OCR
RECOGNISING ACHIEVEMENT

GCE

Human Biology

Advanced GCE **A2 H423**

Advanced Subsidiary GCE **AS H023**

Examiners' Reports

June 2011

HX23/R/11

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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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EXAMINERS' REPORTS

Chief Examiner's Report

Overall this session there was clear evidence of improved performance across the written papers and also in the practical skills units. One exception to this was unit F224. Whilst the Principal Examiner felt that this paper was slightly more difficult than in previous sessions, the main issue for candidates seems to have been with the learning outcomes that were not overtly 'Human' in content, such as 4.1.1 (r), 4.2.3 and 4.2.4. This was also seen in F222, with even good candidates not performing well on Q 3 (d), which covered learning outcomes i, j and k in module 2.3.1. Candidates appear to be less comfortable with a non-human context but Centres cannot afford to neglect learning outcomes such as those listed above and must take care not to suggest that they are, in some way, less important. Examiners also noticed poor performance by candidates on questions testing AO3 objectives and this will be discussed in more detail below.

Two units in this session, F221 and F224, had a large number of candidates who were re-taking the examinations. Centres need to be aware that weaker candidates do not necessarily show an improvement in performance when they re-sit units unless extra time has been spent on teaching and learning.

For candidates re-submitting work for F223, Centres need to adhere to the regulations which apply. Careful reading of the Principal Moderator's guidance in this report and the general guidance in the Handbook is essential.

Understanding and answering the questions

The importance of identifying and implementing the command word in a question has been mentioned in previous reports and there was evidence in F221 and F224 that candidates have improved in this respect. Centres are to be congratulated on reinforcing this. The tendency to 'skim read' such that the candidate writes an answer to the question they assume is being asked was still evident in some examinations – particularly in F222, Q2 (c). All papers contained questions where the command word was 'suggest' and the fact that far more of these questions were attempted, indicates that candidates are better prepared to think and to 'have a go'.

The requirement in a question to *compare* two sets of data requires more than just a description of one set of data followed by a description of the other. Examiners are looking for comparative ideas with statements which refer to *both* sets of data, and are looking for similarities as well as differences. This was an issue which was particularly relevant to F225.

A common feature across the units was the lack of precision in the candidates' responses. Examples could be seen in F221, Q3, with candidates being unclear of the difference between an alpha helix and a beta-pleated sheet, and between alpha and beta sub-units in haemoglobin. In F225, Q2, candidates giving imprecise responses of 'calcium' or 'sodium' were not credited, whereas 'potassium *ions*' or 'sodium *ions*' were.

As in previous sessions, key terms and definitions were tested. Again there was evidence that candidates could not state or use terms precisely – particularly on F225, Q3, where far too many candidates seemed totally unfamiliar with the term 'exon'. Classroom strategies such as 'bingo' or 'matching pairs' are as relevant at A level as they are for lower school teaching in developing student skills in this area, and there is much to be said for candidates downloading a copy of the specification and highlighting these as a 'vocabulary check list'.

Dealing with Data

Candidates are expected to describe patterns from graphs and tables in the theory papers and, while many successfully do this, marks are sometimes lost for poor use of data quotes. As mentioned in previous reports, data needs to be quoted accurately from graphs, using appropriate units as described on the axes. Candidates need to be selective in their choice of data rather than quoting figure after figure in the hope of securing the mark for 'data quotes'.

A greater concern is the inability of some candidates to transfer skills gained in the practical units to the theory papers. Each written paper will always contain questions addressing AO3 learning outcomes and candidates are expected to be able to analyse, interpret, explain and evaluate methodology and results. Up to 4 marks were awarded for these skills on F221 and F224, and up to 10 marks on F222 and F225. Types of AO3 questions will include being asked to identify variables, to plan experiments and to interpret data, error bars etc. These were the areas where candidates on F224 and F225 did not score well this session, suggesting that Centres are not reinforcing these skills outside the context of the two practical skills units.

Mathematical Requirement

Calculations of percentage change are still proving to be a challenge for candidates in general. The calculation on F225 proved particularly difficult since a large amount of data was provided and candidates had to select the appropriate figures to manipulate. Yet again there is evidence that many candidates cannot successfully round up or down to the nearest whole number, suggesting that this is another skill which requires much rehearsal in the classroom.

F221 Molecules, Blood and Gaseous Exchange

General Comments

Overall this question paper was well attempted by candidates and yielded a good range of marks. Candidates demonstrated a wide range of ability with stronger candidates able to display their knowledge and gain high marks. This suggested to examiners that centres were continuing the good work in preparing candidates for the contextual format of the questions.

Candidates were able to complete all questions in the time available and most attempted every section; there was little evidence that candidates had insufficient time.

There were no obvious misinterpretations of the rubric and there is evidence that the candidates' understanding of command words such as *describe* and *explain* is improving. Centres should continue to stress to their candidates the importance of correctly interpreting the command words such as *describe*, *explain* and *suggest*. As in previous papers, the word *suggest* is the usual trigger for candidates to display their deductive and 'thinking' skills and knowledge from other parts of the Human Biology specification can be credited here.

Questions that required some knowledge of Biochemistry continue to discriminate between candidates, with less able candidates often showing contradictions in their answers. Q6 (a) was a good example of this and many candidates found it difficult to correctly describe the polar nature of the water molecule.

Comments on Individual Questions

Q1 This was a straightforward start to the question paper and, as expected, it was generally well answered by the majority of candidates who demonstrated a good basic knowledge of cell ultrastructure.

(a) This part of the question was well answered with many candidates achieving the maximum five marks. Examiners noted that some candidates cannot distinguish between the nucleus and nucleolus (B), and the Golgi apparatus (C) was often mistaken for the smooth endoplasmic reticulum (SER). Another common misconception was for structure (E) with examiners seeing ribosomes in place of vesicles or lysosomes.

(b) Generally well answered, although some candidates did not use the diagram to answer this question and gave answers like 'bean shaped nucleus', even if they had correctly identified the leucocyte as a neutrophil. A number of candidates incorrectly identified the type of leucocyte as a monocyte.

(c) **(i)** Although many candidates correctly stated the function of the cellulose cell wall, examiners were disappointed to note that a number of candidates still confuse the cell wall with the cell surface membrane and incorrectly referred to controlling what enters and leaves the cell.

Examiner Tip
Candidates should be encouraged to study the structure of a plant cell in as much detail as an animal cell and learn at least one function of each cell component.

(c) **(ii)** Examiners were looking for answers to include comparative energy demands of the different cell types. Unfortunately, a large number of candidates confused photosynthesis as an alternative for respiration with comments such as "plants don't need mitochondria as they get their energy from chloroplasts".

(iii) This part of the question was well answered with the majority of candidates gaining one mark for correctly stating chloroplasts. Examiners did not feel that stating 'vacuole' was specific enough and credit was only given where candidates had clarified it as 'large' or 'permanent'.

Q2 Overall, this question showed a normal distribution of marks with the more able candidates gaining marks by demonstrating their knowledge of gaseous exchange. Less able candidates gained marks on part 2(a) but found the rest of the question more challenging.

(a) Generally well answered, with many candidates achieving full marks.

