OCR

Oxford Cambridge and RSA

GCE

Human Biology

Advanced GCE **A2 H423**

Advanced Subsidiary GCE **AS H023**

OCR Report to Centres June 2015

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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:

The question paper appeared to be accessible to candidates across the ability range and, as in previous sessions, there was little evidence to suggest that candidates struggled for time. Examiners noted that few questions elicited 'no response' and centres should be commended for preparing their candidates accordingly, as much of the specification material for this unit would have been taught earlier in the academic year. Overall, candidates demonstrated a wide range of ability with some candidates extending their responses to include knowledge from other areas of the specification. It is encouraging to see that questions that incorporate 'quality of written communication' (QWC) marks have allowed candidates to demonstrate their acquisition of biological terminology, including appropriate use and spelling. As in previous sessions, it is vital for candidates to write in legible handwriting to enable examiners to credit QWC.

Overall **Q1** and **Q3** showed that many candidates are coping better with the biochemical aspects of the specification, although it is important for candidates to read the question carefully to ensure that their responses match the questions being asked. For example, in **Q1(b)(ii)** some candidates directed their responses to discuss facts about glycogen rather than glucose and so failed to gain credit.

Calculations are now causing fewer problems for candidates who are appear well-practiced in manipulating the standard equation for magnification.

Comments on Individual Questions:

Question 1
This question incorporated a range of assessment objectives (**AOs 1, 2 and 3**) with a biochemical thread running throughout. Some questions were in the context of the procedure for testing for blood glucose.

Some candidates did not recognise Figure 1.1 as a fatty acid and many incorrect responses for **1(a)(i)** gave 'amine' as well as 'carboxylic' group, suggesting that they considered this molecule to be an amino acid. The majority of candidates went on to correctly identify glycerol in **1(a)(ii).**

1(b)(i) was generally well-answered with candidates understanding the need to state that glucose was transported '**dissolved**' in the plasma rather than just stating 'in the plasma'. However, in **1(b)(ii),** some candidates gave answers which referred to glycogen rather than glucose by offering responses which referred to the fact that glucose was a good respiratory substrate because it could be converted to glycogen for storage. Some candidates are still incorrectly stating that **energy** is 'produced', 'made' or 'created' which could not be credited.

1(c) and **(d)** were in the context of testing for blood glucose and many candidates were able to gain credit in **1(c)** for referring to sterile conditions as a safety precaution; few candidates referred to precautions relating to the functioning of the blood glucose meter itself. **1d(ii)** was well-answered across the ability range and in **1(d)(i)** there were some good responses from stronger candidates with both marking points being awarded. However, some candidates referred to a *reaction* occurring between the enzyme on the test strip and glucose. Candidates at AS level would be expected to understand that enzymes are catalysts in reactions and do not react with their substrates.

Question 2
First Aid procedure for blood loss and blood products provided the theme for this question which offered candidates a variety of question styles including 'tick box completion' and 'quality of written communication' to address both **AO1** and **AO2**.
Part **2(a)** required candidates to complete a 'tick box' table with statements referring to the procedures for blood loss. The majority of candidates showed good knowledge of the procedures; the most common incorrect response was that some candidates considered that it would be necessary to raise an injured limb above the heart in cases of minor blood loss.

For **2(b)(i)**, candidates who noticed from Figure 2.1 that platelets had mitochondria but no nucleus within their cytoplasm were able to gain both marks for comparing with an erythrocyte. Some candidates also correctly referred to existing knowledge about the presence of haemoglobin in erythrocytes (lack of it in platelets). There were many varied responses about glycogen which would be present (in small quantities) in both components. It was pleasing to see many correct responses for **2(b)(ii)**, but haemophilia is still the most common incorrect response for why a transfusion of platelets would be given.

For **2(c)**, candidates either performed very well and were able to gain maximum marks, or they failed to read the question stem correctly and gave examples of use for the blood products rather than described them; thereby only gaining the 'quality of written communication' (QWC) marking point.

Question 3
This question included more biochemical aspects by linking polysaccharide formation with enzyme structure within the context of liver function. The **AO2** 'suggest' style questions were, as in previous sessions, a good discriminator across the ability range with part **3(b)** needing application of knowledge about the effects of glycogen and glucose within cells.

For **3(a)(i)**, most candidates could correctly identify the type of reaction with some going onto name the glycosidic bond for two marks. Stronger candidates extended their responses further by offering the correct type of glycosidic bond thereby gaining maximum marks.

The question then moved onto enzyme structure for **3(a)(ii)** and whilst there were some good responses for marking points two and three, very few candidates gained maximum marks. Some candidates failed to notice that the question referred to the enzyme, glycogen synthase and modelled their responses around the structure of glycogen.

Question 4
In this question, the context of blood pressure measurements provided candidates with the opportunity to demonstrate their knowledge of the circulatory system and respond to 'How Science Works' style questions involving the sphygmomanometer.

Part **4(a)** surprisingly saw few candidates refer to humans as being 'large' or having a 'small SA:V' and examiners noted that 'why humans need a mass transport system' appeared to be a poorly understood concept.

Overall, there were good responses to **4(b)(i)-(iv)** although many candidates did not refer to 'brachial' in **4(b)(i)** so did not gain credit. In **4(b)(v)**, candidates were required to read a blood pressure measurement from the diagram and many candidates found this challenging; centres are encouraged to provide practical opportunities for candidates to take measurements using a variety of meters and apparatus and also to practice interpreting readings from secondary data. Some candidates correctly read the blood pressure but then performed a calculation to divide the systolic pressure by the diastolic pressure; others added the two readings together.

A wide range of responses were seen in **4(c)**. Some candidates identified a factor, for example, lumen size of a vessel, but did not qualify their response with a description to gain credit for the marking point.

Question 5

This question offered candidates to demonstrate their ability to recall information about lung structure in a QWC style question, but also included a calculation and interpretation of photomicrographs to assess **AO2**.

