gaps in their knowledge, were able to access most questions and answer some questions well. The paper provided a positive examination experience for most candidates. The use of pre-release material encouraged candidates to display their wider knowledge of Human Biology. Some marks were lost by candidates not taking note of the mark allocation for questions and not making sure they had included sufficient specific detail to access the full marks: for example, Q1(c), Q2(e) and Q5(b)(ii). Marks were also lost by candidates not focusing their answer on the question asked, for example in Q5(b)(i).

### Comments on Individual Questions

- Q1 This question was based on Case Study 1 'Asthma on a school trip'. It was evident from the answers given that many candidates had studied the pre-release material.
- (a) Most candidates were able to gain at least 2 marks for this section by stating that difficulty breathing and wheezing were symptoms of an asthma attack. More able candidate gave a third symptom such as coughing and gained full marks. The most common misconception was to give chest pain as a symptom and this was not credited.
- (b) This section, asking for the measurements that could be taken using a peak flow meter, proved to be very difficult and most candidates did not gain any marks. The question was expecting PEF and FEV1. Most candidates gave answers describing vital capacity or tidal volume and a few candidates attempted to give the correct terms but missed part of the definition out.
- (c) Candidates were presented with two graphs, the first one showing the change in numbers of children treated for asthma and a second showing the changes in primary care visits and hospital admissions relating to asthma over the same time period. Candidates were asked to use the information to give evidence that the treatment for asthma is working. Most candidates got two marks for stating that as the numbers of children treated for asthma increased, the number of primary care visits and hospital admission decreased. Only the more able candidates correctly quoted figures to support their answers. Many candidates did not quote any figures, quoted them incorrectly or did not use correct units.
- (d) This section asked candidates to fill in the gaps to complete a paragraph describing the role of bronchodilators and corticosteroids in an asthma attack. This question discriminated well and the more able candidates gained 6 or 7 marks. Most candidates gained 4 or 5 marks. The most common mistakes were to give trachea instead of bronchus or bronchioles, to omit smooth and to give cell wall instead of membrane. The answers often included spelling mistakes and phonetically correct terms were credited.

*Reports on the Units taken in June 2010*

- (e) This question asked candidates to suggest a reason why a spacer may be used with an inhaler. It was pleasing to see a wide range of correct responses covering all the marking points. This showed evidence that candidates had studied the pre-release material and researched treatment for asthma.
- (f) (i) More able candidates gained a mark for correctly stating that we have two copies of the receptor gene because we have one from each parent or that our cells are diploid. The responses from other candidates showed up some fundamental misconceptions; the most common being that we had two copies of the gene in case one receptor gene got damaged or that we had one gene for each lung.
- (ii) This 'suggest' question was poorly answered and most candidates restated that albuterol was less effective in people who have the AA alleles, which was in the stem of the question. Candidates were expected to relate this information to the use of drugs in treating asthma.
- Q2 This question was based on Case Study 2 'Apoptosis - what we learned from worms'. It was evident from the answers given that many candidates had studied the pre-release material.
- (a) (i) Many candidates correctly gave mitosis as the type of cell division in the growth and development of the fertilised egg but there were quite a few incorrect answers when meiosis was given.
- (ii) This section was well answered and there were many good answers that described an organ as a collection of tissues carrying out a specific function and gave intestine or testes as an example. They also described tissues as a group of specialised cells carrying out a specific function and gave muscle as an example. The most common mistake was to give muscular pharynx as an example of a tissue. A few, less able candidates, gave less specific answers that did not gain credit.
- (b) This question asked candidates to describe the changes that occur in a cell during apoptosis. Many candidates gave very good answers to this question and most of the marking points were given by at least some candidates. The best answers referred to cells shrinking, DNA and proteins being broken down, mitochondria and cell organelles break down, blebbing, cell fragmenting into vesicles and phospholipid markers being placed on outside of cell membrane to attract phagocytes. A few candidates did not appear to have studied apoptosis and gave descriptions of phagocytosis.
- (c) Most candidates were able to suggest that the remains of the cell were destroyed by phagocytosis. A few candidates missed this mark by just stating that the remains of the cell were engulfed. Candidates needed to state engulfed by phagocytes to gain the mark.

Reports on the Units taken in June 2010

- (d) This section asked candidates to suggest with reasons why *C. elegans* is a suitable model to study development of an organism. Candidate answered this question very well and most of the marking points were well represented. Good answers mentioned transparency, visible using a microscope, short life cycle, easy to repeat, similar process in humans and fewer ethical issues.
- (e) Candidates were asked to describe how ultrasound was used to monitor fetal development. This section discriminated well and only the most able candidates gained 4 marks. Marks were mostly gained for: describing how sound waves are reflected back from the fetus; converted into an image; to check position of fetus or placenta; to measure crown - rump length; to measure biparietal diameter and to identify physical abnormalities. Many candidates only gained 2 marks for just describing how the image is formed and several candidates described the measurements incorrectly referring to head - rump length and head diameter or circumference. A few candidates incorrectly referred to light or radiation being used.
- (f) Many candidates correctly gave tumour suppressor gene as the name of the type of gene that codes for p53. Some candidates gave proto-oncogene which was credited. There were several spelling mistakes and only correct phonetic spellings were credited.
- Q3 This question involved a calculation and the recall of the dietary requirements and health care during pregnancy. Candidates revealed a lack of knowledge about the roles of nutrients during pregnancy and also lost marks by not using the specific scientific terms such as neural tube and rhodopsin.
- (a) A pleasing number of candidates correctly calculated the percentage increase in DRV for folic acid during pregnancy. However, some students found this calculation difficult. It is important that centres provide students with sufficient opportunity to develop and practise calculations involving percentage increase and decrease.
- (b) (i) Only the more able candidates gained 2 marks for this section by stating that folic acid is needed for the development of the neural tube / spinal cord and to reduce risk of spina bifida. Several candidates didn't give an answer at all and others failed to gain any marks by stating it was need for the development of the spine and to prevent nerve damage, neither of which were credited.
- (ii) Most candidates only gained 1 mark for this section by stating that protein was need for growth. A few more able candidates gained a second mark by explaining how proteins were needed to supply amino acids for the production of new proteins such as haemoglobin, antibodies or enzymes.
- (iii) Very few candidates gained marks on this section by giving general explanations for the role of vitamin A such as need so the baby can see in the dark. Only the most able explained how vitamin A was needed for the production of rhodopsin in the rod cells of the retina. A few candidates referred to the production of collagen and healthy skin.
- (c) This section did not seem to elicit the required response from candidates. Candidates were asked to suggest why there is no need to increase the recommended DRV for iron during pregnancy. The expected answer should have referred to the mother's requirement and that no menstruation during pregnancy results in no loss of blood so the mother would have sufficient iron stored in her liver. Most answers gained no marks and focused on the baby getting iron from the mother unless she was anaemic, and that too much was poisonous.



