GCE

Human Biology

Advanced GCE **A2 H423**

Advanced Subsidiary GCE **AS H023**

OCR Report to Centres June 2014

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Advanced GCE Human Biology (H423)

Advanced Subsidiary GCE Human Biology (H023)

OCR REPORT TO CENTRES

F221 Molecules, Blood and Gas Exchange

General Comments:

As in previous sessions, this question paper appeared to be accessible to candidates across the ability range and very few questions resulted in 'no response'. There was little evidence to suggest that candidates struggled for time and many used the additional pages at the end of the paper to complete their responses, but once again, examiners would recommend that candidates clearly state their intention to continue their response on the additional pages to guide the examiner to the continuation of their responses.

Centres should be commended for continuing to embrace the contextual nature of the Human Biology specification and preparing their candidates accordingly. Overall, candidates demonstrated a wide range of ability with stronger candidates applying their knowledge to new situations to gain higher level marking points and weaker candidates displaying their ability to learn and recall facts, an improvement on last session. However, centres are encouraged to explain to candidates the need to write legibly as in some instances, responses proved difficult to read.

The biochemistry of amino acids in **Q1** was well answered and there has been a gradual improvement in the ability of candidates to perform calculations, as shown by the calculation of scale bar length in **Q2(b)(ii)** which proved accessible across the ability range. **Q5(a)** proved challenging as many candidates simply restated their knowledge of arteries and veins rather than apply it to the lesser studied blood vessels; arterioles and venules.

Comments on Individual Questions:

Question 1
This question addressed **AO1** and **AO2** and a biochemical theme was prevalent with questions on the biochemistry of amino acids and transport across membranes.

1(a)(i)–(iii) were generally well answered by the majority of candidates, although some candidates did not recognise that the R group (CH_3) was already marked on the diagram and so could not be accepted as a response to **(a)(i).**

1(b)(i) was generally well-answered but **1(b)(ii)** proved challenging. Good candidates were able to reason that oxygen did not affect water potential because it was not a polar molecule, but many simply stated that it was because 2% was a small amount and therefore too small to affect water potential.

Overall, **1(c)** was well answered with many candidates describing active transport and providing more than required for the two marks available.

Question 2
AO2 and **AO3** were addressed in this question. Examiners were pleased to report that candidates demonstrated the ability to respond to 'How Science Works' style answers as seen in parts **2(c)(i)** and **2(c)(ii)** where there was a requirement to describe safety precautions and comment on conclusions.

In **2(a)** the majority of candidates were able to correctly interpret photographs and identify stages in the preparation of a blood smear. Centres are encouraged to allow candidates to undertake the practical components of the specification where possible as it is important that candidates continue to appreciate the procedures detailed in the specification.

In **2(b)(i)** candidates were provided with a labelled image of a blood smear and many candidates correctly explained that the nucleus of the leucocyte takes up the stain. Good candidates went on to explain that the stain used was differential or that the erythrocyte was red because of the pigmentation from the haemoglobin molecule and the iron ion contained therein.

It was pleasing to see correct responses from candidates who had correctly obtained the right figures in **2(b)(ii)**, and inserted these into the calculation to link magnification with actual length. This skill appears to be improving. Candidates are reminded to provide their answer as requested by the question as, despite performing the correct calculation, it was common to see some candidates not rounding their answers to a whole number thereby losing marks. Many candidates are still unable to convert cm and mm into µm, and centres are advised to encourage candidates to use mm (rather than cm) for measurements for ease of conversion.

In **2(c)(i)** many candidates obtained full marks. The use of personal protective clothing such as gloves and safety goggles were most commonly seen by examiners but additional valid reasons such as disposing of blood safely in clinical waste or disposing of glass slides in sharps bins were also credited.

AO3 was further tested in **2(c)(ii)** and candidates needed to explain why both the mean and the range were important in establishing the conclusion given. Good answers referred to the fact that the range shows the variation in size between erythrocytes in a sample and how this representation of the data would help to point out if there is an anomalous result in the data set. Some candidates described the accuracy and reliability of the data as a whole or of the conclusion, which did not answer what either the mean or range can be used for so did not receive credit. This question proved useful in discriminating candidates at differing ability levels.

Question 3
This question addressed both **AO1** and **AO2**. The candidates' knowledge of the concepts surrounding blood storage and enzyme activity was being examined in this question. Candidates across the ability range were able to access marks available particularly in part **(a).**

3(a) was generally a well answered question with the majority of candidates able to gain two - three marks for describing and explaining the effect of an increase and decrease in the prothrombin concentration in relation to the rate of the reaction. Higher level responses provided further detail on the effect of increasing the substrate concentration further (until the enzyme was the limiting factor) on the rate of reaction. The use of scientific terms was well documented and many candidates gained the QWC mark.

Centres are advised to encourage candidates to practice looking at graphs or tables of data and making comparative statements to describe the relationships or conclusions drawn from the data. This is where candidates could pick up what are relatively easy marks for a straight forward description.

In **3(b)(i)** candidates that made the connection between the storage temperature and how long the components could be kept for, realised that the difference in temperature would affect the enzyme activity or metabolic reactions and gained credit. Candidates did not receive credit for stating that the platelets would clot but the packed red cells wouldn't or for suggesting that platelets would be denatured or would die quicker than red blood cells.

3(b)(ii) and **3(c)** were both well-answered by many candidates, although some gave vague responses such as 'they have just had surgery' for **3(c)** which were not credited.

In **3(d)**, there appeared to be some confusion as to why an additive such as glycerol should be added to stored blood and some candidates suggested that it was to give the red blood cells energy or food to keep them alive until they needed to be used. Candidates found it easiest to gain marking point two, but accessing the other marking points proved more difficult either due to statements that were too vague or to the fact that candidates did not fully understand the mechanics involved and described red blood cells crystallising or denaturing.

It was encouraging to see many candidates gaining both marks for part **3(e)** and a number clearly described the techniques involved, such as PCR and ELISA. There were still some candidates that confused the antibody and antigen, but definitely fewer than in previous sessions.

Question 4
This question addressed both **AO1** and **AO2**. Candidates were required to demonstrate their knowledge of heart structure and the role of valves in this question and whilst the majority of candidates had learnt the topic thoroughly and could access marks, there were some misconceptions evident in parts **(b)** and **(c).**

4(a) was well answered and many students were able to recognize the chambers of the heart and correctly identify the left and right sides. The most common answer which failed to gain credit was Bundle of His rather than the septum in which the tissue is found. Occasionally candidates misnamed the pulmonary artery as the aorta.

In **4(b)** candidates generally compared either atria to ventricles OR right ventricle to left ventricle therefore describing just one aspect of wall thickness. It was also a common error for candidates to describe atria and ventricles in general terms rather than specifically comparing the wall thickness even though the question had given the prompt that the wall was made of cardiac muscle prior to asking candidates for a comparison.