5(a) was generally well answered and candidates were able to articulate their ideas and gain credit across the marking points including the QWC. It was also very pleasing for examiners to see that, in **5(b)(i),** the majority of candidates were able to accurately measure the length of the alveolus and use this to calculate the actual size. However, many of those achieving the correct response failed to take notice of the wording in bold in the question that directed them to the number of decimal places required and so only one mark could be awarded.

Interpreting the photomicrograph of normal and damaged lung tissue in **5(b((ii),** was challenging for some candidates and provided a good discriminating question. Stronger candidates were able to provide credit-worthy explanations for why there would be a higher breathing rate in the person with lung damage to gain both marks.

5(b)(iii) was generally well-answered provided that candidates correctly identified the spirometer as the apparatus needed to measure vital capacity; although the mark point referring to vital capacity as being the height of peak and trough of the trace was rarely seen. Credit for an AVP was awarded most typically for reference to the 'rotating drum' or 'kymograph' of the spirometer. A common mistake was for candidates to suggest the use of a peak flow meter and then describe its use to measure PEFR or FEV_1 rather than vital capacity.

Question 6

Despite two challenging AO2 style questions in **6(b)(i)** and **6(b)(ii),** there were still few 'no response' questions at the end of the paper suggesting that candidates had managed their time effectively during the examination. The question assessed the ability of candidates to demonstrate application of their knowledge and understanding of electrolytes, water potential and ECG interpretation in the context of conditions that would affect potassium ion concentration.

Part **6(a)** was very well-answered with many candidates achieving maximum marks. In **6(b)(i)** was challenging for weaker candidates who struggled to link the reference to cell membranes in the question stem with the possibility of disruption to the mechanism of potassium ion transport across the membrane. There were, however, some good responses gaining credit for AVPs, for example, some reasoned that the potassium ion channels could be blocked by the toxin so that there would be no facilitated diffusion. The responses to **6(b)(ii)** showed that this concept was well understood and candidates could discuss the consequence of altering osmotic balance.

Finally, for **6(c),** candidates offered good comparative descriptions for the two ECG traces and many candidates were able to gain both marks for this part of the question. There were some candidates, however, who endeavoured to explain what was happening at each stage in the traces, so could not be awarded any of the marking points.

F222 Growth, Development and Disease

General Comments:

Several excellent answers were seen and those candidates who had thoroughly researched the pre-release material performed well. **A03** questions proved a challenge for some 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 under-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. Units were sometimes either not included or wrongly quoted in responses using data. 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:

Question No.

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 mostly **A01**, **AO2** and **AO3** skills.

a)(i) Most candidates correctly explained what is meant by cancer. Those who did not usually referred to 'growth' of cells and not division. Some candidates discussed cell/DNA mutations without further clarification.

a)(ii) Many candidates incorrectly named glycoproteins. Few correctly named antibodies.

b)(i) Most candidates were able to correctly sequence the stages.

b)(ii) Most candidates could correctly name another test for HIV. Some imprecise answers such as 'blood test' failed to gain credit.

c)(i) This question discriminated well, and specialist terms were correctly used. Several candidates had an excellent understanding of the processes involved. Weaker candidates failed to be specific about the location of fat deposition or stated that saturated fats or cholesterol raised blood pressure, with no reference to salt. Very few correctly made the link between saturated fats and LDLs, often confusing them with HDLs. Cholesterol was often discussed as being deposited around the artery wall or lumen rather than under the endothelium. Thrombus formation was mentioned in the context of broken pieces of plaque without mentioning blood or platelet involvement. Several candidates discussed the effect of salt on the water potential of blood, and its consequences but some failed to develop the argument to include the effect on the development of CHD. Weaker candidates discussed blockage of arteries, rather than a narrowing of the lumen restricting blood flow.

c)(ii) Many candidates correctly described a cardiac arrest, although weaker candidates just referred to the heart stopping without qualification. Fewer candidates demonstrated that they understood what a heart attack was, with many referencing a 'blockage' or a lack of oxygen but not making the death of cells explicit. Several answers discussed fibrillation and erratic heart beats, or answered in terms of patient consciousness.

d)(i) Only more able candidates demonstrated an understanding of the need for a baseline reading for comparison. Most candidates explained why glucose levels could be high but failed to appreciate the need to see if the readings remained high for a period of time, or failed to fall to the baseline level.

d)(ii) Many candidates made comments about dietary glucose or rate of metabolism, but failed to recognise the role that other diseases or medication could play in the result of the test.

e)(i) Most candidates showed a good understanding of blood groups. Some candidates did not appreciate that two antibodies could be present in the plasma.

e)(ii) Most candidates correctly understood which blood groups were the universal donor and recipient, but some did not follow the instructions to use the patient number rather than the blood group. The blood groups and patient numbers were given on the previous page.

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) This was usually a well learned definition. Weaker candidates made reference to vaccines containing a weakened form of the disease rather than antigens or the pathogen, or failed to include that it provoked an immune response.

a)(ii) Several candidates failed to correctly describe the type of immunity gained by vaccination.

a)(iii) Many candidates were able to identify the requirement for more memory cells, although few picked up on the death or decrease of memory cells over time. Weaker candidates discussed viral mutations as the reason for the requirement for booster vaccinations.

b)(i) Candidates who had read the question carefully were able to give two properties of placebos. Weaker candidates gave general descriptions of the importance of the patients not knowing they were taking it, or why they are used. Some candidates were not precise enough in their answers and merely stated that placebos should have no effect, rather than not have any side effects or medicinal qualities.

b)(ii) This question was accessible to most candidates. Some candidates did not comprehend that the chance of patients receiving the placebo rather than the drug would have been fully explained at the start of the trial. Hence the idea of giving 'false hope' was not credited.

b)(iii) Many candidates knew that T-helper cells released chemicals, and some could explain the consequences of that. Some candidates thought that T helper cells differentiated into T killer cells, B cells, produced antibodies, or acted as phagocytes.

b)(iv) Specific and non-specific immune responses were generally well understood. The most frequently incorrect answer was the role of monocytes.