- (d) This was a free response section on describing and explaining the effects of a mother drinking alcohol and smoking during pregnancy. The question discriminated well and more able candidates were able to gain high marks by referring to alcohol, carbon monoxide and nicotine with the correct use of specific scientific terms. Most of the marking points were well-represented. There were many good references to carbon monoxide, haemoglobin and carboxyhaemoglobin and to specific defects. However many candidates did not gain the QWC mark by failing to refer to nicotine. Several lower ability candidates were confused about how alcohol and smoking may affect the unborn child and made reference to smoking causing tar to clog up the lungs, leading to cancer and emphysema.
- Q4 This question tested the knowledge and understanding of the specific and non-specific immune response in a novel way which worked very well. Candidates were expected to underline mistakes in the text and give the correct scientific term. This question discriminated well and the more able candidates scored at least 6 out of 7 marks. Very few candidates were able to give lysozyme as the correct term for the enzymes in tears that digest bacterial cell walls. Less able candidates gained marks for antibodies active and lymphocytes but failed to give histamine, thymus and macrophage / neutrophil / monocyte.
- Q5 This question was a straightforward question on Type 2 diabetes and included data analysis on the effect of economic development on the prevalence of Type 2 diabetes.
- (a) Only the more able gained 2 marks for explaining what is meant by type 2 diabetes and in their answers all the marking points were well represented. Less able candidates confused Type 1 and Type 2 diabetes, stating that no insulin was produced or stated that the body was resistant to insulin, none of which were credited. Some candidates gained no marks by describing the possible causes of diabetes rather than explaining what diabetes is.
- (b) (i) Most candidates gained 2 out of 4 marks for this data analysis section by correctly stating that the prevalence of type 2 diabetes increases with economic development and quoting a pair of figures to support this. Only a few more able candidates went on to gain 2 additional marks for describing that the effect was bigger in some ethnic groups and quoting figures to support their answer. Some less able candidates gained no marks by misreading the question and subsequently failing to describe the effects but going on to give reasons for the effect which was the answer required for 5(b)(ii).
- (ii) Most candidates gained 2 marks out of 4 for this section by suggesting that the effect of economic development on the prevalence of diabetes may be due to eating more food, more sugary food, more processed food and a lack of exercise. More able candidates went on to describe how this may lead to obesity and some also suggested there may be genetic differences.
- (c) Candidates were asked how the prevalence of Type 2 diabetes in ethnic populations could be used by health professionals. Many candidates did not focus their answers on the question asked and just described how the risk of diabetes could be reduced, repeating their answer to Q5(b)(ii) and gaining only one mark. Only the most able candidates identified ethnic groups at risk described in detail how they could be targeted with information and treatment now or described how the information could be used to predict requirements for treatment in the future.
- (d) This second free response question asked candidates to describe how the enzyme glucose oxidase is used to measure glucose levels in body fluids. More able candidates gave some excellent answers to this question describing in a clear sequence how biosensors are used to measure blood glucose levels and including marking points 1-8, 10 and 11. Very few candidates gained the QWC mark by failing to give two scientific terms and very few candidates referred to the testing of urine. Many weaker candidates did not gain any marks by either not attempting the

question or giving a description of a fasting blood glucose test.

- Q6 This question gave students the opportunity to display their knowledge and understanding of the structure of HIV, how it is transmitted and to give possible reasons for the AIDS pandemic.
- (a) Students found it very difficult to identify the structures labelled on a diagram of the HIV virus. Very few candidates correctly identified the protein capsid and many candidates gave cell membrane for the structure labelled C which was not credited.
  - (b) This section was well answered and many candidates correctly identified the presence of RNA and reverse transcriptase as the visible features identifying HIV as a retrovirus.
  - (c) Students found it very difficult to suggest what is meant by a syndrome with reference to AIDS. A few very able candidates gained 2 or 3 marks by suggesting that a syndrome is a set of symptoms associated with AIDS and described that AIDS sufferers have a weakened immune system that makes them susceptible to opportunistic infections such as TB or pneumonia. Many answers did not gain any marks. Candidates concentrated on describing how HIV was passed on and that AIDS was incurable. Several less able candidates focused on Down's syndrome and Turner's syndrome and described how they were caused which did not gain credit.
  - (d) The final free response question gave students the opportunity to apply their knowledge of how HIV is transmitted and to suggest reasons for the pandemic. Candidates of all abilities showed a good understanding of how HIV is transmitted. The question discriminated well and more able candidates gave excellent answers gaining full marks. These answers included a detailed description of how HIV is transmitted including marking points 1 – 6, followed by a clear description of how rate of transmission can be increased including marking points 6 -11 and with a correct reference to the Durban Declaration for the QWC. All the marking points were well-represented in the answers given. Less able candidates usually lost marks by failing to suggest how the rate of transmission can be increased and failing to refer explicitly to the Durban declaration.

## **F223 Practical Skills in Human Biology**

### **General Comments**

There has been a further increase in the number of Centres, and overall number of candidates, for F223 which is encouraging.

This session showed, once again, clear evidence of hard work by many teachers and candidates. Most Centres followed the mark schemes closely and produced marks that generated a valid rank order. There were some areas, however, in which leniency was observed and also aspects which hindered the moderation process which are detailed below.

As the Tasks remain live for the life of the specification it is not possible for comments to be made on specific questions, or tasks, but the following report aims to cover general areas in which Centres can improve.

Centres that received adjustments this session fell, in the main, into 3 categories:

- misinterpretation of the published mark schemes
- failure to identify incorrect mathematical answers in candidates work
- failure to submit appropriate tasks: mixed Biology and Human Biology tasks and incorrect selection of tasks to be carried forward from last year.

It is apparent that candidates find the qualitative tasks more demanding than the quantitative tasks, but that the evaluative task remains the most challenging, as expected. The tolerance for F223 is 3 marks out of 40. However, Centres should note that adjustment is back to zero. Hence a difference of 3 marks between the Centre mark and moderator mark will remain in tolerance but a difference of 4 will potentially trigger an adjustment to all the marks within a Centre. This adjustment is mathematically determined based on the number of candidates outside of tolerance and the range of difference between the Centre and moderator marks.

### **Administration and Teacher Guidance**

All Centres are requested to take note of the following areas of concern to ensure that the June 2011 session runs more efficiently for both Centres and OCR. The report is organised into 2 sections: Administration and then Teacher Guidance.

#### ***Administration***

##### **Candidate details**

A large number of Centres had submitted scripts lacking the required information on the front cover of all three tasks. It is essential that the front covers are completed with the candidate name, Centre number and candidate number. If necessary, teachers should complete this information from their own Centre records prior to submission for moderation. Failure to do so can impede, and in some cases, prevent the moderation process from continuing. At this point the work will be returned to the Centre for correction.

## Consortium Arrangements

Centres are strongly recommended to inform OCR when placing final entries if they are in a consortium with other Centres. This prevents delays occurring with moderation. Centres **must** write to Assessor Management at OCR, providing full details of the unit number, candidates and Centres involved.

## Internal Standardisation

Teachers are reminded that it is the responsibility of the Centre to award Coursework marks to produce a single, valid and reliable order of merit which reflects the attainment of all the candidates in the specification at the Centre. This will mean that candidates who have demonstrated the same level of achievement will receive the same mark irrespective of their teaching group. Evidence to show that effective internal moderation has been carried out must be retained in all cases where the Centre's single order of merit is the result of combining two or more orders of merit within the Centre.

During the moderation process, if the moderator marks are found to generate a different rank order then the work will be returned to the Centre to enable the work to be remarked. Guidance will be provided to the Centre to direct teachers to the areas which have led to the discrepancies between the Centre and moderator marks. However, Centres should note that this will be general advice and not advice for precise candidates/questions.

## Candidate marks

There was, again, a marked increase in the number of clerical errors made by Centres this session. These fell into 3 main categories:

- Errors in addition of marks within a task
- Errors in addition of marks across the 3 tasks for individual candidates
- Transcription errors on the MSI or into the EDI system.

Centres should make sure that all work is checked and accurately recorded before submitting marks to OCR.

Please note that OCR has provided an Excel<sup>®</sup> mark spreadsheet on the Interchange website for use in determining the maximum mark for each candidate. This can be found in the Science Coordinator Materials / GCE AS/A2 / Human Biology / Supporting Materials area. It is also helpful to the moderator if a copy of this is submitted with the work for moderation.