Examiners reported that candidates appeared confident in to tackling part **4(c)** of this question and it was extremely rare to see 'No Response'. Some were able to demonstrate their knowledge of the position of the valves and how they enabled the blood to continue to flow in one direction which usually allowed easy access to the QWC mark. Some candidates struggled to articulate the events that lead to the opening or closing of the valves and did not provide a full enough description of systole or diastole to be awarded marks.

4(d)(i) was well answered and a significant proportion of responses could have been credited for all three marking points.

Good responses to part **4(d)(ii)** demonstrated an understanding that atrial fibrillation would result in the ineffective pumping action of the heart and pooling of blood. Where candidates described the damage caused to the heart they were often not specific enough and gave general terms about the cardiac muscle rather than the endothelium.

Question 5
In this question **AO1** and **AO2** were being tested and candidates were required to apply their knowledge of blood vessel structure and function to the lesser known venules and arterioles.

In **5(a)** marks were most commonly awarded for correctly relating the structure of capillaries to their function. Many candidates demonstrated a good knowledge of arteries and veins which allowed them to access some marking points, particularly for veins. However, the question referred specifically to arterioles and venules which required candidates to consider subtle differences in these vessels to those studied in detail. Candidates who used the diagram in Fig.5.1 as suggested in the question were more likely to gain marks for stating that arteriole <u>walls</u> have smooth muscle or that venules have a wider lumen.

Responses for **5(b)(i)** and **5(b)(ii)** varied. Some candidates offered the same response to both question parts or offered the response for **5(b)(ii)** to **5(b)(i)** and vice versa. Few candidates stated why the pressure decreased and instead stated why it had to decrease.

Most candidates who gained credit for **5(b)(i)** Also gained credit for **5(b)(ii).**

Question 6
Parts **(a)(i)-(iv)** addressed **A01** criteria with part **(b)** addressing **A02**. This question provided a straightforward end to the question paper with short answers involving recall of lung function and procedures in **(a)(i)-(iv)** with a slightly more demanding **AO2** style 'suggest' question to finish.

In **6(a)(i)** the majority of candidates were able to correctly describe what was meant by 'respiratory arrest' but fewer were able to consolidate this with the second marking point for 'peak expiratory flow rate'. Many candidates incorrectly referred to maximum volume of air leaving the lungs rather than maximum rate which suggested lack of understanding of the term.

Good responses gave both the term and the correct abbreviation for part **6(a)(ii)**. Vital capacity and tidal volume were the most common incorrect responses offered and reference to spirometer was also seen by examiners which suggested that candidates had confused the equipment being used in this instance.

Q6(a)(iii) and **6(a)(iv)** were both well answered by most candidates but few achieved two marks for part **6(b)**. Many candidates gained marking point one but very few went on to discuss haemoglobin to gain credit for marking point two.

F222 Growth, Development and Disease

General Comments:

Some excellent answers were seen and those candidates who had thoroughly researched the pre-release material performed well. **A03** questions proved a challenge for many candidates on this paper but the free response answers were accessible to the majority of candidates, and discriminated well. Most candidates focussed their answers on the command words and did not just describe when the question required explanation.

The weaker candidates wrote un-developed answers, and used non-scientific terms. Several candidates did not always refer to the information, diagrams, graphs or figures included in the questions to support their answers. However, the stronger candidates had a clear grasp of the questions and developed their answers using the correct scientific terminology, and used precise supporting data where appropriate.

Comments on Individual Questions:

Q1. This question was based on the pre-release material, and tested a range of abilities. Candidates achieved higher marks if they had thoroughly researched the material provided. This question assessed **A01**, and **AO2** skills.

a) Most students correctly identified the name of the Mantoux test and knew that material was injected under the skin. Some candidates failed to specify that it was TB antigens or tuberculin which were injected, rather than just the bacteria. Most knew the result of the test but did not specify the correct time scale. Few candidates identified that it was the size/measurement of the swelling that identified a positive result. X-rays and blood tests were incorrectly identified as the test.

b) (i) Most candidates knew the definition of an endemic disease. Several candidates talked about a rapid spread rather than a sudden increase in number of cases for an epidemic, and a few talked about pandemics.

b) (ii) Most candidates correctly stated overcrowding as a cause of rapid spread. Poor access to health care, or a description, was also a common correct answer. Poor hygiene was often unqualified or incorrectly qualified as 'poor sanitation or drinking water' rather than the idea of spread due to coughing/sneezing. Lack of education was ignored as it is not generally considered to be a major factor in the spread of a droplet transmitted disease such as TB.

c) This question proved to be accessible to most candidates.

d) Most candidates identified that HIV weakens the immune system, but then did not focus on the 'explain' command word to develop their answer further. Some candidates identified that T cells were infected but were not precise about the infection of T helper cells. Very few candidates identified the consequence of fewer T helper cells either on stimulation of other cells on the consequence for antibody production as a result of this.

e) This question was answered relatively well and most candidates could describe the increased likelihood of an infected person meeting a susceptible one due to lack of herd immunity. A few candidates misinterpreted the question and related this to primary and secondary immune response.

f) Most candidates knew that HIV mutates very often, and could relate that to a change in antigen shape. Some referred to the antigens mutating rather than the virus, or were not precise in their description of why a vaccine against one strain would be ineffective against a mutated strain.

g) This question was accessible to most candidates.

Q2 This question was based on the pre-release material, and tested a range of abilities. Candidates achieved higher marks if they had thoroughly researched the material provided. This question assessed **A01**, **AO2 and AO3** skills.

a) (i) Most candidates gained this mark, but a minority confused it with the idea that the species was extinct.

a) (ii) Candidates found this question challenging. Candidates who understood the concept scored well but some confused it with mapping the genome of the plant. They did not clearly express the idea of comparing the barcode of the plant with known medical properties with others, and barcode similarities showing the possibility of the test plant having similar medicinal properties.

b) Many candidates gave the imprecise answer of aspirin 'thinning the blood' rather than reducing clotting. Few mentioned the effect on platelets. A common error was to describe the analgesic properties of aspirin as the most beneficial.

c) (i) This was generally well answered. Some candidates confused aromatherapy with chemotherapy or immunotherapy.

c) (ii) A common mistake was to state that this treatment would not work as well against cancer, rather than it wouldn't work at all. Comments such as 'these give false hope' were not credited. Candidates mistakenly think that plants are 'harvested' to obtain medicine so endangering plant species.

d) Candidates often scored well on this question, and knew about the effect of carbon monoxide on haemoglobin and its subsequent effects. Some candidates quoted the effects of alcohol abuse rather than smoking, or quoted the general effects of smoking (on adult lungs) and assumed this would apply to the fetus also.

e) Most candidates knew that the minerals were iron and calcium. A few candidates quoted Vitamin D instead of calcium, or ignored the rubric and offered two suggestions. Most knew the function of phosphates, but some thought they were required for protein synthesis.

f) Most candidates restated the information in the stem of the question that the folk medicine was known to have an effect, and then failed to develop their answer to give a consequence of this. Some felt that the fact they had been used already made them completely safe, rather than knowing what the possible side effects were, or that they needed no further testing.