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

c) This was generally well answered although some candidates discussed antibiotic resistance and virus mutation as a reason for why antibiotics would be ineffective. Some candidates failed to say that antibiotics would not be effective, but rather stated that HPV was a virus without further qualification, or just repeated the question stem that they are not treated with antibiotics.

Q3 This question equally addressed **AO1** and **AO2**.

a) Most candidates confidently identified correct similarities and differences.

b)(i) Several candidates incorrectly referred to the new DNA molecule as a 'strand' or stated that "half the DNA is from the old and half from the new" without making reference to the new molecule comprising one original / parent strand and one new / daughter strand. Some candidates appeared to think that only half the (exposed) molecule replicated when it unzipped (as in the 'Y-shaped' diagram often drawn) and then it joined back up again.

b)(ii) Many candidates stated that DNA unwinding was an error to be replaced with 'DNA unzips'. It should be realised that the unwinding of DNA is essential in replication. Most identified that adenosine should be replaced with adenine.

b)(iii) Many candidates seemed unclear as to what specifically happens in each of G1 and G2 phases, and repeated their descriptions in each part. Some failed to gain credit for stating that organelles grow rather than <u>grow and divide</u>.

c)(i) An accessible mark for nearly all candidates.

c)(ii) Many candidates were confused about exactly when in meiosis each process happens. Most candidates stated that crossing over occurred in metaphase rather than prophase 1. Candidates mostly gained the independent assortment mark but often failed to make the distinction between chromosomes and chromatids.

c)(iii) As in question **c)(ii),** candidates demonstrated their lack of knowledge regarding when in meiosis particular events occur. Whilst many candidates could correctly identify the process of crossing over and what it involves, many of them gave the incorrect stage.

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

a)(i) The correct name of this measurement is biparietal diameter, although some candidates incorrectly wrote biparietal measurement or length. There was great variation in the spelling of 'biparietal'. Candidates should learn to accurately spell key terms. Some candidates identified the measurement as crown-rump.

a)(ii) An accessible mark for most candidates.

b)(i) Some candidates misinterpreted the question and discussed relative and absolute growth rates. Although candidates knew which measurements were normally recorded, many failed to explain how the measurements would be taken, i.e. with a tape measure for head diameter, and several failed to mention that this measurement should be at the widest point. Many candidates knew how to measure the baby's weight, and described how two or more measurements should be taken, but didn't always state that the mean should be calculated.

b)(ii) The minority of candidates correctly drew a line starting at a high relative growth rate and decreasing. Even fewer included a rise at puberty. Most started their line at 0. Several graphs started off steeply and then levelled off.

b)(iii) Most candidates correctly calculated the difference in mass as 3.3kg, but did not then know what to do with it to calculate the relative growth rate.

b)(iv) This question was not well answered by most candidates. Many answers referred to relative growth rate being more accurate rather than measuring the efficiency of growth.

c) Most candidates failed to compare the trends in the two boys' growth rates, merely describing them or comparing individual points or values on the graph. Only the most able candidates recognized that Q's growth fluctuated and that this was due to Q's lack of nutrients or his illness, rather than his parents' genes, or a growth disorder or chromosome abnormality. Very few candidates noted the increase in Q's growth rate indicating recovery or better nutrition.

Q5 This question assessed **A01**, **AO2 and AO3** skills. Similar numbers of **AO1** and **AO3** marks were available.

a)(i) Most candidates correctly stated the meaning of the term 'infectious disease'. Some candidates did not make reference to a pathogen as the cause.

a)(ii) Correct examples of infectious and non-infectious diseases were given by almost all candidates. A few gave the examples already stated in the question stem.

b) The vast majority of candidates required extra space for this question. Most candidates structured their answer methodically, discussing each disease in turn. Several candidates did not use figures in support of their arguments, or did not use appropriate units. Most were able to give correct reasons for the differences in data, although there was some confusion over the mode of transmission of TB as several answers referred to 'clean water supply', 'poor housing' and 'hand washing'. Some candidates did not compare the mortality rates of the UK and Gambia with the global mean average.

Q6 This question addressed **AO1**, **AO2** and **AO3** skills.

a)(i) Most candidates correctly defined the term 'prevalence'. A few candidates incorrectly answered in terms of new cases or an increase in cases.

a)(ii) Most candidates correctly identified that benzopyrene caused a mutation in p53 gene, although some merely wrote about p53 being inactivated or not working. A number of candidates were able to give further detail of the consequences of the mutation, although some failed to discriminate between the gene and the protein, stating that genes will not be produced. Several candidates wrote that p53 is a proto-oncogene rather than a tumour suppressor gene. Few candidates discussed the lack of apoptosis.

a)(iii) This was a well answered question. Some candidates referred to chemical carcinogens, e.g. diet or smoking, indicating that they did not read the question properly.

a)(iv) Very few candidates were able to give the correct definition as rapid onset and short-lived. Most were able to give only part of the definition. Many talked of it being 'small' or 'non-invasive' or 'curable' or 'in the early stages'.

b)(i) Candidates often made general statements and did not support their answer with correct figures, or use the correct units. Few candidates identified that the difference in the two groups was only evident from 4 years.

b)(ii) Most candidates could correctly name one piece of further information, e.g. age or lifestyle of the groups. Several candidates wrote about the stage or treatment of the cancer, or suggested how to improve the validity, rather than what you would need to know in order to assess it.

b)(iii) Almost all candidates were able to access this mark.

c)(i) Many candidates had a good understanding of the role of NICE, although several candidates incorrectly stated that they were involved in clinical trial work, rather than the pharmaceutical company developing the drug. NICE considers evidence on efficacy and provides guidelines based on all available treatment options, they do not test drugs themselves. Where dosage is concerned, they produce guidance on which dosages should be used and when, but they do not determine dosages or safe dosages as these are determined during trial work.

c)(ii) Nearly all candidates correctly identified that macrophages use phagocytosis or endocytosis, however, most candidates did not correctly name the plasma membrane or cell <u>surface</u> membrane forming blebs, merely calling it the 'cell membrane' or 'membrane'.