(b) This was a relatively difficult question and it was a good discriminator between the more and less able candidates. Good answers discussed relative concentrations of oxygen and carbon dioxide in the alveoli and capillaries and discussed the concept of diffusion. However answers offered by less able candidates often appeared to be statements that they had copied out from part 2(a) of the question. Marking points 3 and 5 were awarded most often although sometimes candidates only gave one half of the mark point eg 'CO_2 diffuses into the alveoli' but failed to state from where.

Examiner Tip
When answering questions on gaseous exchange, candidates should be encouraged to answer in terms of both oxygen ***and*** *carbon dioxide.*

(c) **(i)** Candidates that correctly identified surfactant usually gained both marks for this part of the question. The most common incorrect answer was mucus, which is secreted by goblet cells in the linings of the airways rather than in the alveoli. Occasionally, a candidate would refer to surfactant lowering surface tension without stating 'in the alveoli'.

(ii) In this part of the question, candidates were given the idea of excess fluid in the alveoli and were required to apply this to the effect on both distance and rate of diffusion. A number of good answers were successful in communicating this concept, however many candidates continue to struggle when faced with the application of knowledge to new situations. Few candidates gained both available marks and it was often suggested that the concentration gradient would be reduced or less gas exchange would occur. A few candidates stated that the fluid would block the diffusion pathway so no gas exchange would take place which examiners felt was not worthy of credit.

Q3 The first part of this question examined the ability of candidates to recall the structure of haemoglobin and it was generally well-answered. The question also contained a straightforward calculation, a data-handling exercise and a micrograph for candidates to interpret.

(a) Examiners were generally pleased with the quality of answers for this part of the question and candidates of all abilities, who could successfully recall various aspects of the haemoglobin protein, were able to earn the maximum number of marks available. Candidates not achieving maximum marks were often stating that haemoglobin only has a tertiary structure and did not refer to the fact that haemoglobin has four polypeptide chains. A common misconception seen by examiners was in the description by candidates of the alpha and beta chains of

haemoglobin. These were often confused with the alpha helix and beta-pleated sheets of the protein secondary structure. Also, some candidates described iron as being the prosthetic group itself, rather than being part of the composition of the haem group.

Unfortunately, some candidates appeared to misread the question and described the structure of an erythrocyte, rather than the protein contained within it, despite this being included in the question.

(b) **(i)** Apart from incorrect rounding to two decimal places, there were few problems with this straightforward calculation and the majority of candidates attained both marks for this part of the question.

(ii) In this part of the question, candidates had to use data to suggest a likely cause for the anaemia. The volume of oxygen per gram of haemoglobin was identical in both cases, and examiners were looking for answers which showed that candidates had understood the concept that insufficient haemoglobin was being produced in the patient with anaemia. More able candidates suggested iron deficiency or malfunction in the normal production of erythrocytes as an underlying cause for failing to produce sufficient haemoglobin. They were then able to give the reason as being the lower mass of haemoglobin as shown in the data table. Less able candidates often just reiterated various parts of the data, stating that the anaemia was caused by the fall in volume of oxygen carried without answering the question posed.

(iii) This part of the question was generally well answered. The majority of candidates achieved one mark for stating that there were fewer erythrocytes in smear B and many of those then described the misshapen appearance of the erythrocytes to gain full marks.

Q4 This question was well answered by candidates across the ability range, with a large number of candidates achieving maximum marks.

(a) The majority of candidates were able to correctly name the structures labelled on the diagram. Examiners credited phonetic spellings where possible but unfortunately, candidates who confused terms, for example using "arterio" in place of "atrio" could not be credited.

(b) This part of the question was generally well answered with many candidates attaining full marks. Examiners were also able to award the QWC mark to the majority of candidates for their correct spelling and use of scientific terms. Where candidates understood that this part of the question was about the transfer of electrical impulses across the heart tissue, answers subsequently included correct details about the sequence of events that follow on from the sinoatrial node emitting impulses. A small number incorrectly referred to signals or currents instead of impulses and some candidates confused the sequence of the Bundle of His and the Purkyne fibres. Some of the less able candidates described the cardiac cycle in terms of blood flow and opening / closing of valves which was not credited.

Q5 The first part of this question on First Aid procedures was well answered by the majority of candidates, but few candidates were able to apply their knowledge to the subsequent questions about blood clotting. Only the more able candidates scored well on part **(iv)** of this question which required candidates to apply their knowledge of enzyme action in the context of liver disease.

(a) The vast majority of candidates gained full marks and examiners often saw the full range of marking points available.

(b) **(i)** Generally well answered. The most frequent mistake was with candidates confusing the correct answer prothrombin with thromboplastin.

(ii) Candidates that knew the clotting process correctly identified fibrinogen as the substrate in this case. Examiners could not credit 'fibrogen' which was seen on a number of occasions.

(iii) Only the more able candidates correctly identified calcium ions as being cofactors.

(iv) This part of the question required candidates to apply their knowledge of generic enzyme action to the situation given, in this case, liver disease. Examiners were looking for candidates to make comparisons between normal enzyme action and the relatively lower concentrations of prothrombin and fibrinogen produced by diseased livers. This was a relatively difficult question and few candidates were able to provide a high-scoring answer.

Q6 In this question, parts (a) and (b) caused problems for a large number of candidates. Many candidates could not explain the structure of water and there were many contradictions between the text and the diagram drawn by candidates. However, it was pleasing to see the majority of candidates gaining marks in part (c) for correctly interpreting the diagrams of erythrocytes in varying plasma concentrations.

(a) Candidates were able to gain marks for this part of the question using diagrams that demonstrated the polar nature of the water molecule, and it was pleasing to see a number of candidates using delta symbols with the correct charges next to the hydrogen and oxygen atoms. The most common error was to refer to oxygen or hydrogen atoms as molecules or ions. Some candidates also mixed up the charges or the number of each atom in the water molecule. Examiners did not credit statements which did not refer to the charges within the water molecule as being *slight* or *partial* as this would suggest ionic bonding. A small number of candidates drew phospholipid bilayers and described hydrophobic and hydrophilic molecules, rather than polar ones.

Examiner Tip
Candidates should be encouraged to learn the differences between terms such as atom, ion and molecule. Misconception surrounding the use of key terms is one of the main reasons for candidates failing to gain credit on biochemistry questions and they are often seen to contradict themselves.

(b) Generally, this part of the question was not well answered and candidates often referred incorrectly to the size of the molecules. Many candidates referred to phospholipids rather than lipids. Some candidates were able to state that glucose is polar, but failed to gain credit as they did not go on to say that lipids are not polar.

(c) **(i)** Generally well answered.

(ii) Generally well answered.

(iii) Generally well answered.

(d) **(i)** Generally well answered by the majority of candidates. However, some candidates just stated 'blood loss' or 'had a blood transfusion', which was not specific enough to gain credit.

(ii) Few candidates achieved full marks for this part of the question. Candidates were expected to relate solute concentrations to the effect this has on the water potential of the solution, and subsequently what effect this has on the red blood cells. Examiners reported seeing many vague statements without linking them to either the erythrocytes or the solution. Some candidates referred to water concentration instead of water potential whilst others stated that the solutes would diffuse into or out of the cells rather than water.