Q3 This question equally addressed **AO1** and **AO2**, and had some elements of **AO3**.

a) (i) Very few candidates knew how to correctly calculate % increase. Some candidates could correctly work out the difference in risk, but then often divided by the incorrect denominator.

a) (ii) Candidates who focussed on the command word 'explain' in the question scored well in this question, explaining how increased smoking led to more exposure to carcinogens, leading to the increased mutation risk. Some candidates just gave a description of the trend which failed to gain credit.

a) (iii) Candidates who carefully considered the data and its meaning often scored both marks, recognising that the data for those smoking less than 20 years, or for 40 - 49 years, did not support the statement, whereas the data for those who smoked for 50+ years (for example) did.

b) Candidates' answers about the development of chronic bronchitis were good, but several failed to develop their ideas to explain the effect of the symptoms on gas exchange. Some candidates incorrectly referred to a reduced diffusion gradient rather than a reduced concentration gradient. Some candidates also answered in terms of carbon monoxide and nicotine which were not relevant here. Imprecise answers failed to credit, eg talking about a reduction in the bronchi, rather than a reduction in the diameter of the bronchi. Several candidates went on to describe the symptoms and effects of emphysema, which was not relevant here.

Q4 This question had elements of **AO2** and **AO3**, but mainly addressed **AO1**.

a) Most candidates knew that meiosis resulted in genetic variation, and many knew it formed haploid cells, and gametes. Some realised that this was important in maintaining the diploid chromosome number at fertilisation.

b) Most candidates gave the correct answer (anaphase), with metaphase being the most frequent incorrect response.

c) (i) Most candidates often commented on the decrease in growth rate but failed to qualify it with reference to the size or timescale.

c) (ii) In this question and ages and growth rates were quoted accurately from the graph.

c) (iii) This was well answered, although some students incorrectly believed that this would make them taller due to the continued longer growth rate at 18 years.

d) Some candidates believed that ultrasound could be used to diagnose Turner's syndrome either by measurement or features, rather than it being used to identify the position of the foetus and placenta to correctly guide the amniocentesis needle. Most candidates failed to identify that foetal cells are extracted with the fluid. Most candidates offered a description of the preparation of chromosomes for analysis, rather than stating how the karyotype was used for diagnosis.

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

a) This was well answered. The most common answer was biconcave disc shape.

b) Candidates often failed to score due to not clearly stating that they could differentiate into limited **types** of cells. They would make statements like "can only differentiate into a few cells" without reference to the type of cells.

c) Candidates scored marks in this question but found it difficult to access the full range of marks due to not fully developing their answers or using imprecise statements. Most candidates talked about stem cells undergoing differentiation, but didn't explain about mitosis or gene switching. Few could give a correct definition of a tissue or organ as groups of cells or tissues working together. Where candidates had read the QWC guidance, they often gained credit but several discussed lymphatic system development, instead of nervous and reproductive systems.

d) Candidates often confused proto-oncogenes with tumour suppressor genes. An example of a proto-oncogene is the Ras proto-oncogene, which is quite different from the tumour suppressor gene p53. Most candidates gained marks for identifying the consequence of uncontrolled cell division. The best candidates could describe the role of a proto-oncogene in control of the cell cycle and how that changes when it mutates to an oncogene.

e) (i) Most candidates gave the correct answer of programmed cell death. Some candidates failed to score because they did not indicate that the cell death was controlled or triggered, or used the term 'cell suicide' which is not appropriate scientific language at GCE level.

e) (ii) This question was well answered by the majority of candidates. A minority of candidates talked about removing damaged cells, or menstruation which is not appropriate as the question is in the context of a foetus.

Q6 This question mainly addressed **AO3** but had some elements of **AO1** and **AO2**.

a) Most candidates gained marks for referring to 'calling 999'. Some were not specific about sitting the person down with knees bent (W position), and wrote about lying them down or putting in the recovery position. Whilst candidates did comment on about checking if the person had medication, they did not specify that the medication was for a heart condition. A minority of candidates wanted to give CPR or defibrillate, and clearly had not read the question correctly.

b) (i) The graph presented the data on a grid and it is therefore expected that candidates should quote the data with a reasonable degree of accuracy, including correct units. Candidates failed to gain credit for data quotes which began 'around …' or 'just above (or below) ….'. The figures quoted by candidates were often inaccurate or imprecise.

b) (ii) This question was accessible to most candidates.

c) This was well answered by the majority of candidates, although some did not read the question carefully (set in the context of after the transplant had occurred), and wrote about waiting times or lack of donors.

Q7 This question also mainly addressed **AO3** but had some elements of **AO1** and **AO2**

a) This question was set in the context of energy balance, but most candidates just gave answers in terms of high fat diets leading to obesity. Some wrongly answered in the context of developing diabetes.

b) (i) The graph here also presented the data on a suitable grid and it is therefore expected that candidates should quote the data with a reasonable degree of accuracy, including correct units. Many candidates did well on this question if they quoted data appropriately in support of the statements made. Candidates failed to gain marks if they did not identify the correct trend, misquoted data or failed to specify a time scale.

b) (ii) Some candidates were just repeating material about clinical trials without looking at the question context. Several seemed to believe that it was better to cause harm to only a small group of volunteers.

b) (iii) This was usually well answered. Some candidates were not specific about cutting down on certain food groups or made imprecise statements about eating 'the right amounts' of named nutrients.

c) (i) Candidates failed to appreciate the difference between checking to see if blood glucose was too high or too low (which was what was required), and ensuring it didn't get too high or too low(which is what they were saying, implying a control mechanism) . Some candidates were not specific about the direction of blood glucose concentration (too high/too low) and the correct consequence. A good analogy would be that a thermometer tells you what the temperature is so you know if it is changing, but the water bath keeps it constant. There were too many 'water bath' answers, and not enough 'thermometer' answers.

c) (ii) Most candidates gained a mark for 'enzyme, and several for 'oxidase' or 'dehydrogenase'. Gluconolactone was often incorrectly spelled. Very few candidates identified the transducer.

F223 Practical Skills 1

General Comments:

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

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

Due to a cross examination board decision made by OFQUAL the tolerance for F223 was reduced this year to 2 marks out of 40 and adjustment is back to zero. Hence a difference of +/- 2 marks between the centre mark and moderator mark will remain in tolerance with no adjustments. However, a difference of +/-3 will potentially trigger an adjustment to the all 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. As a result of this change in tolerance more centres were found to have an invalid order of merit after the work had been moderated. This resulted in the work being returned to centres for a remark including some centres who had been unadjusted for many previous sessions (see later).