## Mark submission & Sample requests

### a) *Submission date*

Teachers are reminded that all Coursework marking and internal moderation must be completed in good time before the submission of marks (on Form MS1) to the Moderator 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 there are ten or fewer candidates entered, please send all of the work straight away along with the MS1 form to be received by 15 May. Equally if there are only a few more candidates within the Centre it would be appreciated by the moderators if the Centre(s) could submit all the work to the moderator with the MS1 by the 15<sup>th</sup> May.

b) *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.

**Submission of the moderation sample**

It is essential that the following areas are addressed when sending the work to the moderator:

1. *Mark collation*

Centres are advised to use the task checker which is available from the OCR Interchange website to ensure that the marks for each candidate are recorded accurately. This can be found in the Science Coordinator Materials / GCE AS/A2 / Human Biology / Supporting Materials. It is also helpful to the moderator if a copy of this is submitted with the work for moderation.

All internal marking and moderation procedures must be completed before external moderation can take place. Marks must be recorded on the candidate's work and the relevant totals must be transferred to form MS1 or keyed in to the appropriate software package. Care must be taken to ensure that all mark calculations and transfers are correct. OCR cannot accept responsibility for the submission of incorrect total marks.

2. *Task selection*

Only the task contributing to the final mark out of 40 should be submitted i.e. one qualitative, one quantitative and one evaluative task. If a candidate has the same mark in any category it remains the responsibility of the Centre to select a single task and submit that one task.

3. *Organisation of scripts*

The work should be arranged by candidate (not by task or category) and should be not be placed in plastic wallets or folders but instead collated in task order (qualitative, quantitative and evaluative) and attached together by a treasury tag in the top left hand corner. The tag should enable the pages of the tasks to be opened and moderated.

4. *Centre Authentication Form*

The teacher / supervisor responsible for the marking **must** complete a Centre Authentication Form, CCS160. The form should be signed to confirm that steps have been taken to ensure that the work submitted is solely that of the candidates concerned. A completed copy of the form must accompany the MS1 sent to the Moderator. This is an OCR requirement and failure to submit a CAF will delay the publication of the Centres results until it is received. A copy of this can be downloaded from the OCR website.

5. *Centre data*

The moderators appreciated receiving a copy of the Centre observations/results for the qualitative and quantitative tasks, especially where the observations/results

were different from the expected.

6. *Despatch of the samples*

The work of the specified candidates should be despatched to the Moderator as soon as possible. Centres are advised to have the work of all candidates available so that the appropriate work can be extracted and despatched to the Moderator without delay.

Moderators would be grateful to also receive an Email address as this facilitates rapid communication.

Any correspondence with OCR relating to Special Arrangements for Coursework must also be sent to the Moderator, and the work of the appropriate candidates.

It is essential that samples of Coursework should be packed securely to ensure their safe delivery by the Post Office or other carrier. It is advisable to obtain a certificate of posting as a minimum.

Any subsequent requests from the Moderator (e.g. to reconsider the Centre's Order of Merit or to supply further samples of work) should be acted upon with the minimum of delay.

### **Candidates who wish to resubmit work for F223**

The most important point to note is that tasks **must not** be repeated. 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 the 2009-2010 tasks 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 2010 and in 2011 a student must not repeat that same Evaluative Task in 2011.

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 remarked 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 candidate may have performed well in their Quantitative and Evaluative Tasks in June 2010 and re-submit them along with a 'new' Qualitative Task in June 2011. 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 within the archive folder on Interchange.

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.

## Teacher Guidance

### Marking the tasks

Teachers are reminded of the requirement of the mandatory Code of Practice to show clearly how marks have been awarded in relation to the marking criteria defined in the specification.

This may be done by annotation at appropriate points in the text or a summary on the candidates' work. The annotation this summer was on the whole appropriate and helpful.

Teachers should note however:

- that the number of ticks on the script match the mark awarded for the (sub)question
- there is evidence provided for the safe and skilful practice marks (minimum requirement is the presence of tick(s) next to the wording in on page 2 of the qualitative task
- rings/circles and slashes should **not be** used on the mark total for a question – this is ambiguous for the moderator. For example: is the total mark given? Is a circle indicating full marks or zero marks?
- only one tick should be used per mark awarded.

Centres/Teachers are advised to ensure the following occurs as good practice:

- only one tick is present per mark awarded
- marks for each (sub-)question are recorded in the column entitled 'For Teacher's Use'
- all supporting notation such as benefit of the doubt is written clearly at the place where it has been given by the teacher e.g. E1, D3.

The purpose annotation is to provide the moderator with guidance as to why the mark was given (or not) for by that teacher for that candidate, and hence for the moderator being more likely to be able to support the mark awarded by the teacher.

Centres must not make any changes to the mark schemes published by OCR nor adapt them to credit mark points which teacher(s) think are also acceptable. It is essential only mark points stated in the mark scheme are awarded, taking into account the additional guidance provided in the same document. If there is any ambiguity with any mark point, or areas which teachers think should also be credited but are not stated on the mark scheme these should be queried using the official coursework enquiry system. These will then be raised with the Principal Moderator.

Centres must ensure they adhere to the advice given in the additional guidance column. This information is designed to clarify the requirements of the marking points. There was evidence this session of this guidance being ignored. This leads to discrepancies between the Centre and moderator marks and is likely to push candidates closer to/past the tolerance limit, and potentially trigger a Centre adjustment.

### Task Specific Advice

Centres can seek advice on the implementation and marking of Tasks in future sessions by e-mailing [GCESciencetasks@ocr.org.uk](mailto: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. Centres should also ensure that they have registered with the free email alert system on offer by OCR. This will automatically generate an email informing the Centre of any updates such as mark schemes being published, release of pre-release material etc. It

would be beneficial if the email registered belonged to the teacher responsible for Human Biology within the Centre.

### **Advice on Practical Tasks**

There were some aspects of the practical skills tasks which generated errors for many candidates and these are areas in which Centres are advised to teach the required skills ahead of the assessment session:

#### **Qualitative Tasks**

The provision of the Centre's trial data was very helpful, especially where the candidates' observations were not as expected.

1. *Observations*

Observations in the qualitative tasks should be descriptions and not conclusions. Candidates also used inappropriate terms to describe colours such as clear (as opposed to colourless). Note that 'clear' is not a *colour* observation. 'Colourless' should be used instead, where appropriate. Also 'blue' and 'purple' unqualified are not sufficient to describe the positive result of an iodine test, as these descriptions may indicate any of a range of shades and candidates must be more specific. Appropriately qualified descriptions (such as 'dark blue' etc.) should be used.

2. *Drawing up tables*

Several candidates did not understand the requirements for drawing up a results table; for guidance see Chapter 7 of the Practical Skills Handbook, which can be downloaded for free from the OCR website.

Tables which lack clear borders or do not fulfil the requirements as per the practical skills handbook and are unlikely to gain maximum credit. The same is true for incorrectly formatted units, or units repeated in cells of the table. Whilst it is not possible to assess all aspects of table drawing in any one table, Centres should teach candidates how to draw a 'perfect' table to ensure that they maximise the marks available.

#### **Quantitative Tasks**

Again, the provision of the Centre's trial data was very helpful, especially where the candidates' data were not as expected.

1. *Raw data*

All raw data should be recorded to the same number of decimal places, which should be determined realistically from the precision of the apparatus used to measure it. Note that it is only appropriate to record times to the nearest second or half second, despite the number of decimal places displayed by a stopwatch, due to the effect of human reaction time.

2. *Calculations*

Candidate should be taught how to calculate means and standard deviations as well as the other mathematical requirements stated in the specification. This should be undertaken ahead of the practical assessment.

Centres should also note that it is the responsibility of the teacher to ensure that the answer given is mathematically correct. OCR provides a 'calculation checker' to make this easier for teachers. Mark schemes must be followed regarding the use of significant figures.



## Reports on the Units taken in June 2010

It appeared that the lack of checking of calculations within Centres was a contributory cause in the adjustment of marks.