A common misconception seen by examiners was candidates referring to erythrocytes denaturing, which made them sound like proteins instead of cells. Examiners did not consider such statements to be worthy of credit for the 'cells not being suitable for use in the body' marking point.

F222 Growth, Development and Disease

General Comments

The question paper was of appropriate level of demand and the performance of the cohort produced a fairly normal distribution of marks. More able candidates were able to display their knowledge using correct scientific terms and attained high marks across a wide range of topics. Less able candidates tended not to read questions properly and confused many scientific terms eg using 'immune' when they meant 'resistant', 'active site' instead of 'receptor site' and 'virus' instead of bacteria. Whilst the less able candidates had areas of relative weakness, yet on a few questions their knowledge was very good, for example questions 1(b), 2(d)(i), 5(a)(i) and 5(b)(ii).

A number of candidates did not respond to the more difficult questions. However, this seemed to be related to specific topics of the specification, which suggests that some candidates were not well prepared.

It was pleasing to note that many candidates had studied the Advance Notice and were able to use the information to produce some good answers to questions 1 and 2.

There was some improvement in the quoting of data and more candidates were able to correctly quote the units when data were given as number of cases per 100 000, as in question 1b. The calculation of percentage difference, however, is still proving difficult for many candidates and teachers should ensure that they are given sufficient opportunity to acquire the necessary mathematical skills.

Many marks were lost by candidates through poor examination technique; for example, filling the answer space by simply rewriting the information in the stem of the question and not including any additional information. This is something that could easily be improved if candidates were encouraged to read through their answers and check that they have answered the actual questions.

Comments on Individual Questions

Q1 This question was based on the case study '**SOYA: GOOD OR BAD FOR YOU**' **(Case Study 1).** This question was designed to be an accessible start to the examination.

(a) Most candidates were able to gain 1 or 2 marks for correctly suggesting two ways of reducing the risk of developing bowel cancer. A few candidates missed these marks by giving answers not specific to bowel cancer.

(b) This data analysis question was answered much better than similar data analysis questions in previous years. Most candidates were able to gain 3 or 4 marks for correctly identifying the main trends in the data and quoting correct figures and units.

(c) Many candidates gained two marks for correctly stating that screening results in bowel cancer being detected earlier and therefore treatment is more successful.

(d) This question, sequencing the stages in the development of bowel cancer in the correct order, proved to be accessible to all abilities but also discriminating. Less able candidates gaining 2 out of 4 marks and the most able gaining 4 out of 4.

(e) Most candidates gained 1 out of 2 marks for suggesting that the age of the men also needed to be controlled. Only a few candidates gained a second mark for suggesting weight or race also needed to be controlled.

(f) There were some good answers to this question describing how isoflavone may compete with insulin for receptor sites because the molecular structure of isoflavone is similar to the structure of insulin.

(g) This question on the importance of essential amino acids and polyunsaturated fatty acids in the growth of healthy tissue was poorly answered. Only the more able candidates gained marks, mainly for stating that essential amino acids cannot be synthesised by the body and are needed to make new proteins. Marks were also awarded for stating that polyunsaturated fatty acids are needed to make phospholipids or triglycerides.

(h) Very few candidates gained a mark for study 1 and many candidates just wrote out the stem of the question. The response to study 2 was better and many candidates were able to suggest that studies on monkeys cannot be applied to human populations because monkeys are genetically different to humans and may respond differently to the soya food.

Q2 This question was based on the case study '**MONITORING INFANT GROWTH**'(**Case Study 2).** This question assessed a variety of skills and proved to be a very good discriminator.

(a) Candidates found this question challenging. The more able candidates correctly described optimal growth as the ideal or healthy growth and the average as the mean or mode. Weaker candidates missed marks by just reusing the terms optimal and average.

(b) **(i)** It was surprising that candidates did not do as well as expected on this question, which asked how a baby's weight can be measured accurately and reliably. More able candidates gained 3 or 4 marks out of 4 for describing in detail how the baby is weighed naked on special scales and that three measurements are made and an average taken of the two closest readings. A few candidates were able to state that the weight was recorded in kg and anomalous results repeated. Weaker candidates did not give specific detail and often described a less accurate method where the mother is weighed with and without the baby in her arms.

(ii) Many candidates gained both marks for correctly stating that height or head circumference could also be used to show infant growth. Quite a few candidates confused infant and fetal growth and gave crown-rump length and bi-parietal diameter which were not credited.

(c) **(i)** Some candidates are still struggling to calculate percentage loss. Only the more able gained both marks for giving the correct answer (8%) to the nearest whole number.

(ii) and **(iii)** Just over half the candidates gave the correct answers of 75^{th} centile and 50kg but quite a few candidates did not understand the questions even though they were based on case study 2 which refers to growth charts. Some candidates lost a mark for failing to give units.

(iv) Only the more able candidates gained two marks for interpreting the question correctly and suggesting that babies fail to gain weight if they are not feeding properly, have been ill, or suffer from a problem which affects growth. Many less able candidates lost marks through misreading the question and referring to bottle and breast feeding.

(d) **(i)** This data analysis question was answered much better than similar questions in previous years. Most candidates were able to gain 3 or 4 marks for correctly describing the pattern of growth and quoting correct figures and units.

(ii) This question was well answered and many candidates gained 2 marks for correctly sketching the relative growth rate curve for girls on the axes showing the relative growth rate curve for boys.

(iii) This question was very poorly answered and only a small number of candidates gained marks for correctly suggesting that absolute relative growth rate curves give a more accurate measure of growth rate because they take account of the starting weight or height.

Q3 This question, on tuberculosis (TB), proved to be challenging. It discriminated well and the more able candidates were able to develop their answers using the correct scientific terms.

(a) Only the more able candidates were able to give the correctly spelt name for the organism that causes TB as *Mycobacterium tuberculosis*.

(b) **(i)** Most candidates only gained 1 out of 3 marks for stating that memory cells or antibodies were responsible for the positive reaction in the Mantoux test. Only the more able candidates were able to go on and explain that tuberculin had acted as the antigen and the memory cells and antibodies were specific to tuberculin and reacted with it causing inflammation.

(ii) This question was poorly understood. However, some of the more able candidates gained the mark for stating that a person who had been vaccinated would also have a positive result.

(iii) This question was also poorly understood. However, some of the more able candidates gained the mark for stating that a person who had AIDS / HIV or a weakened immune system would have a false negative.

(c) This was the first extended answer and required candidates to describe how the organism that causes TB may have evolved to become multidrug resistant. More able candidates gained 6 or more marks out of 8 by correctly describing the events in the correct order. Good answers referred to gene mutations causing the bacteria to become resistant to an antibiotic so that when an antibiotic is used the resistant bacteria survive, multiply and pass on the resistant gene to their offspring. They then went on to state that when a new antibiotic is used the process is repeated. Weaker candidates gained only 2 or 3 marks by failing to give any detail, using the term immune instead of resistant and writing at length about prescribing antibiotics and not completing the course of antibiotics.

(d) **(i)** Many candidates gained 1 mark for stating that seed banks may have a store of plants that are endangered or extinct in the wild. Not many went on to say these plants could be screened for chemicals that may have medicinal properties.