Feedback on clerical/organisation issues:
As with previous sessions, there was an increase in the number of centres with clerical errors and again these fell into 4 main categories:
- incorrect addition of marks within the task
- transcription errors from the question to the front cover (leading to an incorrect total on the script)
- addition errors across the three tasks
- transcription errors from the task paper to the coversheet and/or onto the MS1.

Other administration errors were also more common this year including:
- failure to send all three tasks for one or more candidates within the sample
- failure to send the correct tasks for one or more candidates
- sending inappropriate tasks for moderation.

Feedback on marking
Some common errors in marking were found across the tasks and can be summarised as follows:
- some marking points require comparative statements to be made; marks were often credited for single isolated comments
- symbols for the units on graphs were commonly overlooked
- scales on graphs must be equidistant and plots accurate to +/- half a 2mm square
- some mark points require two parts of an answer to gain one mark; this occasionally led to clerical errors where two marks were credited instead of one mark
- only marking points on the mark scheme can be awarded; all tasks are trialled and reviewed prior to publication and they are scrutinised thoroughly and hence only points on the mark scheme can gain credit (to ensure parity between centres)

Internal moderation is an OCR requirement but this was not always evident in the samples seen at the moderation stage.

Request to remark coursework

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

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

Candidates who wish to resubmit work for F223

Tasks **must not** be repeated, at any time by any candidate. If a candidate wishes to resit 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** resit a task from any previous session to enable them to improve on previous performance. If the same Task is available over two consecutive years, a student cannot repeat the same Task, eg if the same Evaluative Task is offered in 2011/2012 and in 2012/2013 a student must **not** repeat that same Evaluative Task in 2012/2013.

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

- candidate does **not** receive their work back **nor** make any amendments to the work
- the 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 student may have performed well in their Quantitative and Evaluative Tasks in June 2013 and re-submit them along with a 'new' Qualitative Task in June 2014. It is recommended that the re-submitted Tasks are reviewed in light of any comments from the original moderation and re-marked if necessary according to the original Mark Scheme.

Centres should retain Tasks securely until it is clear that candidates do not wish to re-submit work to OCR in future sessions. The work must **not** be handed back to the candidates. All work should be securely destroyed when no longer required by the centre.

Training candidates

Under **no** circumstances can any candidate see the task or mark scheme ahead of completing the task. The task should be undertaken in highly controlled conditions. On occasions where the answers of candidates appears to "match" to the wording, phrasing and order of mark schemes the work will be raised as a suspected malpractice and investigated.   This also applies to centres where excessive coaching is suspected to have taken place.

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

- how to complete microscope drawings – differences between low power plans and high power diagrams
- how to draw up appropriate tables for both qualitative and quantitative data
- how to construct an appropriate graph to present the raw/processed data
- differences in key terminology such as accuracy vs precision vs reliability and also the differences between limitations and errors.

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

Remoderation requests
Any queries with marks awarded **this** session (June 2014) should be raised through the results enquiry service (details are available from OCR Interchange). A centre may apply for a re-moderation of coursework in accordance with procedures set out in OCR's Results Enquiry Service.

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

1   Using the coursework enquiry form which is available from the OCR website: http://www.ocr.org.uk/Data/publications/forms/GCW264i_AS_A_Level_GCE_Human_Biology_Units_F223_F226_Coursework_Enquiry_Form.pdf
This form should be completed and sent to OCR at the address stated. This service is free of charge and can be used for guidance and feedback on the accuracy of marking tasks ahead of the submission of marks for moderation. For example, centres can send in photocopies of up to 3 students' work for (each) separate task and gain feedback on the accuracy of marking which can be useful ahead of internal moderation within the centre, or indeed before the submission of final marks to OCR.

2   Contacting OCR via email
Centres can contact OCR through email at OCR.GCEScienceTasks@ocr.org.uk
Centres should clearly state the following information
- Centre number
- Specification and unit
- Personal contact details (name, position and email address)
- Task and category concerned eg milk, qualitative
- Specific details of the enquiry (see below)

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

Areas in which centres may wish to use this service may include:
- clarifying details of the practical task eg procedure
- requesting permission from OCR to make ***minor*** changes to the procedure (please note that permission should be sought before the task is completed as in 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 6 weeks for OCR to respond and hence submit the work in plenty of time ahead of the 15th May.

Comments on individual tasks:

Qualitative1
The Task is a straightforward exercise in the use of serial dilutions and to test for the presence of proteins from blood plasma. Most candidates were able to complete the analysis and interpretation of results. Some candidates were unable to produce correctly structured tables. In part 2 of the Task, candidates are expected to correctly refer to data that they had collected. Some were unable to do this to an effective level and did not refer to raw data when *asked to do so.*

Qualitative 2
Aseptic technique and diagnostic testing of bacterial cultures was assessed in this Task. Again candidates were required to construct a suitable table to record their observations; most did this well though some did not give informative column headings. Candidates were required to use their observations to draw conclusions in part 2.

Qualitative 3
Observations using a microscope and drawing skills were assessed in this Task. Question 1 required accurate drawing of a specified number of cells, a significant number of candidates were unable to produce diagrams of adequate quality to gain the single mark for that Box 1. Candidates were required to annotate their drawing of the microscope slide in Box 1; it was clear that many candidates did not understand the difference between a label and an annotation. Candidates also lost marks for failing to state an appropriate magnification. Markers must ensure that on occasions where more than one bullet point is required to gain just one mark, both have been covered; Q3 was an example of this where two elements had to be present.

Quantitative 1
This is the first Task where osmosis is at the centre of the exercise. The majority of candidates were able to complete the Task adequately, but a number did not obtain the expected trend and lost the skilful practice mark. There were several occasions where the processing of data had not been checked by the marker; resulting in differences between centre and moderator marks. Q2 required a graph to be drawn; again candidates were often incorrectly given credit when the **plot** area covered less than 50%. Care must be taken by candidates (and markers alike) that the appropriate symbol is used for the relevant units eg 'min' (not mins), 's' (not sec, *secs, seconds).*

Quantitative 2
Osmosis in erythrocytes was generally a very successful exercise. Most candidates obtained the expected results and were able to complete the exercise without difficulty. Some candidates failed to use the term 'mean' (instead of average) when labelling axis. In part 2 there was less success where candidates were asked to make comparative comments between the means for the different solutions. Three simple statements of the different means gained no credit.

Quantitative 3
This task looked at the coagulation of milk proteins in the presence of calcium ions. Several candidates failed to gain the skilful practice mark as a plateau was observed by some candidates. Graphs were produced to a mixed standard with common errors being inappropriate symbols for units, inaccurate plotting, inappropriate use of the graph paper, and inappropriate trend lines. In part 2 candidates must ensure they refer to raw data (less/more) when asked to do so and not refer to rates (ie faster/slower/quicker).