Candidates did not always show an awareness of how to handle significant figures of processed data (e.g. means, standard deviations, etc.). Processed data should be recorded either to the **same** number of decimal places as the raw data, or to **one** additional decimal place.

### 3. *Graphs*

Candidates must produce a line graph that has either a plot-to-plot line drawn with a ruler, or an appropriate line/curve of best fit. There was also evidence that candidates were not always aware of the difference between a bar chart and a histogram. Axes should also be labelled appropriately i.e. 'mean...' rather than 'average...' as average could include mean, mode or median. Data must also be plotted accurately, to within +/- 1mm. Teachers must check all plots before awarding any appropriate marks.

Whilst it is not possible to assess all aspects of graph drawing in any one graph, Centres should teach candidates how to draw a 'perfect' graph to ensure that they maximise the marks available. Details of the types of graph and how to draw them can be found on page 22 of the practical skills handbook.

### 4. *Command words*

As with written papers, candidates who fail to recognise the difference between command words such as 'describe' and 'explain' limited the marks they could achieve. A list of command words can be found in the appendix of the specification. These skills can be developed by using past exam questions from the written papers.

## **Evaluation Tasks**

### 1. *Evaluation terminology*

There was evidence in scripts seen by moderators that many candidates, and indeed some teachers, lacked an understanding of the terms accuracy, precision, reliability and validity. Likewise candidates were often credited for suggesting errors in place of limitations (and vice versa). Limitations are factors that have not been controlled or taken into account in the design of the procedure. These can be described as 'design faults' of the procedure, and will affect each run and replicate equally throughout the investigation whereas an error is something that has occurred on one (or possibly more) occasion(s). This effects intermittent and random results, and may be due to a mistake by the investigator.

It is essential that these areas are addressed before the candidates embark on new tasks or progress onto Unit F226. Again, definitions for these terms can be found in the Practical Skills Handbook.

### 2. *Mathematical processing*

Mathematical skills have, and will be, assessed in the evaluative task. A list of mathematical requirements can be found in the appendix of the specification. For example, Candidates must be able to calculate and recognise anomalous results within data. Suitable methods of identifying anomalous results include, e.g.: results greater than +/- 2 standard deviations from the mean; results greater than +/- 10% of the mean; the use of inter-quartile ranges.

In assessing reliability, some candidates appeared unsure of the difference between error bars and range bars. Note that range bars plot the highest and lowest data

(i.e. no mathematical skill is demonstrated), whereas error bars require that the standard deviation is calculated and then plotted above and below the mean.

3. *Ethical issues*

This is an area in which candidates find the expression of their answers difficult. Teachers should discuss various issues which are inherent within the specification and develop candidates' ability to express themselves concisely and coherently. Teachers frequently awarded marks for comments which were loosely phrased and did not fully meet the requirements of the mark scheme.

### Further advice and support

Any queries with marks awarded this session should be raised through the Enquiry About Results (EAR) 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 if required.

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. This form should be completed and sent to OCR at the address stated.
2. Contacting OCR via email  
Centres can contact OCR through email at [OCR.GCEScienceTasks@ocr.org.uk](mailto: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 e.g. milk, qualitative
  - Specific details of the enquiry (see below)

Centre should allow at least a week for a response, especially at peak times of the year.

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

- clarifying details of the practical task e.g. 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 some cases if it is not approved by OCR then candidates marks may well 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 4-6 weeks for OCR to respond and hence submit the work in plenty of time ahead of the 15<sup>th</sup> May.

## F224 Energy, Reproduction and Populations

### General Comments

Although this was only the second time this paper has been taken, it was agreed by examiners that it was of appropriate difficulty and comparable to the January paper. Candidates were able to complete all questions in the time available and most attempted every section.

There were no obvious misinterpretations of the rubric except occasionally where candidates lost marks because they had not focused correctly on the command word at the start of the question. Candidates need to be aware of the important differences between the words *describe*, *explain* and *suggest*. The word *suggest* is often a trigger for candidates to display their knowledge of other parts of the Human Biology specification.

The overall performance of the candidates showed a relatively normal distribution of marks. There was certainly a wide range of ability and attainment. Stronger candidates were able to display their knowledge and attained high marks. The less able candidates had noticeably patchy knowledge, yet on a few questions their knowledge was excellent (for example questions 1 and 5).

Whilst it was pleasing to note an improvement in the quoting of data since the January paper, there was a particular problem regarding the description of patterns or trends in graphs for questions 4 and 6.

### Comments on Individual Questions

- Q1 The stimulus material for this question comprised of a completed crossword entitled "Functions of the Hormones of Human Reproduction". This question was designed to be an accessible start to the exam.
- (a) (i) & (ii) Many candidates had not read the title of the crossword because a frequent answer to (i) was "male sex hormone" and (ii) "female sex hormone". Good candidates were, however, able to correctly state that testosterone promoted spermatogenesis, or was responsible for secondary sexual characteristics, and that prolactin was required for milk production rather than secretion.
- (b) (i) & (ii) Most candidates were able to select the correct hormones from the crossword, namely (i) oestrogen and (ii) HCG or progesterone. It was expected that candidates would use correct spelling for their answers to (a) and (b) as these words were taken directly from the crossword.
- (c) It was encouraging to note that the vast majority of candidates were able to name oestrogen and progesterone as hormones used in the contraceptive pill.
- (d) Whilst many were able to state "implant" or "injection" as a method of delivering contraceptive hormones without using a pill, a number of candidates mistakenly mentioned the use of an IUD. It is worth noting that an IUD has no hormones on it whereas an IUS does and this answer was credited.
- Q2 This question assessed a variety of skills and proved to be a very good discriminator.
- (a) This question asked candidates to identify the polypeptide chain and haem group on a diagram of a myoglobin molecule. Many were able to do this successfully and credit was given to the mention of iron instead of the haem group.

*Reports on the Units taken in June 2010*

- (b) (i) Candidates were presented with a graph showing the oxygen dissociation curves for both myoglobin and haemoglobin. They were asked to read off four figures from the graph and then to carry out subtractions. This is a very useful skill and it was pleasing to note that a majority of candidates were able to do this.
- (ii) The expected answer for the location in the body where haemoglobin would be nearly 100% saturated with oxygen was the lungs. Credit was also given to the left side of the heart and associated blood vessels. No credit was given to alveoli unless capillaries were mentioned. The heart alone received no credit as half of the blood passing through it would be deoxygenated.
- (iii) Having carried out a calculation on the dissociation curves for myoglobin and haemoglobin in (b)(i), candidates were then asked to describe and explain the difference in affinity for oxygen between the two. Many were able to correctly state that myoglobin had the greater affinity. Some went on to explain that oxymyoglobin was a reserve of oxygen that was only released when the levels of oxygen were very low such as during intense exercise. A common error was to describe the difference in structures of the two compounds which did not address the question.
- (c) (i) Candidates were asked to suggest why men showed the symptoms of hereditary haemochromatosis at an earlier age than women. Many were able to state that women would lose blood, and therefore iron, during menstruation. Very few were able to score a second mark by referring to the possibility of sex-linkage or that men may have a higher red cell count.
- (ii) Most candidates correctly named two forms of male contraception, the most common being a condom and a vasectomy.

Q3 This question, on erythropoietin (EPO), provided a good range of marks and allowed more able candidates to display their knowledge.