(ii) Some candidates had no idea what was meant by *ex-situ* conservation whereas others were able to describe it accurately as the maintenance of plants or animals outside their natural environment. A few candidates also gained a mark for giving an example of *ex-situ* conservation such as botanical gardens or zoos.

Q4 This question assessed candidates' understanding of the cell cycle, stem cells and differentiation.

(a) **(i)** Most candidates correctly identified the stage in the cell cycle as interphase.

(ii) Many candidates correctly named the processes as growth or synthesis of proteins at G1 and DNA replication at S.

(b) Most candidates suggested that using embryonic stem cells could be seen as destroying a life – this gained one mark. For a second mark, a few candidates went on to state that the embryo was unable to give consent or that there are religious objections to the use of embryos.

(c) **(i)** This was the second extended answer and many of the more able candidates gained 6 or more marks. They were able to describe the process of differentiation as involving genes being switched on or off leading to specialisation of the cells as different proteins were made. They then went on to correctly describe the changes that take place to produce an erythrocyte (becoming smaller, losing the nucleus and mitochondria, becoming biconcave in shape, and containing haemoglobin). Also they were able to describe the changes that take place in the neutrophil (becoming larger, developing a lobed nucleus and cytoplasm becoming granular). A few weaker candidates did not attempt this question and others restricted their answer to erythrocytes and so did not gain the QWC mark. A common error was to describe the nucleus of the neutrophil as bean-shaped.

(ii) Very few candidates were able to suggest why erythrocytes did not live longer than about 120 days. Only the most able referred to the erythrocyte not having a nucleus and therefore not being able to divide or control protein synthesis, thus gaining 1 mark.

Q5 This question proved to be accessible to all and assessed the understanding of the risks associated with the development of coronary heart disease and the effect of exercise on patients with angina.

(a) **(i)** This data analysis question was answered much better than similar questions in previous years. Most candidates were able to gain 3 or 4 marks for correctly describing the effect of age and gender on the risk of dying from coronary heart disease and quoting correct figures and units.

(ii) Many candidates knew the risk factors but put them in the context of more men dying than women so they were not credited with the marks. Very few candidates referred to women being protected from coronary heart disease (CHD) before the menopause as a result of oestrogen secretion.

(b) **(i)** This question asked candidates to explain why people with angina experience pain on exercise. This was only answered well by the more able candidates. They explained that the heart muscle required more oxygen during exercise and that the narrowing of the coronary artery reduced the flow of blood to the heart muscle. They then went on to say how this led to insufficient oxygen being supplied for aerobic respiration. Many less able candidates misinterpreted the question and described the effect of exercise on the cardiovascular system.

(ii) Most candidates gained 3 or 4 out of 4 marks by using the information given to correctly describe the process of angioplasty.

(iii) Many candidates gained both marks for correctly stating that a heart transplant and bypass are two other surgical techniques used to treat CHD.

Q6 This was a straightforward question assessing DNA replication and mistakes that can be made.

(a) Many able candidates gained 4 or more marks out of 5 for this gap-fill describing DNA replication. Some less able candidates only gained 1 or 2 marks and seemed unfamiliar with the correct scientific terms.

(b) **(i)** There were many good answers to this question suggesting why it is not possible to detect mistakes in DNA replication using karyotyping. Most of these answers referred to changed chromosomes being visible in karyotypes but not the changed nucleotides.

(ii) Most candidates were able to name two conditions detected by karyotyping. The most common answers being Turner's, Klinefelters' or Down's syndrome.

F223 Practical Tasks in Human Biology

As with last year there has been a further increase in the number of centres and candidates for unit F223, which is encouraging.

The panel of moderators commended the work and effort that was evident in the scripts submitted for moderation.

As the tasks remain live for the entire 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 2 categories:
- misinterpretation of the published mark schemes
- failure to identify incorrect mathematical answers in candidates' work.

It remains apparent that candidates continue to find the qualitative tasks more demanding than the quantitative tasks, but that the evaluative tasks remain the most challenging, as expected. The tolerance applied by moderators for F223 is 3 marks out of 40. However, centres should note that any adjustment is always back to zero. Hence, a difference of 3 marks between the centre's mark and moderator's mark will remain within tolerance and no scaling will apply, but a difference of 4 will potentially trigger an adjustment to all marks within a centre. This adjustment is mathematically determined, based on the number of candidates outside tolerance and the range of difference between the centre's and moderator's marks.

All centres are requested to take note of the following areas of concern to ensure that the June 2012 session runs more efficiently for both centres and OCR. The report is organised into two sections: Administration and Teacher Guidance.

General Administration

There was also a notable increase in the number of centres with clerical errors. These clerical errors consisted of:

- 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.

Returning work to Centres

During the moderation process, if the moderator's 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. This is usually as a result of one or two candidates' work being marked more leniently than others. Usually this is caused by an accumulation of marking errors which have not been flagged up during internal moderation. When this happens, an invalid order of merit would result if the centre was also judged to be out of tolerance to the extent that the marks needed to be adjusted. Also, the degree of adjustment may be magnified by the one or two candidates that have been

more leniently marked than others. To reduce the impact of this on other candidates, centres may be asked to remark some scripts. Naturally this causes concern, but it is very important that centres do not misunderstand this process as it is intended to benefit as may candidates as possible; challenging the moderation decision at this stage will not affect the outcome. The appropriate procedure is to request a remoderation in due course if deemed necessary. Different Tasks may not be substituted for those candidates since the rule of selecting the highest scoring Tasks no longer applies once a sample has been submitted. Guidance will be provided to the centre to direct teachers to the areas which have led to the discrepancies between the centre's and moderator's marks. However, centres should note that this advice is general advice and not advice for particular candidates/questions, nor should a dialogue between the moderator and centre be expected.

Mark submission and sample requests

1 Submission date

Teachers are reminded that all coursework marking and internal moderation must be completed in good time before the submission of marks (on form MS1 or via EDI) to the Moderator and to OCR by 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 to the moderator as soon as possible to be received by 15 May.

It is beneficial for both OCR and the centre if marks can be submitted by EDI. This ensures that the centre is sent the candidate sample request much sooner and provides more time within the centre for organising and collating the sample.

2 Sample requests

All centres should note that moderation sample requests will be automatically generated once the MS1 or EDI submission has been received and processed. 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.

Submission of the moderation sample

It is essential that the correct materials are sent to the moderator. Details of what is required can be found in the Practical Skills Handbook (as well as in the Chief Examiner's report to Centres June 2010).

The teacher 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. A copy of this form can be downloaded from the following site:

http://www.ocr.org.uk/download/forms/ocr_10868_form_ccs160.pdf

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 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 2010/2011 and in 2011/2012 a student must **not** repeat that same Evaluative Task in 2011/2012.

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 the work is submitted that it has been remarked following the feedback provided by the Moderator's report to the centre.

Centres should also note that a maximum of **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 2011 and can resubmit them along with a 'new' Qualitative Task in June 2012. It is recommended that the resubmitted 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 resubmit 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.

It is important to place a tick in the candidate's text exactly at the point where the marker considers enough has been done to credit the mark. Ticks anywhere else in the text or margins can lead to clerical errors as well as making it difficult for the moderator to understand why marks have been credited. The purpose of annotation is to provide the moderator with guidance as to why the mark was given (or not) by that teacher for that candidate, and this leads to the moderator being more likely to be able to support the mark awarded by the teacher.