Evaluative 1
This Task followed on from Quantitative 1 being an extension of the study of the effect of intracellular ion concentrations on model cells. Q1 was not always answered well with candidates failing to refer to mean mass, the effect over the entire duration of the task and also not making comparative comments. In Q3a marks were awarded frequently for answers which did not address the whole mark point. On occasions questions require more than one response before a mark could be credited eg Q4b(ii) bullet point 2.

Evaluative 2
This is the follow-on Task developing Quantitative 2. Questions 2, 5, 8b and 9 were particularly prone to being credited when the complete sense of the marking points was missing. Centres must ensure that specific terminology is used where specified eg Q2 (all mp), Q5 (mp2 and 3).

Evaluative 3
This Task followed on from Quantitative 3 and was generally well done by many candidates. Questions 1 and 7 were often not correctly marked with incomplete marking points being credited. Q2 was misinterpreted by several centres: candidates were asked to identify one data entry mistake and one calculation error. The 'accept' comments in the additional guidance column was only relevant to M1/V1 (as indicated by being in line with these mark points). Few candidates gained full marks on this question. Q7 required the candidates to refer to validity of the statement in all mps except mp1; this was often not the case. With the marking tolerance now set by Ofqual at +/- 2 for the unit, errors in Q1,2 and 7 had some unfortunate outcomes.

F224 Energy, Reproduction and Populations

General Comments:

A lot of very good responses were seen by examiners, particularly concerning the Nitrogen Cycle. The biochemistry questions continue to prove challenging for many candidates.

Candidates, particularly at A2, must be able to both recall and use information.

More instruction should be given by centres with regard to reading questions more carefully and making sure that candidates are responding to what is actually being asked of them.

The best responses addressed the specific question asked and considered all aspects of the question in a relevant way.

Comments on Individual Questions:

Question No.1 covered various aspects of pregnancy focusing on the involvement of the placenta. The question was mix of **AO1** and **AO2**.

In part **(a)** most candidates could explain the meaning of term organ but were unable to give examples of any tissues in the placenta.

It was not that uncommon to see endothelium in place of endometrium in part **(b).**

The majority of candidates answered part **(c)** correctly as multiple pregnancy. One candidate suggested expensive as the answer but could not been given a mark.

The information needed to answer parts **(e)(i)** and **(ii)** was present within the stem of the question but many candidates failed to analyse the question correctly and draw this information out. Part **(e)(iii)** was meant to be a stretch and challenge question. Many candidates appreciated there was only one placenta, few managed to link this fact to a higher oxygen demand with increasing growth or development of the embryos. Candidates who gained this marking point gained it largely on the basis of the umbilical cord being tangled.

Question No.2 encompassed both the social and biological implications of developing 'brownfield sites'. Both in terms of meeting the needs of increasing population numbers and the effects of this development and measures taken to counteract these effects. Previous re-colonisation of the sites by vegetation and concentration of soil nutrients was also covered. This question tested **AO2** primarily.

In part **(b)** many Candidates showed a good knowledge of the bacterial species involved in nitrification and gained two of the four possible marking points. The majority of candidates failed to make the link between the nitrogen compounds within the decaying mosses and lichens and the formation of ammonia. The QWC mark was usually awarded indicating the correct use of technical terms by most candidates.

The idea that trees use up CO_2 was appreciated by most candidates in part **(d).** Although many candidates did not link it to its use in photosynthesis. Offsetting or overall reduction in atmospheric did not seem to be fully understood. Many statements were too vague such as trees 'reducing the CO_2 in the atmosphere'. Answers focusing on reduction in food miles or fuel use appeared less often but although always not precisely stated there was an understanding of the advantages of using local produce.

Question No.3 required an understanding of the links between photosynthesis and respiration. Both in terms of both the reactants involved and their locations. The role of ATP in the release of energy for biological processes was also covered. Candidates generally found this question challenging. It tested **AO1** throughout.

The location of the chloroplast caused a lot of problems in **(a).** Stroma was a commonly given incorrectly as though the candidate was locating it within the cell rather than the tissue. In many cases where the palisade layer was identified the candidate lost the mark for placing the chloroplast within a cell rather than tissue.

Most candidates knew the gases, and got them the right way round, in part **(b)(i),** but only the better candidates worked out that the substance was water in part **(b)(ii).** ADP was answered correctly by almost all candidates.

A large number of candidates placed the enzymes outside of both organelles in **(c),** not appreciating the significance of the enzyme reactions and their locations.

The common error in **(d)** was the suggestion of either NADP or NADPH.

Correct answers for **(e)** focused mainly on the regeneration of ATP or its use as an immediate energy source. Many candidates are still losing marks for stating energy is 'produced'.

Question No.4 required an understanding of the interaction between the different proteins involved in muscle contraction and how a genetic mutation can bring about changes in a protein (dystrophin). An explanation of the consequent effects of this mutation was then required. The reason for lack of detection of the condition by amniocentesis or CVS was also tested.

There were some very good answers to part **(b)** but others failed to remember all the details or a detailed description of the interchanges between actin, myosin and the binding of calcium to troponin. Many candidates knew that the sarcomere shortens even if they didn't know anything else. There seemed to be a lot of confusion between lines, zones and bands, but many managed to get the QWC mark anyway.

Many answers to **(d)(i)** failed to score marking points due to a systematic lack of detail in each stage involved. Many answers 'jumped' from a gene mutation (without the detail of specific possible changes in DNA) to a change in an amino acid or change in protein shape. All the marking points appeared in various answers but few scored beyond three marking points due to missing out necessary detail. Although many candidates related the failure to relax in part **(d)** to the continued release of calcium ions rather than their lack of reabsorption, many had a good understanding of the reason for the failure to relax in terms of myosin remaining bound to actin, and also that calcium ions remain bound to troponin.

Question No.5 required an understanding of respiratory substrates as energy sources in terms of their RQ value. The measurement and variables that need to be taken into account in a named investigation was also tested. The reason for the breakdown of fats aerobically and the method used by athletes preparing for a sporting event also needed to be explained and described.

In part **(a)** either the substance was broken down or energy was released, the two were often not linked. Many candidates also lost marks for stating that energy was produced as a consequence. The majority gaining marks gained them for stating that ATP was produced as a result of the breakdown.

There were rarely incorrect figures given in part **(b)** but a lot of candidates made errors with the decimal places therefore losing a mark.

A large number of Candidates gave respirometer in answer to **(c)(i).** It needs stressing to candidates that respiration is not the same as breathing. Very few candidates suggested proteins as an additional possible substrate in **(c)(ii).**

Many candidates struggled and seemed to find part **(d)(i)** hard and few seemed aware that fats contained a large number of hydrogen atoms, or the involvement of oxygen in the formation of water. Some of the more able candidates recognised the fact that oxygen was a terminal hydrogen ion acceptor even if they did not make the earlier links. Most candidates knew that glycogen was the carbohydrate storage compound in part **(d)(ii),** and that carbohydrate depletion should be followed by carbohydrate loading within specified time limits. Unfortunately many candidates lost a marking point, as they did not distinguish between the two stages putting the whole procedure under the description of carbohydrate loading.