- (a) (i) It was expected that candidates would realise that more EPO would be secreted at altitude because of the low partial pressure of oxygen. Credit was given for a general idea of less oxygen available but no marks were awarded for a lack of oxygen.
- (ii) A large proportion of candidates seemed to think that EPO was produced by the hypothalamus or pituitary gland, instead of the kidney. Other common errors included the liver and pancreas.
- (iii) In answering this question, about the biological disadvantages of using recombinant EPO, a banned substance, many gave a clear introduction before naming conditions such as heart or kidney failure and strokes. Some candidates misunderstood the question and described the professional consequences to the athlete of the drug being a banned substance. Others mistakenly based their answer on the effects of blood doping.
- (b) This was the first extended answer question and required candidates to outline the translation of an mRNA code into a polypeptide that could form a protein such as EPO. Whilst there was a significant minority who failed to write more than a few lines it was pleasing to see that many candidates were able to confidently describe this sequential process. Some started the answer by describing transcription in the nucleus and this may have compromised their use of time for the whole exam. Many correctly stated that mRNA would bind to ribosomes and that tRNA would bring specific amino acids to be joined by peptide bonds to form the polypeptide.

## Reports on the Units taken in June 2010

A quality of written communication (QWC) mark was available and it is worth mentioning that this was only awarded if the key words were spelt correctly and used in context.

- Q4 This question addressed both the effects of alcohol on the body and the process of anaerobic respiration that takes place in the muscles of a sprinter.
- (a) (i) Candidates were presented with a graph showing the relationship between the concentration of alcohol in the blood and the concentration of NAD in hepatocytes. They were asked to describe the relationship. Unfortunately a large number of candidates do not understand the difference between the graphical representation of dependent and independent variables. Consequently many stated that the decrease in concentration of NAD *caused* the rise in the concentration of alcohol. Candidates should be encouraged to mention the variable on the x axis first when describing relationships or trends from graphs.
- (ii) Some candidates noted that a rise in alcohol concentration would lead to a drop in NAD and then suggested two respiratory processes that would be affected; such as glycolysis, Krebs cycle and oxidative phosphorylation. Others misunderstood the question and referred to lung ventilation or suggested aerobic and anaerobic respiration.
- (b) (i) A surprisingly large number of candidates gave glucose, fat and glycogen as an example of a short term supply of energy in muscle cells instead of creatine phosphate. This was disappointing as candidates should know that these compounds need to be metabolised first.
- (ii) It was pleasing to see that many were able to accurately outline anaerobic respiration in muscle cells. Good answers noted that the pyruvate produced by glycolysis would, in the absence of oxygen, be reduced to lactate in order to regenerate NAD, producing a net gain of two molecules of ATP. Some candidates tended to be imprecise by using the word "convert" to describe when one compound is changed into another rather than use the accurate words like "oxidised" or "reduced". This was also true in some answers to question 4(b)(iii).
- (iii) Although some mistakenly thought that EPOC could be used to break lactate down to form pyruvate, many were able to state that the extra oxygen could replenish oxymyoglobin, oxyhaemoglobin and creatine phosphate. This question did refer back to question 2 and it was pleasing to see how some candidates were able to make that link.
- Q5 Various areas of human fertility were assessed in this question which proved to be very accessible to candidates of all abilities.
- (a) There was much confusion in understanding the difference between multiple pregnancy and multiple birth. Credit was given if a candidate could show that more than one simultaneous development of a fetus constituted a multiple pregnancy and that multiple birth means that more than one child is born from the same pregnancy.
- (b) It was pleasing to see that most candidates could use the data in the chart to correctly calculate the percentage of births, using IVF, which resulted in twins being born.
- (c) Candidates who read the question carefully were able to mention health risks to the *mother* such as hypertension, pre-eclampsia and excessive bleeding. Others stated risks that were primarily concerned with the babies, such as a miscarriage.

*Reports on the Units taken in June 2010*

- (d) Candidates displayed good knowledge in suggesting reasons for male infertility; the most common being abnormal sperm, low sperm count and the production of antibodies against the sperm.
- (e) Many were aware of the recent change in the law regarding sperm donation and were able to describe the lack of anonymity as a factor responsible for the decline in sperm donors. However, only a few took the idea further and mentioned the potential legal or financial issues surrounding a lack of anonymity.

Q6 An outline of the nitrogen cycle was used at the start of this question.

- (a) It was apparent that many candidates were unfamiliar with the nitrogen cycle. Few candidates gave the correct names of the bacteria that turned ammonium salts into nitrites and then into nitrates.
- (b) This was the second question where a QWC mark was awarded. Candidates showed good knowledge of the decrease in efficiency between trophic levels and the reasons for the decrease, such as not all of the plant being eaten and energy losses due to respiration, excretion and movement of the animal.
- (c) (i) The chart illustrated a positive correlation between an increase in the human population numbers of certain countries and their rate of deforestation. As in question 4(a)(i), some candidates incorrectly stated that the dependent variable would have an effect on the independent variable, in this case that an increase in deforestation would cause an increase in human population numbers. Credit was given for the correct use of data.  
  
(ii) In this question, candidates were able to display their awareness of green issues by suggesting ways in which an *individual* could reduce his or her carbon footprint. Many good answers were given, the most common being related to reducing private in favour of public transport, switching off appliances and methods of carbon offsetting.

## F225 Genetics, Control and Ageing

### General Comments

This was the first time F225 was offered and the examiners were pleased with the quality of answers produced by some candidates. There was some evidence that candidates found themselves running out of time with higher omit rates on questions 5 and 6 than on earlier questions on the paper. Candidates did find the synoptic aspects of the paper challenging, particularly those questions which referred back to immunity and biochemistry.

### Teaching Tip:

At the end of topic 'map' the synoptic links as a class exercise and produce mind maps or 'spider diagrams'. For example, look at the genetics learning outcomes (5.1.1(b) and (c)). Cystic fibrosis has links to membrane transport and lung structure, Huntington's links to protein structure, PKU links to enzyme action etc. Having listed the links, probe the student's understanding of the material. It was clear from question 2(c) that misconceptions about the blood group antibodies were widespread among candidates. (see detailed feedback below).

### Comments on Individual Questions

Q1

- (a) Many candidates had failed to read the question stem which clearly stated that, in 1(a), the image was a *section* through the kidney cortex. Candidates answered in terms of whole kidney structure with cortex, medulla and nephron being the most common answers. However, almost 75% of candidates failed to score any marks on this question indicating that microscope work or the study of photomicrographs is possibly being neglected in some centres.
- (b) Part 1(b) was answered well although not many candidates seemed to be aware of the high pressure in the glomerulus *forcing* molecules out into the renal capsule. Candidates talked about molecules diffusing through, with several describing how *blood* is forced through. Structural adaptations were well described with some excellent descriptions of podocytes and filtration slits. Weaker candidates failed to distinguish between ultrafiltration and selective reabsorption and went on to describe the structure and function of the whole nephron.
- (c) (i) & (ii) In this part question, only 25% of candidates correctly identified the glycosidic bond, with hydrogen bonds being the commonest response. The link between structure and function has always proved a difficult area for candidates in examination questions and (c)(ii) required candidates to deduce that, in order to be filtered, inulin would need to be small and soluble. This was a 'stretch and challenge' question and the majority of candidates simply repeated the material given in the question.

Reports on the Units taken in June 2010

- (d) (i) & (ii) Despite this question asking for a 'range', some candidates gave a single figure but most gave correct units and were able to score one mark. Part (ii) was again a stretch and challenge question and this produced some good answers. Some candidates failed to spot that it was *plasma* creatinine levels that were being referred to and wrote about urine concentrations being affected by water content.

In part (c) and (d), candidates frequently wrote 'insulin' and 'creatine'. While this could not be credited, candidates were only penalised once. However, this does seem to indicate the advantage to candidates of highlighting key words and novel words in questions – particularly as these are likely to occur more frequently on A2 papers which will be using more A02 assessment which requires learning outcomes to be tested in novel contexts.

- (e) Part (e) was answered well by most candidates although some weaker candidates answered in terms of how haemodialysis worked and there was evidence that candidates could not distinguish between haemodialysis and peritoneal dialysis.