The mark scheme has to be applied exactly as it is presented. There is no procedure that permits the addition of extra marking points by a Centre. The rigour of the mark scheme is determined by the Task setters and some apparently correct responses are deliberately excluded because they are not of AS standard. The crediting of good biology which does not answer the question is an easy trap to fall into and great care needs to be exercised in this context. Additional marks must **NOT** be awarded, as it is essential that parity is maintained across the entire national cohort. 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 queries will then be raised with the Principal Moderator. 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 clarifying.

Marking

There were some aspects of the practical skills tasks which generated many candidate errors and centres are advised to ensure that they 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 when making observations for example using the word clear instead of colourless.

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 from the OCR website:

http://www.ocr.org.uk/download/sm/ocr_12826_sm_gce_prac_skills_hb.pdf

Tables which do not fulfil the requirements are unlikely to gain maximum credit. Incorrect units or units repeated in cells of the table need to be avoided. 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.

The specification requires that candidates be taught SI units. All units must be marked exactly as in the mark scheme; for example, Time (mins) will not do instead of Time (min), likewise (secs) in place of (s).

2 Calculations

Centres are reminded 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. A significant contributory cause in the adjustment of marks in some centres was because candidate calculations had not been checked. 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

Several centres were incorrectly awarding marks for lines of best fit which were extended beyond the first and last plot. As no data has been collected in these regions this should not be permitted.

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.

Evaluation Tasks:

This is the area where there tended to be the largest discrepancies between the marks awarded by the centre and those supported by the moderator.

It is imperative to remember that each task can be sat in isolation; as such there is no requirement for a candidate to complete the quantitative task ahead of the evaluative task. The

evaluation task questions, and hence mark schemes, are based solely on the information on the SES sheet. Candidates will not be credited for errors/limitations that they experienced individually as this would be unfair to candidates who have not undertaken the quantitative task. Candidates must be trained to this effect ahead of the evaluation paper.

1 Explanations of findings

There was evidence of these questions being leniently marked in several task areas. It is important that all aspects of a mark point are covered before a mark is awarded. For example if the mark point states 'more substrate particles/ molecules' then the term molecules or particles must be present in the answer. To that end a comment such as '*as the concentration increases there is more substrate'* does **not** get a mark.

2 Evaluation terminology

There was evidence in scripts seen by moderators that many candidates 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 leads to 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 F226. Again, definitions for these terms can be found in the Practical Skills Handbook.

3 Mathematical processing

Mathematical skills are 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, for example, results greater than +/- 2 standard deviations from the mean and results greater than +/- 10% of the mean.

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 (ie no mathematical skill is demonstrated), whereas error bars require that the standard deviation is calculated and then plotted above and below the mean. As with graphs the bars must be plotted with appropriate accuracy (+/- half a small square of the graph paper used).

Queries about tasks

Any enquires regarding the ongoing delivery of F223 (and F226) can be addressed to OCR using the free coursework consultancy service. Centres can receive free advice on future practical skills by contacting OCR via email at: GCEScienceTasks@ocr.org.uk

Centres should state the following information

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

Centres may wish to use this service for:

- 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)

- clarifying 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 therefore need to submit the work well in advance of the 15 May deadline for submission of marks.

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

F224 Energy, Reproduction and Populations

General Comments

It was agreed by examiners that this paper was slightly more difficult than the equivalent paper of last June. However, most candidates were able to complete all questions in the time available and very few blank sections were seen.

It was pleasing to see that many candidates continue to recognise the command word in a question and consequently can answer the question effectively. Nevertheless, it is clear that some candidates need to read questions very carefully before starting their answers. Question 4 showed a diagram of a respirometer, possibly more detailed than the ones used by candidates during the course. The introduction to the question described how the respirometer may be used to measure RQ values of respiratory substrates (as this had appeared on previous papers); however, the actual question asked the candidates how it could be used to measure the rate of respiration of yeast at different temperatures. Unfortunately, some candidates described the measurement of RQ values.

The overall performance of the candidates showed a relatively normal distribution of marks, though the mark range was narrower than last year. Stronger candidates were given the opportunity to display their knowledge and could have attained higher marks if they had been more detailed in their answers. Candidates at the E/U boundary were able to display their knowledge, particularly in questions 1 and 2.

Comments on Individual Questions

Q1 This question tested basic recall of knowledge about the female reproductive system and also required candidates to apply AS level knowledge to two contexts - exchange of substances and vascular structure. The question proved a good discriminator.

(a) **(i)(ii)** Candidates were asked to identify two structures of the female reproductive system on a diagram and most were able to do this. They also had to identify where fertilisation usually took place; most identified the fallopian tube but some indicated the uterine cavity or endometrium, possibly because they had confused fertilisation and implantation.

(b) **(i)** Candidates were asked to name two substances that were exchanged between mother and foetus, one in each direction. Most chose to nominate oxygen and carbon dioxide, in the correct order. Other appropriate responses included glucose, urea and antibodies. It is worth mentioning that if a question asks for a named substance then a formula is not sufficient. Some answers were too vague as they simply said 'waste' or 'nutrients'.

(ii) Candidates had to relate the structural adaptations of the placenta to the exchange of substances. Most candidates were able to indicate that there was an extensive capillary network. Many mentioned that there was a large surface area but did not connect it to the chorionic villi, which were clearly identified in Fig. 1.2. The idea of efficient diffusion was credited and better candidates were able to explain the maintenance of a steep concentration gradient.

(iii) This question asked for two structural differences between the umbilical artery and vein. This was a synoptic question relating back to the AS specification set in a new context. It was disappointing to note that many candidates were too vague or got their differences the wrong way round. Some failed to describe structural differences and gave functional differences instead.

Q2 Candidates were presented with a flow diagram showing some of the processes relating to the respiration of glucose in a hepatocyte and skeletal muscle cell.

(a) **(i)** Candidates were asked for two uses of glucose in a liver cell apart from being used to keep blood glucose concentrations normal. Most candidates were able to mention either glycolysis or glycogenesis, though some wrote "gluconeogenesis".

(ii) Candidates were told that anaerobic respiration could be considered less efficient than aerobic respiration and asked to explain what this meant. Most candidates spoke in terms of less ATP being produced, and the better candidates specified that this meant "per molecule of glucose or respiratory substrate". Candidates were also able to score marks for mentioning lactate build up or that lactate molecules still contained energy.

(iii) A table was provided for candidates to write where in the cell the four main processes of respiration took place. Marks were usually lost by not being specific enough when different sections of the mitochondrion were required. This question proved to be a very good discriminator.

(iv) This question asked why phosphorylated glucose might not diffuse out of a muscle cell, and candidates needed to realise that the process of adding phosphate groups made the molecule bigger and therefore unable to fit into the channel protein for glucose, or that no specific carrier existed for the new molecule. A large number of good candidates got the idea, and some also mentioned that the molecule, being now (negatively) charged, would not dissolve in the plasma membrane.

(v) Candidates were asked to explain the meaning of EPOC. Unfortunately a lot of answers related to oxygen debt, or to extra oxygen breathed in during exercise. A minority successfully stated that it was the extra oxygen breathed in after exercise minus the oxygen breathed in before exercise.