F223 Practical Skills 1

As tasks remain confidential and live for the lifetime of the specification no specific details can be discussed here. Centres are thanked by the moderation team for the work and effort that was evident in the majority of scripts submitted for moderation.

This year Centres should have sent all Centre trial data for the qualitative tasks, as stated in the additional guidance column of the published mark schemes. This was not always the case and as such made it difficult to support marks given by teachers. There was also a significant number of Centres who did not send the moderators copy of the MS1 and CCS160 with the initial sample delaying the moderation process.

Feedback on clerical/organisation issues:

Centres should still take care to ensure that clerical and organisational issues are avoided such as:
- incorrect addition of marks within/across the task(s)
- transcription errors within tasks/between tasks and to the MS1
- 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.

Feedback on marking

This year saw an increase in the decision by Centres to award marks for comments which are not on the published mark schemes. This can't be permitted as it is essential that parity is achieved across all Centres and candidates. If the Centre has any queries regarding the application of the mark scheme this can be sent to OCR.sciencetasks@ocr.org.uk stating exactly which task and question the query relates to as well as the Centre number.

Request to remark coursework

As with previous sessions there have been occasions when the rank order obtained by the moderator has differed from that of the Centre. This can be caused by, in some cases, only one or two candidates being marked more harshly/leniently than others in the sample. As such it is essential that the Centre re-marks the work to produce a fair and valid order of merit within their cohort.

This year several Centres appeared to misunderstand this process and queried the comments and advice given by the moderator on the invalid order of merit form. The procedure at this point is for Centres to re-mark the work following the advice and comments given and not to query these comments using the science task email system. Should the Centre not agree with the Moderator's comments then they are at liberty to retain their original marking on the understanding that this can affect the algorithm that is applied to the Centre in terms of adjusting their candidates' marks. If a Centre has any issues with the moderation of their Centre's work then they have the opportunity to appeal once the results are published and for the work to then be reviewed by a senior Moderator.

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 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 e.g. identical student data in quantitative tasks.

Centres are encourage to train candidates in the skills required for these assessment tasks but not to prepare them specifically e.g. using a Benedicts test on a range of glucose solutions to teach about the nature of the chemical test and the appropriate colour changes is acceptable should the assessment task then be using Benedict's testing on milk.   All practical 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.

Remoderation requests

Any queries with marks awarded **this** session (June 2015) 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

Centres can continue to receive free advice on future practical skills in two ways:
1. Postal service: using the postal 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
2. Email service: Centres can contact OCR through email at
   OCR.GCEScienceTasks@ocr.org.uk

F224 Energy, Reproduction and Populations

General Comments:

A lot of very good responses were seen by examiners, particularly concerning the Calvin cycle. Although some of the biochemistry questions, particularly the question about substrate level phosphorylation, still proved challenging for many candidates.

The following are points which should be clarified when teaching this unit: cholesterol is not a causative agent of high blood pressure; chemiosmosis is a process and the electron transport chain is a structure; the difference between nitrifying and nitrogen fixing bacteria and the fact that bacteria, not legumes, fix nitrogen.

Candidates should also be made aware that full spellings of essential reactants or terms are often required in answers, particularly those for 'quality of written communication' (QWC) questions. The incorrect spelling of bisphosphate given as biphosphate was very common; a term that if correctly spelled would have given many more candidates a QWC mark.

Comments on Individual Questions:

Question No.1 focused on fertility treatment, with reference to IVF and ICSI, and interpreting the results of a pregnancy test. The question tested both **AO1** and **AO2**.

The majority of candidates stated vas deferens in part **(a)(i)**. In part **(a)(ii)** most candidates appreciated that fluid had been added to the sperm in the semen resulting in a decrease in concentration and many knew that the origin of the fluid was the seminal vesicles or prostate gland. Candidates that did not score well usually made references to fructose and other substances being added to the sperm. They often gained the second mark point for stating the correct origin. A few candidates incorrectly stated that the concentration of sperm in the epididymis is greater because that is where sperm is made and stored. Part **(b)(i)** required an exact knowledge of both terms and many candidates did not know what the initials ICSI represented, giving a variety of incorrect possibilities. Many candidates thought that the C stood for cervical, which could be linked to errors in part **(b)(ii).** Most candidates stated that sperm are directly injected into the oocyte in ICSI in **(b)(ii).** Few candidates made reference to the lack of maturity of the sperm. Some candidates wrote about implantation of the sperm in the fallopian tubes in ICSI and fertilisation occurring naturally in IVF. It was surprising how many candidates did not know the correct names for the constant and variable regions in **(c)(i).** Most candidates were able to interpret the results given in part **(c)(ii)** correctly.

Question No.2 asked about the benefits of exercise in terms of the beneficial effects of lowering blood cholesterol, the effects of exercise on the skeletal system and the practical aspects of investigating aerobic fitness including data analysis. The question tested **AO1**, **AO2** and **AO3**. In part **(a)(i)** many candidates were well aware of the reduced risk of atherosclerosis and named heart problems. A number of candidates who made references to strokes had not read the question properly missing the fact that it was about benefits to the cardiovascular system. There was some confusion in answers where candidates were clearly answering in terms of the effects of exercise on the cardiovascular system and not the effects of a reduction in blood cholesterol. Hence many answers incorrectly included references to changes in blood pressure. There were still a lot of references to fats blocking, or clogging, arteries, only the higher scoring candidates using the correct terminology to describe atherosclerosis. **(a)(ii)** Stronger bones or a reduction in the risk of osteoporosis was the main answer given in **(a)(ii).** Errors made were largely associated with references to increased muscle mass. Most candidates seem to know that aerobic respiration takes place in the mitochondrion and that oxidative phosphorylation was the