Q2

- (a) In part (a), some excellent definitions were given of both gene and allele. Some candidates were careless in their choice of terminology and referred to genes as a 'strand' of DNA or a 'part' of DNA and this was not credited.
- (b) In part (b), it was clear that some candidates could not distinguish between genotype and phenotype for blood groups and inserted answers incorrectly in the columns provided. An 'error carried forward' was operated.
- (c) This question exposed a major lack of understanding of the ABO blood group antibodies. Most candidates suggested that anti-A antibody production is 'triggered' in response to a 'foreign' blood group. Anti A and anti B antibodies are isoagglutinins – sometimes referred to as 'naturally occurring antibodies'. Someone who is blood group O or B will have anti-A antibodies constitutively present in their plasma.
- (d) (i), (ii) & (iii) In (i), the most common mistake was to explain what a palindrome was rather than a palindromic sequence while in part (ii) some candidates recorded the number of triplets rather than the number of bases. Part (iii) did not present any problems although sweeping statements such as 'Q has no bands the same' were not credited and some candidates did not appear to realise that the child would have two parents and only gave one answer.



*Reports on the Units taken in June 2010*

Q3

- (a) (i) Part (a)(i) was done well by most candidates.
- (ii) In (a)(ii), responses tended to drift away from the question being asked to a discussion of the reasons for the shortage of donated organs or the ethics of organ donation. The QWC mark was awarded for a discussion of at least two sources with at least one advantage and disadvantage of each source. In both parts of this question, it was clear that some candidates assume that the word 'donor' means 'live donor', and this led to a discussion of the merits or otherwise of different types of live donors.
- (b) (i) In part (b)(i), aqueous fluid, tissue fluid and water were not credited. A small number of candidates wrote 'aqueous / vitreous fluid' and this was not credited.
- (ii) In part (ii), the commonest mistake was to 'explain' in terms of water keeping the cornea clean – again indicating a failure on the part of some candidates to read the stem of the question. Many candidates did explain in terms of osmosis failed to gain full marks since they went on to talk about water concentration rather than water potential. Where water potential was referred to, the idea of a gradient or the water potential in the cells being lower was not made clearly.
- (c) In part (c), most candidates got the idea of rejection not being an issue but some candidates went on to explain the reason in terms of not having to 'worry about blood groups not matching' – possibly carrying over an idea from question 2.
- (d) This question was done well by the majority of candidates.

Q4

- (a) In part (a), it was clear that many candidates were aware of the principles of homeostasis and many stated these but were then unable to relate them to the control of thyroxine levels. Most candidates achieved marking point 2 but failed to gain any further marks as the idea of the hypothalamus being a receptor detecting a rise in thyroxine or TSH was not made clear. Centres are reminded that Human Biology is a specification which looks at biological principles in a context and candidates will be expected to identify stimuli, receptors, effectors and responses in a variety of different situations.
- (b) Part (b) was synoptic in that candidates were expected to refer to aerobic respiration. One common misconception was that more mitochondria led to more ATP being produced so more respiration could happen – implying respiration requires ATP rather than produces it. The idea of ATP being turned over in cells to meet the requirement of cells is not clear to candidates – many thought that the additional ATP would make active transport or muscle contraction faster. Energy or heat as a 'product' was not credited.
- (c) (i) Part (c) was again synoptic and most candidates recalled the idea of enzymes forming enzyme substrate complexes with their substrates. Only

*Reports on the Units taken in June 2010*

the best candidates recalled the role of the Golgi apparatus and the interaction between antigen and the variable region of an antibody.

- (ii) In (ii), examiners were looking for clear references to what would be left behind in the well or to false positive results being obtained if something else reacted with the enzyme or to any factor which would change the colour – vague references to ‘contamination’ were not credited.

Q5

(a) A significant number of candidates omitted part (a) which was surprising as bone density tests are a learning outcome and, while several candidates referred to the use of X-rays, relatively few could describe a DEXA scan and the idea of calculating a T-score was not seen at all.

(b) (i) The calculation in (b)(i) was done well, with the most frequent error being incorrect rounding up from 4 339.5.

(ii) Most candidates scored well in part (b)(ii). The question stem asked candidates to ‘compare and contrast’ and the examiners expected similarities and differences between males and females to be referred to. The QWC was for using figures in support of at least one similarity and one difference and these figures had to be with units. The most common mistake was careless references to the age groups being described – ‘At a younger age, there were more male cases than female cases’ or stating that there were more cases in males up to the age of 74 when, at age 70 to 74, the number of cases is equal.

(iii) Many candidates correctly answered part (iii) in terms of HRT with the commonest misconception being that, as more males were affected at a younger age, they needed more intensive treatment.

(c) (i) & (ii) In part (c), most candidates scored marks in part (i) but failed to score full marks in part (ii) as explanations of why a low calcium ion concentration slowed blood clotting etc were given in terms too vague to be credited. Again, this was a synoptic question – calcium ions are linked to a number of physiological processes covered by the specification and this would be a useful synoptic exercise to carry out with students.

Q6 The omit rate for parts of question 6 was somewhat higher than elsewhere on the paper indicating several candidates were running out of time.

(a) This question produced several responses which explained how an action potential was generated and propagated in a non-myelinated neurone. Many candidates could state that the myelin sheath acted as an insulator but few could explain how the action potential could ‘jump from node to node’ and descriptions of ‘sideways movement’ of sodium ions were rarely seen.

(b) This question was generally done well with most candidates scoring at least one mark for indicating that sensory neurones were involved. Many listed sensory along with relay and motor neurones and some candidates confused receptors and effectors or answered in terms of ‘effector neurones’ or ‘receptor neurones’.

*Reports on the Units taken in June 2010*

- (c) Part (c) was a stretch and challenge question and 20% of candidates omitted this question. Again, some candidates misread the question stem and answered in terms of hydrogen ions binding to the channel protein. The idea of complementary shapes is another overarching theme in Human Biology and is another synoptic area which needs to be reviewed with students.
  
- (d) In part (d), many candidates described how opiates mimic naturally occurring endorphins and block the transmission of pain but, other than binding to receptors, few went on to describe the mechanism in sufficient detail to score more marks. The concept of cell signalling and the role of G proteins were not described often but marks were more commonly lost for not making clear which ions or ion channels were involved.

## F226 Extended Investigation in Human Biology

### General Comments

As this was the first series for this unit, it was encouraging to note a significant entry compared to the highest recorded entry for 2868/01 from the legacy specification.

The team of moderators for F226 were pleased with the overall standard of work submitted by most Centres. There was clear evidence of hard work by many teachers and candidates. Most Centres followed the descriptors closely and produced marks that generated a valid rank order. The written work submitted reflected a wide range of ability which was in general marked internally at an appropriate level. There were some areas, however, in which leniency was observed and also aspects which hindered the moderation process.

Some Centres, however, permitted candidates to undertake investigations which are categorically not permitted by OCR as stated in the Teacher Support: Extended Investigation Handbook. To clarify, OCR *does not* permit Investigations that involve the administration of alcohol, caffeine, nicotine and other similar substances to human participants. Further, the administration of glucose and other sugars to human participants is also prohibited due to the risk of undiagnosed diabetes. No investigation that potentially causes harm to participants should be undertaken (e.g. exposure to inhaled particulates/air pollution). Harm resulting from administration of substances such as those listed above could result in prosecution under Health and Safety legislation by the appropriate authorities. For this session **ONLY** candidates were given benefit of the doubt in some areas however, in future sessions such work will be adjusted or replacement work will need to be submitted.