(vi) Following on from **(v)** candidates were asked to suggest two further possible uses for the extra oxygen. Many got one mark for mentioning reoxygenation of both haemoglobin and myoglobin, and some went on to mention the production of ATP or creatine phosphate. Some referred to its use in the overall increase in the metabolic rate.

(b) Candidates were asked to write a discussion about the benefits of regular aerobic exercise on the muscles and cardiovascular system. An equal number of marking points were available for each, though candidates tended to score more on the cardiovascular mark points than on the muscle ones. A common omission was not to specify a decrease in <u>resting</u> heart rate or <u>resting</u> blood pressure. A reasonable number of candidates wasted time by describing the effects of exercise on the lungs.

Q3 The whole of this question was based on the role of sperm in human fertility issues.

(a) **(i)(ii)** This question asked candidates to carry out a calculation using figures derived from a graph provided. This was generally found quite difficult, although several candidates were able to gain 1 mark for showing part of their calculation. This question then asked candidates to extrapolate a trend line on a graph to estimate the mean sperm count of men in 2015, and this was generally well answered.

(iii) Candidates were asked to suggest possible reasons for decreases in sperm density. Many answers mistakenly concentrated on listing increases in obesity, smoking and drinking alcohol or decreased fitness levels and an ageing population as possible reasons. Some candidates were able to correctly mention a rise in STDs, however, use of anabolic steroids, cannabis or an increase in female hormones in the water supply were not often given and therefore few answers gained the full three marks on this question.

(b) **(i)** Candidates found it difficult to explain in detail the way in which sperm are stored in sperm banks. Most were able to explain that the sperm were frozen in liquid nitrogen, but in general the answers did not explain in enough detail about mixing with preservatives or being labelled and stored in an insulated metal container.

(ii) This question was well answered, with the majority of answers detailing that the sperm and semen should be screened for genetic and infectious diseases.

(iii) The majority of candidates were able to describe a suitable example of why a man may have his sperm harvested and stored. The most common of these was before chemotherapy or upon discovering he has a terminal illness such as cancer. A common error in answering this question was for candidates to suggest that this may happen prior to a vasectomy in case the man were to change his mind about having children.

Q4 This question assessed the ability of a candidate to describe a practical experiment that they should have performed themselves.

(a) A minority of candidates were able to name soda lime or potassium hydroxide as the substance E in the diagram. Common misunderstandings in answers named the substance as glucose, lime water or water. Several candidates who struggled to name the substance were able to gain a mark for stating its function – absorbing carbon dioxide.

(b) This question proved to be one of the most challenging on the paper and overall was not answered well. References to respiratory quotients did not gain marks, and many candidates struggled to describe how the experiment would be carried out. Where marks were gained, it was mostly for references to measuring the distance moved by the fluid, in a set time, and repeating at the same temperature. Most candidates were not able to go on and explain the calculation of the rate and the plotting of a graph. Several good answers were able to suggest a suitable range of five or more temperatures at which the experiment could be carried out. However, several answers suggested temperatures in excess of boiling point.
Some candidates did not attempt this question at all.

Q5 Candidates were presented with a flow diagram outlining primary succession in the Lake District.

(a) This question asked students to explain primary succession. Many answers were vague and referred to food chains. It was expected that a good candidate would mention pioneer plants colonising uninhabited ground, leading to a climax community in stages.

(b) Most candidates answered this question, about the role of lichens and mosses, well. They were able to state that the lichens and mosses held water, provided nutrients and stabilised the environment for further plants to grow.

(c) This question was also answered well, with many good responses stating that grazing, mowing and burning of the land would result in the shrubs not being able to grow and so a climax community not being reached.

(d) **(i)** This question clearly asked for **a** structure within the chloroplast responsible for the absorption of light energy. Many good answers stated the granum, the thylakoid membranes or the photosystem but a very common error was to name chlorophyll which is not a structure.
(ii) This question required the naming of two products of the light dependent stage that are used in the light independent stage. While many answers were able to gain credit for ATP and NADPH, there were several common incorrect answers that appeared, including glucose, Rubisco, ADP, NAD and light.

(iii) Candidates were asked to look at a graph showing the increase and then levelling-off of biomass in plants during succession and suggest a reason for this. Many candidates were unable to state competition for light or minerals as a reason for this, and many answers incorrectly stated that the plants had stored the maximum amount of energy and were "full", or that it was the night time and the plants were not photosynthesising. Where credit was gained, it was mostly for stating that a climax community had been reached.

Q6 This question was a general one about biodiversity.

(a) Candidates were required to explain the meaning of biodiversity and many were able to score a mark by talking in terms of numbers of different species. A second mark for talking about genetic diversity was not often given.

(b) Candidates here had to suggest three or more reasons why high biodiversity is desirable economically. There was a wide range of acceptable answers, but generally candidates did not pay enough attention to the economic aspect, hence this question discriminated well. Medical uses of plant compounds (probably the most common idea) in particular were not given an economic justification. Ecotourism was a popular and correct response as was the production of food or resource materials such as wood for building.

F225 Genetics, Control and Ageing

General Comments

The quality of response seen by the examiners was felt to be better than in previous sessions and, overall, the demand of the paper was felt to be slightly higher than last June's. Extended answers required far more in terms of sequencing and explanation rather than description, and some excellent scripts were seen with many more candidates scoring over 80 marks.

Some synoptic material was handled well by candidates – particularly 2 (b) (i) and 5 (a) where the links were to enzyme learning outcomes from F221. However, the links between protein synthesis (F224) and genetic mutations and inheritance which were tested in Question 3 proved more demanding, indicating that candidates need more reinforcement in this area. Again, basic biochemistry proved difficult for several candidates on 6 (a) (i) where a requirement to identify a *nitrogenous* waste product produced responses such as glucose and sodium ions.

As in previous sessions, it was clear that some key words were not well understood by candidates including *autosomal* and *exon* (Q3). In the same question it was clear that candidates still confuse the terms *phenotype* and *genotype*. With so many 'technical terms' in the Unit, vocabulary tests still make very useful starters. A variation on this is 'hot seating' – having issued a list of definitions to learn, one student is chosen at random to occupy the 'hot seat'. The rest of the group then take turns to call out a word and ask for a definition.

Candidate performance on data response questions was pleasing but several lost marks due to careless reading of data from graphs or giving approximate figures. Where a grid is provided, the data quoted is expected to be accurate. One area of concern was the poor response to 1 (c) where surprisingly few candidates could identify that the data points represented the **mean** insulin concentration and that the error bars would indicate the **reliability** of this data. As on the AS practical tasks, the terms accuracy and validity were used as if they were synonymous with reliability. Equally disturbing was the inability of some candidates to identify the variables required in Q2. Both of these questions were testing AO3 assessment objectives which, while tested in the Experimental Units F223 and F226, also appear on written papers. Centres need to be aware of this and reinforce these concepts in the context of examined units – 10% of the marks on F225 test AO3 outcomes and Centres are advised to consult Section 4.7. on page 49 of the Human Biology Specification.

Comments on Individual Questions

Q1 This question was based largely on Module 3 with synoptic links to F224 and F222 and some testing of AO3 outcomes (see above).