Question No.6 was about the effects of cryopreservation and subsequent thawing on the viability of sperm samples obtained from the semen of bulls. This was a data question and data was provided for candidates to assess both the effects of cryopreservation on viability and if there was a significant difference between samples.

Most candidates were aware of mitochondrial membranes being damaged with the more able ones also being aware of the acrosome membrane in part **(a).**

Very few candidates answered **(b)(i)** correctly, they needed to relate the effect of cryopreservation on the viability of sperm. Many described the extent of membrane damage or compared samples without even using the term viability in their answer. Part **(b)(ii)** involved a straightforward consideration of mean values and/or consideration of the spread of data related to the standard deviation values to assess if there was a significant difference between the two samples. Candidates who appreciated this managed a clear concise answer, but there were those who did not seem to be aware of what was needed. Those who quoted data from the sperm fluorescing green failed to score the marking point.

F225 Genetics, Control and Ageing

General Comments:

The overall performance by candidates on the paper was in line with previous years although many found the data response questions challenging. Many otherwise excellent candidates failed to gain marks through misreading the question stem and this was particularly so in Question 2b. The quality of the spelling and grammar was very variable and some candidates clearly struggled to express their ideas. Again, this was particularly the case in Question 2b with 'glycogen' and 'glucagon' being confused but perhaps more surprising was the confusion in Question 1(b)(i) between the terms autonomic and automatic with respect to reflexes. Similar problems were seen in Question 3 (b)(ii) where candidates did not make the distinction between sickle cell anaemia, sickle cell trait and the sickle cell allele.

The calculation in Question 1 (c)(iii) was done well but few candidates took the opportunity to use data correctly to support their answer in Questions 4(b)(ii) and 6b(i).

Most candidates completed the paper suggesting that the time allowance was sufficient although, as in previous sessions, candidates would have benefitted more by using the additional time allowance on A2 papers thinking about the question prior to writing down their response.

Comments on Individual Questions:

Question No. 1
Parts (a) and (d) addressed **A01** criteria with the remained of the questions addressing **A02**.

Question **1 (a)** was accessibly to most candidates with the commonest mistake being to confuse the spinal cord with the medulla or to confuse the cerebellum with the cerebrum. Phonetic spellings were accepted but these had to be unambiguous.

In **(b)(i)** a surprising number of candidates stated that reflex tests were assessing the autonomic nervous system - a mix-up between the terms automatic and autonomic. Some candidates confused reflex tests with Nerve Conduction Velocity testing.

Part **(b)(ii)** was an **AO2** question testing the candidates' knowledge of the functions of different parts of the brain. The commonest incorrect answer was cerebellum with other answers such as 'cortex' or 'left side' failing to score as they were too imprecise.

Most candidates stated that plasmin was an enzyme but very few could state that it was fibrin that was broken down. A common misconception was that the blood clot fitted into the active site of the enzyme indicating a failure to grasp the relative sizes of cells and molecules which has been an issues in previous exam sessions.

In **(b)(ii)** where candidates correctly stated a 'eukaryotic' cell then they invariably went on to explain why and scored both marks. Texts frequently give examples of commonly used eukaryotic cell lines such as Chinese Hamster Ovary cells which probably explains why several candidates gave an 'ovum' incorrectly as an example.

In **(b)(iii)** the calculation was done well with the majority of candidates stating the correct answer to the required degree of precision. Part **(iv)** asked them to interpret this answer and was synoptic to F222. A common mistake was to state that a BMI of 33 meant that the person was overweight rather than obese but otherwise this question was done well.

Part **(d)(i)** was another example where candidates inability to express themselves well led to a mark being lost. Some candidates misinterpreted the 'short term' idea as a memory loss which was only temporary and which would be restored in the near future. Most candidates were able to suggest two techniques although vague description such as 'play games' were not credited. It was gratifying to see responses which referred to cognitive therapy and to the 'loci' method where patients link events or people to specific objects.

Question No. 2
This question was almost entirely **AO1** but did contain marks which were synoptic with F221 (cell structure) and F224 (protein synthesis).

Most candidates correctly identified the Islets of Langerhans in **(a)(i)** from the photomicrograph. A failure to gain credit usually resulted from either an imprecise answer ('endocrine tissue') or confusion with the glomerulus despite the question clearly being about the pancreas. In **(a)(ii)** again most candidates correctly stated beta cells.

In part **2(b),** several candidates answered the question in terms of homeostasis and wrote excellent answers to a question which had not been asked. In terms of homeostasis, a surprising number of candidates still believe that the alpha and beta cells are regulated by the hypothalamus and the pituitary. For those candidates who did attempt to address the question recurring errors included using the terms 'transcription' and 'translation' as if they were interchangeable, describing exocytosis as the release of vesicles into the blood stream and using the term 'active transport' to describe exocytosis. Examiners were happy to credit the link between mitochondria and use of ATP for exocytosis as ATP would be required, for example, to move vesicles to the cell surface membrane. However, the term 'active transport' is reserved for transmembrane transport which requires a specific ATP- driven protein 'pump' - a different form of transport to exocytosis. As stated in the introduction, too many candidates wrote about the release of glycogen or glucogen from alpha cells.

Question No. 3
This question addressed both **AO1** and **AO2**.

Part **(a)** was done well although some candidates did not appreciate the significance of the term 'allele' in the question and gave answers which included Down's, Turner's or Klinefelter's. Very astute candidates gave familial glycosuria as an answer and this was credited. Hunter's syndrome was given as a response. This is a genetic disease and was credited although it was possibly an error on the part of the candidate. The question asked for two diseases to be stated rather than named so PKU was acceptable as were phonetic spellings although they needed to be approaching 'phenylketonuria'.

Part **(b)(i)** was synoptic with F222 and relatively few candidates gained a mark here with most confusing the term endemic with pandemic or epidemic.

In **(b)(ii),** few candidates used the idea of malaria acting as a selection pressure and many candidates were not specific enough in describing the heterozygotes or those with the sickle cell trait having the advantage in terms of survival where malaria is present. Some candidates had clearly not covered the learning outcome in F225 and answered in terms of high birth rates and poverty in these regions meaning access to health care was not available.

In **(c)(i)** a surprising number of candidates wrote about the gene not being incorporated into the sex chromosome or seemed to confuse autosomal chromosomes with somatic cells, for example 'Only targets ordinary cells because these are controlled by autosomal chromosomes not sex chromosomes'.

In **(c)(ii)** some candidates did not focus on the idea of getting the DNA into the cell and answered in terms of getting the DNA into the body and protecting it from an immune response. The idea of endocytosis was picked up by good candidates but without explaining why the nature of DNA made this necessary.