stage requiring oxygen in **(b)(i).** The most common error was referring to the electron transport chain. In part **(b)(ii)** most candidates knew that RhEPO increases erythrocyte production enabling increased oxygen transport. A variety of suitable variables were suggested in **(c)(i),** the most common incorrect suggestion being baseline levels of fitness. Changes in fitness were under investigation and an initial fitness assessment was carried out. Calculation of the percentage increase in VO_2 max for **(c)(ii)** was carried out correctly by a lot of candidates, and quite a few others got one mark for correctly working out the initial stage of the calculation. Part **(c)(iii)** contained a stretch and challenge mark and many candidates found this question difficult. Candidates largely failed to appreciate that this was a comparative investigation and most looked at the data purely in terms of increasing duration times or increasing the number of days in the frequency investigation without linking the two. It was also apparent that candidates in some cases were not interpreting the data correctly. Either using the lines on the graph in a linear manner reading values for 10, 20 and 40 minutes from the lines or taking the frequency values as a timeline.

Question No.3 looked at the nutritional aspects of using Spirulina as a food source for both humans and animals. Candidates were asked to identify a species of bacterium that can fix nitrogen, which Spirulina is unable to do, then from the extract of a leaflet promoting Spirulina, link named substances with their beneficial effects.

Candidates were also asked to outline the synthesis of lipids in the light independent reactions of photosynthesis, and finally, consider the advantages of eating Spirulina directly rather than using it as cattle food. The question tested both **AO1** and **AO2**.

Rhizobium was correctly identified by many candidates in part (a). Azotobacter, the other correct alternative was rarely given. Nitrobacter and Nitrosomonas were frequently mentioned. In parts **(b)(i) – (iv)** amino acids and antioxidants were often correctly stated but vitamins B3 and B9 were usually incorrectly identified. Overall part **(c)** was answered well with many candidates gaining at least three marks. Early stages of this process, for instance CO_2 combining with RuBP using the enzyme Rubisco were stated by most. The point for the formation of a 6 carbon molecule was made but the link to two three carbon compounds was often not made even though glycerate phosphate was mentioned. Reduction to triose phosphate and its conversion to lipids scored marks for many candidates. Unfortunately many lost the QWC mark through not spelling out the appropriate terms. The quality of some of the answers gave the impression that candidates could easily have spelled out terms such as carbon dioxide, enzymes or triose phosphate. There seems to be confusion in some candidates about RuBP and Rubisco and the number of carbons at different stages in the cycle. Virtually all candidates stated that energy losses would occur if Spirulina was not eaten directly, but very few linked it to the ability to support a larger population by cultivating it for human consumption rather than as cattle feed. Students need to be reminded to read questions carefully and answer the questions asked.

Question No.4 required a precise knowledge of the stages involved in the development of the reproductive cells and their genetic components, followed by a comparison of the mechanisms of action of oestrogen, FSH and LH. It initially required detail regarding the entry/or not of these hormones into target cells, followed by identifying the source of FSH and LH. Candidates were then asked to identify molecules or organelles involved in the action of the hormone oestrogen on a target cell as shown in a simplified diagram, followed by the location and role of the target cell. Finally candidates were asked to suggest the effect of FSH in the nuclei of endometrial cells. The question tested both **AO1** and **AO2**.

In parts **(a)(i) - (iii)** most candidates correctly obtained one or two of the correct answers, those obtaining all three were in the minority. Oogonium was correctly answered by most candidates and secondary oocyte the least. Often the two were given the wrong way round and if oogonium was given correctly, it didn't follow that secondary spermatocyte would be given correctly as well. Part **(b)(i)** called for a straightforward link between ability to cross the cell membrane and lipid solubility and most candidates seemed aware of this link. Marks were quite often lost for

incorrectly relating the ability to cross the membrane to molecular size, or considering FSH and LH in terms of binding to a receptor on the cell surface membrane, hence repeating the stem of the question. Most candidates were aware that the organ was the anterior pituitary gland in **(b)(ii)** ,the main source of error being the brain. Many candidates scored all three points in **(c)(i)** showing a good knowledge of the roles of the molecules and organelles. Marks were most commonly lost for not identifying RNA as mRNA and for giving vesicle instead of Golgi vesicle. The Graafian follicle or ovary were correctly identified in **(c)(ii)** as the target cell in many cases, but the role of LH was less clear. Ovulation appeared in some answers, but it was often not linked to a surge in LH. Noticeably, breast tissue was incorrectly given as an organ with the associated role of lactation. In part **(d)**, which was a stretch and challenge mark, a lot of candidates associated FSH with the thickening of the endometrial lining and many gained one mark for linking the role of FSH in stimulating cell division. Fewer linked FSH to stimulating DNA replication, necessary for mitosis to occur. Candidates that did not score well usually gave vague explanations about the need for the thickening of the endometrium in preparation for the implantation of the zygote. Another common mistake was stating that DNA replicates by mitosis.

Question No.5 asked about the collection of reliable population data and the reasons affecting population growth. Initially, using an insert with population data for England and Wales in 2001, candidates were asked to suggest reasons for the 1960s baby boom, the factors which affect the numbers of births each year and finally why there were dramatic increases in population size despite a fall in fertility rate between 1911 and 2001. With reference to the second page of the insert regarding data produced from the census data in 2011, candidates were also asked to explain the reasons for the increase in 20 –29 year olds and one effect that this might have had on the size of any other age group. The question tested both **AO2** and **AO3**.