(a) Most candidates correctly identified the pancreas. Weaker candidates did not pick up on the request for named cells and wrote 'Islets of Langerhans' which was insufficient on its own. Incorrect responses seen included kidney and liver.

(b) This question produced some excellent responses but candidates should be advised regarding the need for correct spelling of terms such as glycogenesis, glycogen and gluconeogenesis. It was not uncommon for a candidate to describe glucose being converted to glycogen, only to call this process glycogenolysis and forfeit the mark. A common error was for candidates to describe the binding of insulin causing cells to take up glucose rather than insulin causing an *increase* in the uptake of glucose. Centres should reinforce the need to refer to the *surface* or *plasma* membrane rather than 'cell membrane' alone.

(c) Problems with c (i) have already been referred to in the general comments. In c(ii) the word 'compare' was often ignored by weaker candidates who simply described one difference. The command word 'compare' is expected to trigger candidates to look for similarities and differences.
(iii) was a stretch and challenge question and while many candidates were credited for identifying that the fetus would receive more glucose, the examiners were looking for more than just a simple statement that the fetus needed glucose for respiration. Weaker candidates wrote in terms of more 'nutrients' and even more 'oxygen' being received by the fetus.

(d) Candidates were expected to use the information given on gestational diabetes and compare this to their knowledge of Type 2 diabetes as understood from F225 and F222. Most candidates were able to obtain 2 or 3 marks but many answered in terms of Type 2 diabetes being due to a 'bad' diet or 'age' which was not credited. Some candidates ignored the information given on gestational diabetes and answered in terms of a comparison between type 1 and type 2 diabetes. Since no information was provided regarding any treatment for gestational diabetes, candidates who answered only in terms of treatment were not credited.

Q2 This question was based on Module 2 with synoptic links to F221 and F224 and some testing of AO3.

(a) This question produced some excellent responses with most candidates writing extensively suggesting this is material they are confident with. However, the QWC proved to be difficult to achieve as many candidates were careless in their use of terminology. Common mistakes were to refer to 'the synapse' as if the word is interchangeable with 'neurone' – 'an action potential arrives and causes calcium ions to move into the synapse'. Other candidates failed to distinguish between the pre-synaptic neurone and the post-synaptic neurone. As previously, several candidates refer to 'calcium' or 'sodium' rather than the respective 'ions'. The term 'voltage gated' was used incorrectly to refer to the sodium ion channels which open as a consequence of acetylcholine binding and several candidates described acetylcholine as entering the post-synaptic neurone. Where the flow of ions was described correctly, it was not uncommon to see descriptions of ions entering membranes rather than neurones.

(b) Part (i) was answered well suggesting centres are reinforcing ideas such as specificity and complementary shapes. In part (ii) a number of candidates answered in terms of neonicotinoids blocking the receptors and preventing the transmission of an impulse – possibly 'skim reading' the description of the insecticide mimicking acetylcholine. A few candidates answered in terms of the similarity between the symptoms described (tremors) and Parkinson's disease and explained in terms of the interaction between dopamine and acetylcholine in the brain of the insect. Whilst this could not be credited, as it is factually incorrect, it is not surprising that Human Biology candidates should offer this explanation.

(c) Issues arising from part (i) were discussed previously in the general comments. In part (ii) most candidates could link the absence of bees to a failure of pollination and the potential knock on effect for food chains and crop production. Not unexpectedly there was confusion between fertilisation and pollination and answers which implied that, without bees to remove pollen, there would be more in the air and hence a rise in prevalence of hay fever again showed a lack of basic knowledge of plants.

Q3 This question was based on Module 1 and covered several learning outcomes

(a) The terms 'recessive' and 'autosomal' appear in two different learning outcomes. While many candidates could identify what the term 'autosomal' meant, several explained in terms of alleles that were linked. This suggests that candidates have not discriminated between the 'linkage' idea and the concept of different types of chromosome. The same issues occurred as on previous papers with candidates using expressions such as 'not a sex gene' or 'in all the cells except the sex cells' again suggesting misconceptions regarding genes, alleles, chromosomes and cells.

(b) This was done well by most candidates. The commonest mistake was not to link the genotypes at the end of the question to the correct phenotype or to assign the term 'carrier' to the heterozygote genotype without indicating that they would be phenotypically 'normal'. A common misconception among weaker candidates was to write the symbols 'X' and 'Y' where gametes were required. Several attempted to 'solve' this in terms of sex linked alleles or used the same annotation as for the blood groups (eg $\mathbf{I^g}$ or $\mathbf{I^G}$). Marking was carried out on the basis of 'error carried forward' so it was still possible to gain some marks. Where alternative symbols were chosen (such as P and p), no penalty was applied. Again, as on previous papers, some candidates did not appear to know what was meant by the terms 'phenotype' and 'genotype'.

(c) Very few candidates were able to explain what was meant by the term 'exon'. Common misconceptions were that it was a 'stop codon' or a base or nucleotide or that it was essentially another word for codon. Many candidates omitted to answer at all or wrote in comments such as 'We have not done this word'. Where candidates did make it clear that they knew it was the coding sequences, they failed to point out that they were part of or within a gene.
Part (ii) was a 'stretch and challenge' question with candidates required to work out that the 'transcript' would be a shorter mRNA molecule with a subsequent 'knock on' effect on primary and tertiary protein structure. This is synoptic with F224 protein synthesis and while several good responses could explain at A2 standard the effect on the protein, relatively few were able to describe the changes to the mRNA. Part (iii) was done well by the majority of candidates.

(d) This proved to be a question which discriminated well with the more able candidates comfortably describing natural selection and the mechanism which has led to changes in allele frequency in places where mould is present as a selection pressure. Less able candidates were able to integrate material from the given texts and link this to the fact that mould would be more common in Europe but then became tangled in their explanation – mainly due to poor vocabulary (genes not alleles, PKU being inherited rather than the allele for PKU, no idea of heterozygotes having the advantage). A common misconception among weaker candidates was the idea that people acquire the allele rather as they would acquire immunity. Again there was evidence of 'skim reading' of questions with some candidates answering in terms of sickle cell anaemia.

(e) Most candidates scored well.

Q4 This question addressed the structure of the nervous system and the effect of ageing on the peripheral nervous system.

(a) Surprisingly few candidates scored the full nine marks with the main problem being the location of the 'smooth muscle' in a part of the respiratory system. The majority of candidates wrote in 'lungs' suggesting that the knowledge of lung structure acquired in F221 had not transferred well to A2. A surprising number of candidates wrote 'cardiac muscle' – again possibly indicating confusion between the myogenic nature of cardiac muscle and the autonomic control of smooth muscle. All three muscle types appear in F221 and the differences need to be made very clear to candidates at that stage and then reinforced at A2.

(b) Many candidates scored well on this question showing extensive knowledge of the changes due to ageing – particularly in the eyes. Where candidates failed to score was when 'lists' of conditions such as glaucoma, AMD, cataracts etc were given with no explanation of the effect on vision; sometimes the effects of the two diseases were transposed with symptoms of AMD ascribed to glaucoma and vice versa. There were many 'loose' descriptions of the stereo-cilia and their location. It was not essential to use the term and a description of sensory hairs was sufficient but many candidates simply used the term 'hairs' and located them in a variety of places in the ear including the ear canal and the ear drum. The spelling of 'cochlea' varied considerably and examiners accepted most forms of the word.