### General Summary

As with Unit F223, with respect to general administration there were a large number of clerical errors made within Centres. Common errors included:

- failure to submit marks by MS1 or EDI at appropriate time (standard deadline 15<sup>th</sup> May)
- incorrect addition of the 3 skill areas to give a mark out of 40
- failure to complete and submit the Centre authentication form

Centres are encouraged to note that a 'Centre Authentication Form' must be submitted. Failure to do so will mean that this has to be requested at a later date and could potentially delay the publication of candidates' results.

Most forms that will be required for any particular session can be found on the website: [http://www.ocr.org.uk/qualifications/publications/AS\\_ALevelGCEHumanBiology.html](http://www.ocr.org.uk/qualifications/publications/AS_ALevelGCEHumanBiology.html)

There also appeared to be minimal annotation by teachers which made it more difficult for moderators to understand the reasons why teachers had awarded a mark, and inevitably harder for moderators to support those decisions.

In the main, adjustments were due to Centres:

- choosing an inappropriate task
- misinterpreting the demand and requirements of the descriptors
- marking erratically/inconsistently within the Centre

## *Reports on the Units taken in June 2010*

The common reasons marks differed between the moderator and the Centre were in the:

- A skill: leniency in the awarding of descriptors A3, A4, A10, A15
- B skill: leniency in the awarding of descriptors B3, B5, B10
- C skill: leniency in the awarding of descriptors C3, C4, C5, C8, C11, C14

Any Centres who wish to gain more detailed feedback regarding this year's moderation may request a re-moderation via the Enquiry About Results (EAR) service.

A coursework consultancy service, available free of charge, can also be requested relating to the forthcoming Extended Investigations.

### **Administration and Teacher Guidance**

All Centres are requested to take note of the following areas of concern to ensure that the June 2011 session runs more efficiently for both Centres and OCR. The report is organised into 2 sections: Administration and then Teacher Guidance.

#### ***Administration***

##### **Candidate details**

For this session there was no cover sheet provided by OCR to record individual skill marks and overall marks for candidates. However, following Centre feedback, for the June 2011 session an optional coursework coversheet will be available and can be attached to each candidate's work. The form will be available from the OCR website from September 2010.

##### **Consortium Arrangements**

Centres are strongly recommended to inform OCR when placing final entries if they are in a consortium with other Centres. This prevents delays occurring with moderation. Centres **must** write to Assessor Management at OCR, providing full details of the unit number, candidates and Centres involved.

##### **Internal Standardisation**

Teachers are reminded that it is the responsibility of the Centre to award coursework marks to produce a single, valid and reliable order of merit which reflects the attainment of all the candidates in the specification at the Centre. This will mean that candidates who have demonstrated the same level of achievement will receive the same mark irrespective of their teaching group. Evidence to show that effective internal moderation has been carried out must be retained in all cases where the Centre's single order of merit is the result of combining two or more orders of merit within the Centre.

During the moderation process, if the moderator marks are found to generate a different rank order, the work will be returned to the Centre to enable the work to be remarked. Guidance will be provided to the Centre to direct teachers to the areas which have led to the discrepancies between the Centre and moderator marks. However, Centres should note that this will be general advice and not advice for precise candidates/questions.

##### **Candidate marks**

There was, again, a marked increase in the number of clerical errors made by Centres this session. These fell into 3 main categories:

- Errors in addition of marks within a skill
- Errors in addition of marks across the 3 skill for individual candidates
- Transcription errors on the MSI or into the EDI system.

Centres should make sure that all work is checked and accurately recorded before submitting marks to OCR.

Please use the optional coversheet for recording the maximum mark for each candidate in each skill and the overall total. This will assist both the teacher and moderator and reduce clerical errors.

### **Mark submission & Sample requests**

a) *Submission date*

Teachers are reminded that all Coursework marking and internal moderation must be completed in good time before the submission of marks (on Form MS1) to the Moderator 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 there are ten or fewer candidates entered, please send all of the work straight away along with the MS1 form and CCS160 to be received by 15 May. Equally if there are only a few more candidates within the Centre it would be appreciated by the moderators if the Centre(s) could submit all the work to the moderator with the MS1 by the 15<sup>th</sup> May.

b) *Sample requests*

All Centres should note that moderation samples will be automatically generated once the Centre marks have been received. 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.

## **Teacher Guidance**

### **Nature of tasks:**

Common investigations which showed accessibility to all descriptors included the:

- Effect of temperature on the rate of respiration
- Effect of different respiratory substrates on the rate of respiration
- Effect of age and memory
- Effect of temperature on the rate of photosynthesis.

These investigations were suitable for all three skills and allowed access to the higher descriptors. However there were submissions of investigations which are not appropriate and should not be undertaken by any candidate in the future:

- Effect of caffeine on memory
- Effect of alcohol on Daphnia heart rate
- Effect of exercise on asthmatics and non asthmatics
- The effect of light on memory.

Centres are advised to note that whilst individual Investigations, especially at A2, are educationally invaluable, they can lead to inconsistencies in the marking and moderating process. This can lead to Centres falling out of tolerance due to one/two specific investigations and hence the whole cohort being adjusted as a consequence. In these cases, it is likely that additional scripts will be requested from the Centre or work returned to the Centre for a remark to prevent such an adjustment from occurring. Centres are reminded there is no requirement for each candidate to carry out a different investigation. Centres should also ensure that any investigation undertaken by human subjects conforms to the advice given by CLEAPPS.

It is essential that Centres seek approval for any A2 investigation that is outside those suggested in the Teacher support: Extended Investigation handbook or INSET material. This can be arranged by emailing: [GCESciencetasks@ocr.org.uk](mailto:GCESciencetasks@ocr.org.uk).

Centres should remember that the safety of all subjects involved in any investigation remains the responsibility of the teacher/Centre and not OCR. Teachers should ensure that they follow all necessary advice from appropriate bodies and consider carefully investigations that they authorise.

## Guidance on descriptors

Some areas within the skills appeared to be more leniently marked than others and these are discussed below.

### Skill A

For descriptor A3, Centres commonly credited candidates who did not use theory taken from F221 and/or F222 to justify their prediction. The inclusion of segregated theory does not allow descriptor A3 to be awarded, nor does the inclusion of a reference to a secondary source. The theory must be used to explain, in detail, the reasoning behind the quantitative prediction made for A1. The same is also true for A4 only using theory taken from F224 and/or F225 to justify their prediction.

In the case of A5 candidates must clearly state the dependent and independent variable and identify key factors to be taken into account. This must not be inferred or deduced by the teacher/marker. In enzyme driven investigations, candidates must take into account enzyme concentration, substrate concentration, pH and temperature. In Human physiology investigations, candidates must take into account age, gender and genetics as well as considering BMI and social habits such as smoking, alcohol consumption. Also some candidates stated that the rate was the dependent variable. As rates are determined from processing data they can not be referred to as dependent data.

A6 was met by most candidates but care should be taken to ensure that candidates state a suitable number of measurements for the dependent variable to enable the planned appropriate statistical test to be carried out ie 20 data sets for a t-test in each group, 10 data sets for a Spearman's rank or 8 data sets for a Mann Whitney U test.

A7 and A8 were leniently awarded for two main reasons: in the case of both these descriptors, the secondary source(s)/preliminary work must be used to inform the planned method/procedure e.g. to justify the selection of a piece of apparatus, to determine a range for the independent variable. In the case of preliminary work for A8, data **must** be included to support the completion of such a study. These descriptors can not be awarded for solely referencing theory and stating a bibliography as it does not refer to the strategy.

A10 was often awarded too leniently across most Centres. There are two aspects of this descriptor which must all be met to gain A10: a detailed strategy that can be implemented to ensure accurate and precise data is collected. Note that *accuracy* is an assessment of how close the obtained value is to the true value. Accuracy can be improved by taking into account the accuracy of pieces of apparatus whereas precision is the number of decimal places to which any measurement can be recorded, as determined by the apparatus used. The strategy should therefore be written in such detail to indicate this level of precision eg stating volumes and/or masses to 1 decimal place, stating precise times for acclimatisation. This is a higher level descriptor and as such requires detailed methods to be completed such that accurate and precise data will be collected should it be replicated by other candidates.