Part **(a)** needed a reference to the fact that all households have to respond to the Census, as it is a legal requirement. The same is true for the registration of births and deaths. Many answers referred to data collection without reference to it being a compulsory activity, which negated the mark. A lot of candidates just re-worded the stem of the question concerning the registration of births and deaths and how the information is accurate because it comes from different sources. The idea that the supplying this information is compulsory needs to be reinforced when teaching this topic. The majority of candidates recognised that the number of 30 – 39 year olds was the largest group in **(b)** and gave correct data quotes regarding males and females. Marks were lost in relevant answers for not giving suitable data. Some candidates missed out on the data quote by giving the total for males and females, or by comparing one gender with the other age ranges. Very few candidates answered **(c)(i)** correctly, the fertility rate of males being the most popular incorrect answer. Most candidates got two marks for **(c)(ii)** showing a good understanding that people are living longer due to advances in medicine and health care. Lower infant mortality was also a fairly common answer, but little reference was made to improvements in agriculture. Increases were also attributed to immigration in a noticeable number of answers. Immigration was stated by the majority of candidates in answer to **(d)(i)**, the usual reason for lost marks was where candidates referred to emigration without specifying it was to the UK. Most answers in **(d)(ii)** were based on an increase in 0 – 9 year olds explained by the fact that 20 – 29 year olds were at childbearing age and having children. A few referred to an older population group with the 20 – 29 year old group in a helping or caring capacity.

Question No.6 looked at the respiratory activity of yeast cells in terms of aerobic and anaerobic respiration. Candidates were asked to identify one product of both aerobic and anaerobic respiration in yeast cells essential in beer production followed by one product of anaerobic respiration in yeast cells not produced in aerobic respiration. Candidates were then asked to outline how ATP is made in the cytoplasm from the metabolism of a three-carbon compound, and finally asked to name an anabolic process which takes place in the nucleus of both yeast and human cells. This question test mainly **AO1**.

In part **(a)(i)** the majority of candidates stated incorrect answers such as NAD, pyruvate, ethanol. Part **(a)(ii)** was also incorrectly answered by many candidates, often the intermediates ethanal or lactate given as incorrect products. A lot of candidates only gained one mark in **(b),** either for the conversion of triose phosphate into pyruvate or stating substrate level phosphorylation. Very few gained the full three marks. Many assumed the three-carbon compound was pyruvate either going into the Krebs cycle via the link reaction (cytoplasm was emboldened in the question) or forming ethanol or lactate with the regeneration of NAD. The impression was that the early stages of glycolysis, glucose to hexose bisphosphate were clear, but from then on most candidates were not clear about the steps involved and moved directly to pyruvate, bypassing triose phosphate. Some candidates got a mark for formation of ATP through substrate level phosphorylation. Comparatively those who did not do well in this question largely scored well in part **3(c)** on the Calvin cycle, also involving triose phosphate but with a less complicated pathway. Triose phosphate, in particular, counted towards the QWC mark because the question asked about the formation of ATP by the direct transfer of a phosphate group. Many candidates answered **(c)** correctly in terms of DNA replication or RNA synthesis. Protein synthesis and active transport were the most common incorrect answers.

F225 Genetics, Control and Ageing

General Comments:

The overall performance of candidates was in line with previous sessions on most question types including the calculation with most candidates gaining at least one mark. Questions which required candidates to consider issues, such as **4(a)**, were done well with many candidates giving thoughtful and well reasoned responses.

However, both extended writing questions proved to be difficult for candidates mainly due to misuse of terminology. More detail will be given in the relevant section but there was confusion regarding non-disjunction and translocation in **2(a)** and between depolarisation and hyperpolarisation in **3(b).** This coupled with a failure to read the actual requirements of the question led to even the best candidates not achieving the available **QWC** marks as often as expected. Again, a failure to read the actual context and requirement of the question meant that, for example, on **7(b)(i)** candidates who were clearly well informed about haemodialysis did not relate this to the context of the question.

There were several questions on the paper which included diagrams which were relevant to the question. It was clear that many candidates had only glanced superficially at these yet all contained information that candidates were expected to make use of in their answers.

As in previous sessions biochemistry proved to be a major weakness. Identifying and naming amine and carboxyl groups proved difficult for some otherwise good candidates. However, the number of candidates who assume that restriction enzymes 'cut' hydrogen bonds demonstrates how very few of them really understand the nature of hydrogen bonding and the structure of DNA.

Many candidates made use of the extension pages at the end of the examination booklet with most numbering the questions correctly. However, some candidates continued answers at the bottom of the page without necessarily signalling this with an arrow or note in the relevant section of the question paper. Centres need to be aware that, while every blank page is checked, the nature of electronic marking can mean that answers written in the bottom margin of a page can be missed and candidates should be discouraged from using that part of the paper. There was no evidence that candidates were short of time.

Comments on Individual Questions:

Question 1   Parts **(c)(i)** and **(d)** addressed **AO1** criteria with some also being tested on **(b)** and **(d)(iii).** The remaining question addressed mainly **AO2** with some **AO3** on **(c)(ii).**

Part **(a)** was generally done well but use of the pronoun 'it' rather than referring to the internal environment meant some candidates did not make it clear that they were referring to the internal environment.

The commonest mistake in part **(b)** was to assume that, as motor was given for the parasympathetic then the sympathetic neurone must be sensory. As in previous sessions, candidates still confuse the terms glycogenesis and glycogenolysis and this was seen again later in the paper in **5 (b)(i)**.

A number of candidates answering **(c)(i)** seem to think that friction from moving muscles was responsible for heat but even otherwise good candidates used terms such as energy 'production'

or referred to heat energy as a 'by-product' which was not credited. It is unfortunate that these terms are used colloquially instead of referring to energy release or transformation and candidates do need to be monitored carefully and encouraged to use the correct terminology. In **(c)(ii)** was a stretch and challenge question and many candidates were able to suggest that vasodilation in skin blood vessels would lead to further heat loss. There were some misconceptions regarding the effects of thyroxine suggesting that some candidates think the hormone plays a role in short term temperature regulation. Part **(d)(i)** and **(ii)** were answered well although some candidates mistook the medulla for the spinal cord. In **(d)(iii)** the arrows on the diagram were indicating several areas of the brain. By requesting candidates to list the symptoms of severe hypothermia and then referring to **Fig. 1.2** as directed, good candidates linked the symptoms to the relevant control area in the brain being warmed. Weaker candidates were mostly able to list symptoms but then failed to take any account of the diagram.