In **(d)(i)** the examiners were looking for clear reference to exons and introns and good candidates picked up on this. Some responses were in terms of 'coding' and 'non coding' DNA which missed the point that the question was referring to the DNA within a single gene. A few candidates confused introns and exons with many more answering incorrectly in terms of 'missing' bases because of sticky ends.

In **(d)(ii)** there was much confusion in the use of terminology and the action of enzymes. Many candidates are under the false impression that restriction enzymes cut out a section of the plasmid. Others described the use of a vector to get the gene into the plasmid. A common misunderstanding was that DNA ligase was required for annealing, rather than annealing being a stage which did not require an enzyme with the ligase being used after annealing to form covalent bonds by a condensation reaction to reform the sugar-phosphate 'backbone'. It was clear that many candidates had not thought synoptically about the enzymes involved in genetic engineering and it was very rare to see any reference to condensation reactions (ligase) or hydrolysis reactions (restriction enzymes).

Part **(e)** was a stretch and challenge question and some candidates certainly answered along the right lines - that cells would be dividing and that, as it is not in the genome, the gene would not be replicated and so not passed on to daughter cells. However, careless structuring of responses meant some otherwise excellent candidates referring to the gene not being replicated in mitosis and this could not be credited. Weaker candidates did not read the stem of the question which indicated that the gene was in the cells and answered in terms of the gene being broken down in the body by the immune system.

Part **(f)** was synoptic with F222. The majority of candidates were aware that an immune response would be triggered but many did not address the question stem which was why *repeated* doses were ineffective and good references to the secondary immune response were only rarely seen.

Question No. 4
This question addressed **AO1**, **AO2** and **AO3** objectives.

Part **(a)(i)** was accessible to most candidates although several could not recall the name of the Snellen Chart and some did confuse the visual acuity test with tests for colour blindness or the pupil response test. In **(a)(ii)** it is clear that the role of cone cells in visual acuity is not widely understood with relative few candidates referring to single cone cells being connected to single ganglion cells (in the fovea). The role of the macula as the region where high concentrations of cone cells are found (with the fovea being composed only of cone cells) was not understood with some candidates writing about the macula focussing the lens.

In part **(b)** most candidates were aware of the role of confidence limits and could go on in part **(ii)** to compare the changes between males and females. However, several candidates did not quote data correctly and comments on reliability failed to take into account that the confidence limits diverged with age.   Part **(c)** was aimed at higher candidates and most responses seen did not address the question. Some candidates in part **(i)** clearly appreciated that, to get total numbers would require the population numbers, but then did not relate this to the figures provided where separate graphs for males and females were given. In **(c)(ii)**, again only very able candidates appreciated that the difference in shape was due to the population in the older age groups declining with fewer men being alive than women.

In part **(d)** many candidates could suggest a risk factor with high blood pressure appearing quite commonly. Again, a failure to read carefully the stem of the question meant that the cause of wet AMD (the *growth* of blood vessels) was then not addressed and weaker candidates suggested that high blood pressure meant the blood vessels leaked rather than explain why high blood pressure meant blood vessels would grow in the first place. Some very imaginative answers were seen in the form of high altitude or sickle cell anaemia as factors which increased the risk.

In part **(ii)** some good explanations were seen although some weaker candidates assumed the antibody would engulf the VEGF.

Part **(d)** was done well but in **(e)** the question required candidates to suggest what further information was needed for a valid statement - rather than simply identify a variable that was controlled. So answers such as 'age' required more development....the age might well be known but if the age of the two groups was not the same then the statement would not be valid.

Question No. 5
The majority of this question addressed **AO2** objectives.

In part **(a)** weaker candidates wrote in terms of toxins or waste without referring to metabolic waste. Some candidates wrote that urea was produced in the kidneys. The main reason for not scoring both marks was a failure to address the question which required some idea of the kidney as an organ and not just a definition of excretion. There are a number of 'compound' terms on the specification (eg autosomal linkage) which need to be 'unpicked' during teaching and this was a synoptic question with F221. Parts **(b) (i)** and **(ii)** were accessible to most candidates with the commonest mistake being to confuse the cortex and medulla or to answer 'nephron' for the region in part **(i)** despite the fact that this was given in the question.

Part **(c)(i)** was a good discriminator. Weaker candidates implied that the extra glucose molecules added to the volume. Other candidates contradicted themselves and stated that more water would be reabsorbed but many good candidates could explain the reduction in water potential gradient leading to less water being reabsorbed. In part **(ii)** candidates were expected to identify the role of the counsellor in assessing the risk of children inheriting the condition and advising on the options for family planning. Weaker candidates wrote vague answers about advice on treatment.

Question No. 6
This question addressed **AO1**, **AO2** and **AO3** objectives.

In part **(a)** weaker candidates were unsure what osteoarthritis was and described osteoporosis in terms of brittle or porous bones - neither of which, on their own, were accepted. Part **(b)(i)** required a careful consideration of the data. Weaker candidates re-stated the question and quoted figures without any further comment. In part **(ii),** many candidates were able to explain the high DALY in terms of physical work from an early age. Some candidates implied it was a lifestyle choice to undertake more physical exercise. Others drifted into a discussion of low calcium or vitamin D - forgetting that they were osteoarthritis DALYs not osteoporosis. In part **(iii)** most candidates were aware of the effect of the menopause but fewer went on to link this to differences in the incidence in males and females. Some good references to validity were seen but, as in previous session, a list such as valid, reliable and accurate was not credited.

Question No. 7
This question addressed **AO1** and **AO2** objectives.

While most candidates could identify therapeutic cloning, responses were seen that covered each of the options given with some candidates ticking more than one box. Part **(b)** was accessible although some candidates did make the same point twice regarding the ability to differentiate into a variety of different cells.

Question No. 8
This question addressed **AO1** and **AO2** objectives.

The commonest incorrect responses on part **(a)** were spinal cord or autonomic. Part **(b)(i)** was a stretch and challenge question and required an appreciation on the part of the candidates of the effect of vasodilation on blood pressure and need to maintain blood pressure. In **(b)(ii)** the question required a consequence of vasodilation and sweating whereas weaker candidates replied in terms of other responses to high temperatures. In part **(c),** while many candidates answered this well, some other responses were imprecisely worded in terms of how progestin and oestrogen were taken. The fact that implants release hormones continuously was the most common answer given.

F226 Extended Investigation

General Comments:

This session showed again the amount of time and effort both teacher and candidates alike put in to the deliver, completion and assessment of the F226 unit. The Extended Investigation continues to enable candidates to allow independent work and their development of transferable skills to take on to Higher Education and later employment.