For descriptor A12, many candidates did not justify their method in terms of validity i.e. explaining their selection of the apparatus, how to control the key variables and the identifying critical points in the strategy such as the necessity for acclimatisation or warm ups and warm downs prior to exercise.

To gain A13, the proposed table must fulfil all the requirements stated in the Teacher Support: Extended Investigation Handbook. The table must also have sufficient rows/columns to enable the planned quantity of data to be collected. Candidates must not repeat units in the cells of the table to gain credit for A13.



## *Reports on the Units taken in June 2010*

A14 requires candidates to clearly state their intention to carry out both simple and detailed numerical processing. Examples of simple mathematical processing include the calculation of means (not the determination of a mode or median as no calculation is involved), calculation of gradients and calculation of percentages. Examples of detailed mathematical processing include the calculation of standard deviations, calculation of standard errors and appropriate statistical tests.

To gain A15, the proposed graph must fulfil all the requirements stated in the Teacher Support: Extended Investigation Handbook. Common errors included:

- Failing to specify the exact type of graph to be plotted
- Suggesting a bar chart but sketching a histogram (ie contradiction)
- Failure to propose a graph for the processed data eg no 'mean....' on the y-axis

### **Skill B**

On the whole, this skill was more accurately marked in Centres although a few descriptors did were misinterpreted on occasions.

All raw data should be recorded to the same number of decimal places, which should be determined realistically from the precision of the apparatus used to measure it to meet B4.

B5 tables must fulfil all criteria as stated in the Teacher Support: Extended Investigation booklet. Centres should note that tabulated pooled data must not be used to assess B6. Individual candidates should record their own data in a single table which is used for the assessment of B5.

In the case of B7, the plotting of range bars is not appropriate as no detailed processing has been undertaken. Range bars plot the highest and lowest data (i.e. no mathematical skill is demonstrated), whereas error bars require that the standard deviation is calculated and then plotted above and below the mean. It is the calculation of the SD which can be credited for B7.

For B8, candidates did not always show an awareness of how to handle significant figures of processed data (eg means or standard deviations). Processed data should be recorded either to the same number of decimal places as the raw data, or to one additional decimal place.

B9 was an area of some leniency: candidates who do not find any anomalous results must indicate by which method they have determined this eg: results greater than +/- 2 standard deviations from the mean, results greater than +/- 10% of the mean, or the use of inter-quartile ranges. Those that do recognise anomalous results must clearly identify these and also state the method they used to identify them.

In the case of B10, there were several key issues which led to this descriptor not being supported:

- incorrect types drawn: bar chart in place of a histogram (and vice versa)
- inappropriate axis labels ('average...' used incorrectly in place of 'mean...')
- lack of units for both the IV and DV
- line graphs that lacked a plot-to-plot line drawn with a ruler
- lack of title
- incorrect plots

## Skill C

To gain credit for C1, candidates must quote processed data, with appropriate units, in support of the trends/patterns they described.

Candidates should be encouraged to use the terms 'undermines' or 'supports' when they refer to their original prediction to meet C2.

In the case of C3 and C4, the same leniency and errors were observed by moderators as for A3 and A4. For C3, Centres commonly credited candidates who did not use theory taken from F221 and/or F222 to explain their conclusions. The inclusion of segregated theory does not allow descriptor A3 to be awarded, nor does the inclusion of a reference to a secondary source. The theory must be used to explain, in detail, the reasoning behind the conclusions made for C1. The same is also true for C4 only using theory taken from F224 and/or F225.

The descriptor, C5, requires the candidates to present an informed opinion on the reliability of the raw data. Candidates are expected to produce more than a simple statement referring to the overall data. Candidates should discuss which data sets are more/less reliable than others and justify these comments with reference to SD and/or error bars and /or range bars.

For C6, calculating the percentage error for the pieces of apparatus is not sufficient to meet C6 alone. There must be some discussion of these values to enable the descriptor to be supported. The command word of the descriptor is 'comment on' and consequently it requires more than numerical values being stated. Candidates should understand that accuracy is an assessment of how close the obtained value is to the true value. Accuracy can be assessed by the calculation of (or comment on) the percentage error, or comment on the accuracy of pieces of apparatus. Accuracy can also be assessed by commenting on how the trend line compares with the theoretical trend line.

Centres are advised to note that whilst C5 refers to the reliability of the data collected, C7 refers to the reliability of the collection strategy. Some candidates did not distinguish between these descriptors fully. Discussion relating to limitations does not allow descriptor C7 to be awarded. Instead, candidates should state and explain a minimum of two errors (see below).

In descriptor C8, there remains confusion in some Centres as to the difference between errors and limitations:

- **A limitation** – is a fault that lies within the method and will potentially affect each trial/run of the method such as the fluctuation of the temperature in a waterbath or the parallax error when reading a meniscus (refer to descriptor C8).
- **An error** – is a fault that occurs at random and effects intermittent set of data/one point such as the failure to measure out a chemical correctly for one run (refer to descriptor C7).

In the case of C9 & C10, many candidates did not explain the effect of the limitation(s) on the raw data. The effect on the data must be quantified and relate to the raw data (not rates and processed data).

In some cases candidates did not suggest improvements that related specifically to improving the strategy in terms of improving the *accuracy* and/or *precision* of the raw data and hence could not be supported for C11. Reference to performing more replicates is not in itself sufficient, nor is references to increasing the accuracy of the mean (as the mean is processed data and the descriptor specifically requires the improvements to consider the raw data). Any improvements suggested need to be realistic and practical within the context of the investigation (e.g. using standard school apparatus). Again, some candidates did not explain the effect the

*Reports on the Units taken in June 2010*

suggested improvement(s) would have on the accuracy and precision of the raw data collected to meet the requirements for C12 and C13.

C14 was not supported in all occasions as some candidates lacked an understanding in the term 'validity'. Note that the validity of an experiment or investigation depends upon factors such as the range and reliability of the observations or measurements that underpin it, any assumptions made in developing hypotheses or planning the investigation, and the nature of the investigation itself.

**Suggested writing frames**

The tables below can be used to guide the candidates, without unfair assistance, in the fulfilling of various sub descriptors. Depending on the depth and detail of the content within the table the sub descriptor(s) may be partially or full met.

**Apparatus list:**

Item	Quantity	Concentration & Volume <i>Partial evidence for A6</i>	What is it used for <i>Partial evidence for A12</i>	Reason for choice <i>Partial evidence for A12</i>

**Table to show how concentrations of working solutions will be made:**

*(Partial evidence for A10 and A12)*

End concentration	Volume of stock solution	Volume of .....

**Table to show key variables:**

Variable	Type of variable (dependent/independent/controlled) <i>Partial evidence for A5</i>	Why it must be controlled <i>Partial evidence for A12</i>	How it will be controlled <i>Partial evidence for A10 and A12</i>

**Table to evaluate the investigation:**

Limitation in method <i>Partial evidence for C8</i>	Error caused as a result of the limitation ie effect on the data collected <i>Partial evidence for C9 &amp; 10</i>	Suggested improvement <i>Partial evidence for C11</i>	Justification of improvement <i>Partial evidence for C12 &amp; 13</i>

**Further support:**

Centres can seek further advice on the implementation and marking of the Extended Investigation in future sessions by e-mailing [GCesciencetasks@ocr.org.uk](mailto:GCesciencetasks@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. Centres are reminded that there is a free Coursework Consultancy service available. Please email the above address for further details.

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