Question 2 Part **(a)** was split between **AO1** and **AO2** criteria. Part **(b)** addressed **AO3** criteria.

Question **2(a)** was split into two parts. The first part required candidates to 'spot' differences between the karyotype shown and that of DS due to Trisomy 21. For many candidates, this was the only mark they achieved. Some weaker candidates confused DS with Turner's or Klinefelter's syndrome. Many candidates could successfully describe what happens in a translocation although some were describing the process but calling it a non-disjunction. However, very few candidates realised that, following translocation, the 'extended' chromosome 14 could segregate with the 'normal' 21 and that it was the fertilisation of a gamete with this combination of chromosomes by a 'normal' gamete that would lead to this karyotype. Candidates are clearly familiar with this inherited form of DS but need far more guidance as to how it is actually inherited.

In **2(b)(i)** weaker candidates referred to people 'wanting' to keep details private which was not enough to gain credit. Some further explanation was required and some very perceptive and thoughtful answers were seen. In **(b)(ii)** explanations were required and the commonest answers referred to either increased maternal age or increase in the screening. Good candidates also spotted that the data was not a rate and correctly suggested increasing birth rates. Weaker candidates described the data without necessarily explaining. Part **(iii)** was a stretch and challenge question and many candidates correctly deduced that the viability of fetus with DS would have to be taken into account. Again, some candidates expressed their ideas with great sensitivity.

Question 3 Parts **(a)** and **(c)** were **AO1** questions while the extended writing section on part **(b)** was both **AO1** and **AO2** criteria.

In **3(a)** a few candidates circled the relevant parts of the molecule but failed to add names. Other candidates inserted the names in the dotted lines. This was credited if the correct parts were circled and if the order corresponded to the order on the diagram. Some candidates circled incorrect areas on the diagrams. Others circled correctly but used incorrect names. Some responses seen included naming the NH_2 group as 'nitrogen', 'nitrate' or 'nitrogenous base'. Other candidates referred to it as the 'R' group.

Part **(b)** split into two parts. Many candidates successfully described the sequence of events at the GABA synapse although some stated that it was the influx of chloride ions that was responsible for exocytosis. Weaker candidates made the same mistake seen in previous sessions when this topic was tested and implied that it is the vesicle that is released and diffuses across the synapse with some referring to seminal vesicles. Many candidates struggled with the second part of the question. Some answered in terms of competitive binding by GABA on acetylcholine binding sites despite information on how GABA affects the post-synaptic chloride ion channels. Some answered in terms of GABA or acetylcholine entering the post-synaptic neurone. Several candidates attempted to answer in terms of the effects of more negative ions inside the post-synaptic neurone but contradicted themselves by using the term

hyperpolarisation when they meant depolarisation. However, there were some excellent responses where candidates explained that hyperpolarisation due to chloride ions meant the influx of sodium ions would be insufficient to achieve a threshold potential.

Part **(c) (i)** and **(ii)** were done well - an extensive list of symptoms was credited in part **(i)** and answers which were 'off spec' but correct were credited in part **(ii).**

Question 4   Part **(a)** addressed **AO1** objectives while **(b)** and **(c)(i)** addressed **AO2** with remainder of **(c)** addressing **AO3**.

As mentioned previously, **4(a)** was done well with the information and question being well considered and answers being well expressed. In **(b)(i)** many missed the fact that it was the type of gland that was required and gave the name of a gland. It was surprising to see how many candidates suggested it was an exocrine gland as this term does not appear on the specification. Part **(b)(ii)** was not done well. The main reason was a failure to use the information given and link this to their knowledge and understanding of the biological consequences of glaucoma and Alzheimer's. Weaker students did not answer in terms of their biological knowledge at all.

Many candidates gained at least 1 mark on **(c)(i)** for selecting MRI scans. This was a synoptic question with candidates expected to recall some details and uses of other scanning techniques covered in the specification. Many failed to gain a second mark for not explaining in sufficient detail why the technique would be safer than other options. Part **(c)(ii)** had elements of stretch and challenge. The key feature of a longitudinal study was given and many candidates were able to give age as the independent variable. The idea of a 'control' was less well understood and though many pointed out that the same group of people would be used throughout, the consequences of this in terms of what would automatically stay the same was not grasped. The idea of a negative correlation was well understood but the question asked for the graph to be completed - hence axes and units were required. A number of candidates make mistakes when giving units of concentration such as mmol/dm^{-3} indicating that candidates still struggle with standard form.

Question 5 a(ii) and **(b)(i)** tested **AO1** objectives with the remainder of the questions testing **AO2**.

In **5(a)(i)** the question required applying knowledge of the role of blood glucose other than its effect on water potential. High blood pressure and damage to cells are due to the osmotic effect of glucose. A number of candidates also think that high blood glucose causes diabetes rather than being a symptom of it. Many candidates did answer in terms of the role of glucose as a respiratory substrate. In **(a)(ii)** many candidates lost marks by stating the anterior pituitary gland as the source of ADH secretion.

Part **(b)(i)** was answered well although one common misconception was that insulin is administered after meals. Some candidates lost marks by describing the conversion of glucose to glycogen but then using an incorrect term. This was treated as a 'contradiction'. Most candidates expressed themselves well but some phrase their answer in terms of insulin converting glucose to glycogen or insulin opening glucose channels in the membrane rather than insulin being the cell signalling molecule which triggers these events. Many candidates gained full marks on **(b)(ii)** although some candidates linked the presence of ADH to glucose uptake.