It remains a concern that not all centres make use of the free coursework consultancy service which offers feedback on work which has been completed by the candidates and marked by the teacher. This service provides feedback on the marking of the EI. Such feedback must only be used to inform the teachers on the accuracy of their marking, it must not be given to candidates to enable them to rework their EI. Those centres that had used the service and acted on the feedback given were found to be much less frequently adjusted.

It was also found that Centres who used the OCR marking grids was also more accurate in their interpretation of the descriptors and this too led to more accurate marking and less discrepancies between centre and moderator marks. Centres who were adjusted often awarded a mark when only some elements of the descriptor had been met and not all the elements.

Suitability of investigations:
It remains a significant concern that again for this session the main reason for large scale adjustments was where centres had permitted candidates to undertake investigations which were both inappropriate and categorically not permitted by OCR as stated in the Teacher Support: Extended Investigation Handbook. Investigations that involve the administration of **alcohol**, **caffeine**, **nicotine** and other similar substances to human participants are not permitted. **No** investigation that potentially causes harm to participants should be undertaken (eg exposure to inhaled particulates/air pollution).

It can't be stressed enough that centres are strongly advised to have all proposed titles checked and approved **before** embarking on any work on F226. Any queries should be emailed to OCR.GCEScienceTasks@ocr.org.uk with the centre number and nature of the enquiry made clear in the subject field. Likewise centres are reminded there is **no** requirement for all candidates to carry out investigations on different titles. Indeed, centres who enter all candidates on one topic and factor show greater consistency in marking. It is essential that the investigation is centred on an **A2 learning objective** from either F224 or F225. . Submission of AS centred investigations will fail to enable candidates to access to A3, A4, C3, C4 and C5, as well as reducing the likelihood of meeting other descriptors, and will reduce the overall attainment of the candidate(s).

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

General administration:
There was an improvement in the organisation of the work submitted for moderation this year for which the centres are thanked. For reference, each candidate's work should be sent to the moderator as detailed below:

- all 3 skills for each candidate should be attached using a treasury tag in the top left hand corner of the work
- a completed cover sheet should be attached – clearly stating the candidate number and centre number, 3 skill totals and final total
- if used, a copy of the OCR marking grid should also be included for each candidate.

Please do not send work in individual plastic wallets and hard bound folders as this is unnecessary, hinders the moderation process and infers additional postage costs for the centre.

The sample should then be
- collated in the order as detailed in the sample request email
- accompanied by a Centre Authentication Form – this is compulsory
- a copy of the MS1 must also be sent to the moderator.

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

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

Adjustment to centre marks:
In the main adjustments were due to centres:
- choosing an inappropriate task (see previous comments about title selection)
- misinterpreting the demand and requirements of the descriptors (centres are advised to use the OCR marking grids)
- marking inconsistently across the cohort – again this was more evident in centres where candidates had completed many different investigations.

Any centres who wish to gain more detailed feedback regarding this year's moderation, or proposals for next year, should contact OCR via the coursework consultancy service, available free of charge.

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

a)   Extended Investigation Handbook
     This document is available to download from the OCR website and provides detailed guidance about all aspects of F226.

b) Email support
Centres can seek further advice on the implementation and marking of the Extended Investigation in future sessions by e-mailing OCR.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. This service can be used for enquiries such as:
- Title approval
- Descriptor clarification
- Marking guidance

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

Comments on individual skills:

Centres are strongly recommended to use the marking grids available from OCR. On several descriptors there are several elements which must all be met in full before the descriptor can be supported for a mark. In many cases marks were awarded for incomplete descriptors.

Descriptors which continue to be a cause for differences between moderator and centre marks are listed below:

Skill A
A1 requires the scientifically valid question to be based on an A2 learning outcome and expanded within the aim. The question must not just be posed as the title of the investigation.

A3 requires the **use of** detailed, relevant scientific knowledge and understanding from Unit F221 and /or F222 to justify the stated question and /or prediction. The theory must be from F221 or F222 and a suitable number of key AS terms used. The common error here is to credit page(s) of unlinked theory which is not **used** to justify the prediction (ie the candidates only provides segregated theory).

A4 is the same as A3 except the theory and standard must be at A2 and be taken from F224 and/or F225.

A10 requires the candidates to describe, in detail, a strategy for collecting precise and accurate data. The strategy must show all of the following:
- sufficient detail to allow replication by the candidate
- clearly state how precise data will be collected
- clearly state how accurate data will be collected
- highlight area(s) for care and/or speed needed
- **details of how limitations and sources of error will be minimised**
- and state how key factors will be controlled/regulated

Centres are reminded that it is a requirement that the Skill A is taken in and checked (ideally marked) by the centre before the candidate(s) embark on the Skill B and C. Under no circumstances can the candidate be given a copy of the marked work back to rework. A photocopy can be given to enable the candidate to implement the Skill B but they cannot make alterations to the Skill A.

Skill B
This skill is a higher attaining skill and one where there is generally closer agreement between the centre and moderator marks. Areas where differences arise are commonly:
- errors in simple and processed data not identified by teacher(s) which are found during the moderation process
- failure by the candidate(s) to identify which acceptable method has been used to determine the presence of any anomalous results
- inappropriate use of symbols for the units on axis in graphs
- inappropriate labels on graph axis eg use of the term 'average' (unacceptable) rather than 'mean'.

Skill C
C3 and C4, as with A3 and A4, require the theory to be used, not just stated. The candidate(s) must use the theory from the appropriate part of the specification to explain their conclusion(s).

C6 requires candidates to comment on the accuracy of the raw data collected by discussing (hence detail is required rather than a statement) at least 2 of the following:
- the percentage error of pieces of equipment (not the just stating the precision of each piece of apparatus) and the effect this has on raw data
- how the raw data has affected the trend line
- how close the raw data is to the line of best fit (NB this is not the same as the closeness of the means to the line of best fit/trend line).

C9 (& C10) requires candidate(s) to explain the effect that one of the significant limitations will have had on the accuracy and/or precision of the raw data collected. This effect needs to be
- quantified eg higher/lower/shorter/longer
- on the **RAW** data (ie not the impact on means and/or rates).

C12 (& C13) requires candidates to explain the effect that one improvement would have on the accuracy and precision of the raw data collected. This must state **how** improvement is likely to bring data points closer to a line of best fit or bring the trend line closer to the predicted trend line.

C14 requires candidates to **comment** on the validity of the outcome of the investigation. This is only expected to be met by the highest ability candidates. Candidates should comment on at least 3 of the following:
- confidence levels in any statistical tests carried out
- the accuracy and precision of the data collected
- the reliability of the strategy and data collected
- sources of error and limitations within the strategy
- reference to appropriate published data.

C15 applies to all three descriptors and must be assessed for the EI as a whole (not just the C skill).

Planning and evaluative skills are, by their nature, more discriminating than the implementing skill. Only the very best candidates are expected to be able to score highly in these skills. Grade E candidates typically may only be able to obtain in the region of 6-7 marks in skills A and C.

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