A few candidates attempted to answer in terms of damage to the relevant areas of the brain – ignoring the term 'peripheral' in the question stem. As the question was concerned with hearing and vision, explanations which involved damage to the myelin sheath had to be in the context of sensory neurones – ideally the optic nerve or the auditory nerve.

Q5 This question was based on Module 3 learning outcomes on temperature control and measurement with some synoptic links to F221.

(a) Some good responses were seen but the examiners noted some common misconceptions. Some candidates wrote in terms of enzymes being denatured at high and low temperatures. Many candidates wrote in terms of enzymes being denatured at temperatures above 37^{o}C. Most human enzymes have optimum temperatures above 37^{o}C and denaturation does not occur until temperatures are considerably higher. It was very rare to see references to low temperatures reducing rates of diffusion.

(b) Part (i) was done well by most candidates although weaker candidates tended to explain why oral temperatures and temperatures at the skin surface were less accurate and then repeat the stem of the question saying ear temperatures are more accurate thereby scoring only one mark. In part (ii), most candidates could explain that mass could be lost in other ways with some giving examples.

(c) Candidates were presented with a lot of data and were required to use this to discuss the responses to high temperatures. Common mistakes involved misquoting data – particularly from the graph of temperature changes. Good candidates referred to thyroxine correctly but it was not unusual to see references to more thyroxine being produced rather than less. There was some confusion over the graph showing time to onset of sweating with some candidates assuming this referred to the duration of sweating.

(d) Most candidates scored at least 2 marks on this question by spotting that the subjects would be showing some of the symptoms of hyperthermia.

Q6 This question proved to be the most difficult on the paper overall. There was no evidence that candidates ran out of time, indicating that this topic is one which candidates have difficulty with.

(a) As indicated previously in the general comments, part (i) was not done well with many candidates ignoring the fact that a nitrogenous waste product was required. Some candidates suggested amino acids forgetting that these are reabsorbed. The concept of what constitutes metabolic waste is not one which candidates seem secure with. In part (ii), candidates were credited if percentage increases or decreases were calculated but this still proved to be a difficult question for many candidates.

(b) Candidates who did not identify the waste product as 'urea' in (a)(i) struggled here, although candidates who stated 'amino acids' were often able to pick up marks for observing that more amino acids would be produced from the high protein diet and that some of these would be excess to requirement. Deamination is not well understood by candidates, with several stating that proteins are deaminated or that proteins are converted to urea.

(c) This was a stretch and challenge question as well as being synoptic to F224. While good candidates spotted correctly that proteins or amino acids are respiratory substrates, only very able candidates deduced that, if carbohydrate content was reduced then the amount of amino acids needed for respiration would increase and hence more urea would result.

(d) Although the majority of candidates spotted that it was diabetes insipidus that was being referred to here, diabetes mellitus could also result in an increased volume of urine by a different mechanism. Consequently the marks were for the explanation with matched the type of diabetes identified. A common mistake was to suggest that more ADH was secreted suggesting that candidates rote learn the feedback mechanism which results in the production of ADH.

(e) Most candidates gained the mark for respiration with more able candidates referring to aerobic respiration and a gratifying number picking out the specific stages which would produce carbon dioxide. A surprising number of candidates suggested mucus as a waste product from the respiratory system suggesting that candidates confuse secretion and excretion.

F226 Extended Investigation in Human Biology

This is the second session for F226 and the moderators were encouraged to see an overall increase in the understanding and application of the descriptors. The team of moderators were pleased with the overall standard of work submitted by centres. There was clear evidence of hard work by many teachers and candidates.

Suitability of investigations:
One main concern this session, however, was that centres had permitted candidates to undertake investigations which were both inappropriate and not permitted by OCR, as stated in the Teacher Support: Extended Investigation Handbook.

Unsuitable investigations included:

1 Does colour contrast have an effect on the readability of number plates?
2 How does caffeine intake affect the reaction times of teenage girls?
3 How does smoking affect the peak flow of smokers and non-smokers?
4 Does aspirin affect the rate at which blood clots?
5 What effect does temperature have on the heart rate of Daphnia?
6 Is the government's recommended weekly amount of exercise sufficient to maintain a healthy BMI?

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 (eg exposure to inhaled particulates/air pollution). Centres should remember that the safety of all subjects involved in any investigation remains the responsibility of the teacher and centre and not OCR. Harm resulting from administration of substances such as those listed above could result in prosecution under Health and Safety legislation by the appropriate authorities. Teachers should ensure that they follow all necessary advice from appropriate bodies and consider carefully the investigations that they authorise candidates to carry out.

Investigations should be centred on an A2 learning objective from either the F224 or F225 specification. The topic should also allow scientific knowledge and understanding from F221 and/or F222 to be used and integrated to enable the prediction to be justified and conclusions explained.

Submission of AS based investigations will not allow access to all descriptors including A4 and C4, which will reduce the overall attainment of the candidate(s). Submission of investigations that are not centred on any direct aspect of the specification will fail to access A3, A4, C3 and C5, as well as reducing the likelihood of candidates meeting other descriptors.

Common tasks which showed accessibility to all descriptors included, amongst others:

- 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
- Effect of pH on the rate of photosynthesis

Centres are reminded that there is no requirement for each candidate to carry out a different investigation.

It is essential that any investigation which is not stated as being suitable in the Extended Investigation handbook is checked with OCR **before** the candidate(s) embark on any aspect of the investigation. Title approval and other queries relating to F226 can be raised with OCR via email at GCEScienceTasks@ocr.org.uk clearly stating the centre number and nature of the enquiry.

General administration:

Centres are encouraged to use the cover sheet provided by OCR for each candidate to show clearly which descriptors have been awarded by the centre and also the overall total for the piece of work. There were a pleasing number of centres who had used this form this year, and these centres had less clerical errors. This can be found on the OCR public website. This should be used as a cover sheet for each candidate who is submitted for moderation.

Centres are should note that a 'Centre Authentication Form' (CCS160) **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/type/gce/science/human_biology/documents/index.html

Returning work to Centres:

During the moderation process, if the moderator's 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. This is usually the result of one or two candidates' work being marked with more leniency than that of others. Usually this is caused by an accumulation of marking errors which have not been flagged up during internal moderation. When this happens, an invalid order of merit would result if the centre was also judged to be out of tolerance to the extent that the marks needed to be adjusted. Also, the degree of adjustment may be magnified by the one or two candidates that have been more leniently marked than others. To reduce the impact of this on other candidates, centres may be asked to remark some scripts. Naturally this causes concern and it is very important that centres do not misunderstand this process as it is intended to benefit as may candidates as possible.

Adjustment to centre marks:

In the main, adjustments were due to centres:

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

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 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 a Centre's single order of merit is the result of combining two or more orders of merit within the Centre.

Teacher support:

There are 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 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. Please email GCESciencetasks@ocr.org.uk for further details.

d) *INSET*
F226 specific INSET is available in the Autumn term from OCR which will give detailed and individual advice to centres regarding the organisation, implementation, marking and internal moderating of extended investigations. Please see the training link at www.ocr.org.uk for further details.

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