Many candidates correctly identified the PCT and capillary in **(c)(i).** The presence of microvilli and transport proteins as evidence for the region being the PCT was the commonest way of gaining the second mark. Where candidates had identified the capillary, vague answers such as 'thin wall' or 'one cell thick' did not gain credit. Part **(c)(ii)** was a stretch and challenge question. Relatively few candidates linked the movement of proteins to the fluid mosaic structure of the membrane. Part **(c)(iii)** also had elements of stretch and challenge. Most candidates were able

to identify a transport mechanism which required a protein but only the most able could describe the number of available protein channels as a limiting factor in glucose uptake. Weaker candidates are clearly very confused by the terminology of kidney function and use 'ultrafiltration' and 'selective reabsorption' as interchangeable terms.

Additional information regarding the protein albumin was giving in part **(d)** but many weaker candidates attempted to answer **(d)(ii)** in terms of glucose in the urine. In part **(i)** a lot of 'guessing' had taken place. 'Liver' was allowed as one role of the liver is the synthesis of plasma proteins such as albumin. In part **(ii)** again there was confusion between ultrafiltration and selective reabsorption. Some candidates suggested that damage to the PCT meant that the protein could not be reabsorbed.

Question 6
Three **AO1** marks were available on this question in **(a)(i), (c)(i)** and **(c)(ii).** One **AO3** mark was available on **(a)(ii)** with all remaining marks on **AO2** objectives.

There were two parts to the term in 6 **(a)(i)** and the mark tariff reflected this. Many candidates lost marks by failing to explain what the menopause actually was. In part **(a)(ii)**, although some good answers were seen, many candidates simply explained how the mean was calculated or suggested it would be affected by the size of the population. Most candidates ignored the information given in the stem of **Q6** concerning all the variables which would affect age and which could differ between populations. The most common correct answers referred to outliers affecting the mean but not the median.

Part **(b)** was synoptic with Unit 4 and the question was most commonly answered in terms of cigarettes causing a drop in oestrogen production but no further detail was given in terms of the cells producing the oestrogen or the knock on effect of low oestrogen in terms of the menopause.

Part **(c)(i)** was done well by most candidates although a few 'cytokines' and 'Thiamines' were seen. In **(ii)** the terms restriction enzyme and palindromic sequence were well known but even very good candidates seemed to think that it was hydrogen bonds that were being cut. This may have been a 'gut response' to a question on DNA but it was a widespread misconception which needs to be addressed in Centres.

Part **(c) (iii)** contained elements of stretch and challenge. Many candidates were clearly familiar with gel electrophoresis as a technique but relatively few could explain why the banding patterns would differ between the 'C' and 'T' variant. There were some obvious misconceptions such as the restriction enzyme cutting out the whole of the palindromic sequence. Responses to part **(c)** seem to suggest that a lot of 'rote' learning is taking place on these topics without necessarily developing the knowledge and understanding.

Question 7
Questions **(a)(iii)** and **(b)(i)** tested entirely **AO1** objectives. All remaining questions were either entirely based on **AO2** criteria or addressed a mixture.

The calculation in **(a)(i)** was done well by many candidates although many did not notice that the answer was required in µm or used incorrect factors of 10 in their calculations. Parts **(a)(i)** were was synoptic with candidates needing to recall the role of platelets and suggest how this could cause red blood cell fragmentation. In **(a)(ii)** a surprising number of candidates opted for haemophilia - possibly triggered by the platelets and blood clotting ideas in the previous part of the question.

In part **(b)(i)** many candidates misread the question which was about treating kidney failure not treating an E.coli infection. The error was frequently compounded as description was only required for the long term treatment. Many candidates did score maximum marks but many failed to take into account the context of the question. There were some good answers on EPO treatment and on blood transfusions in **(b)(ii)** but many candidates again had lost the context of the question which was kidney damage and answered in terms of iron supplements.

Answers to part **(c)** were good with the majority of candidates scoring at least 3 marks. The commonest mistakes were autosomal rather than sex linkage and mistake on the probability at the end suggesting this was a guess rather than using a Punnett square. Many scripts did show evidence that this is what good candidates did.

F226 Extended Investigation

The extended investigation requires a significant amount of work on both the behalf of the candidates and the teaching staff and once again there was evidence of many excellent pieces of work.

This year did see a reduction in the variety of the Extended Investigation (EI) being undertaken and more Centres completing one investigation across the whole cohort. This appears to produce more consistent marking across the Centre.   However, there still remains a significant concern that some candidates are choosing topics and questions that do not allow accessibility to all descriptors. It is an essential requirement that the EI covers a learning outcome from the A2 units (F214 or F215) and that it also allows access to learning outcome(s) from the AS units.

Another concern is that some Centres are allowing candidates to undertake EI which are inappropriate on the grounds of ethics &/or health and safety e.g. use of Daphnia and heart rate, sugar intake of significant amounts. This is not endorsed by OCR and remains the responsibility of the Centre for the safety of their candidates and any subjects involved in the EI.

More Centres are making use of the consultancy service and acting on advice given. There are some Centres who chose not to follow the advice given by the consultation. This then results in the adjustments being made at the moderation stage and can affect the whole entry. Following a consultation report it is not permitted to allow the candidates to alter their work. The consultation process is to provide feedback on the quality of the teachers' marking and not to supply information on how to improve the candidates'' work. Any evidence of this will be treated as a suspected malpractice and investigated accordingly. The use of OCR marking grids is appreciated by the moderator and has also been shown to increase the accuracy of the initial marker within the centre.

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

Raising queries for F226:
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.

Request to remark coursework
As with previous sessions there have been occasions when the rank order obtained by the moderator has differed from that of the centre. This can be caused by, in some cases, only one or two candidates being marked more harshly/leniently than others in the sample. As such, it is essential that the Centre remarks the work to produce a fair and valid order of merit within their cohort.

This year several Centres appeared to misunderstand this process and queried the comments and advice given by the moderator on the invalid order of merit form. The procedure at this point is for Centres to remark the work following the advice and comments given and not to query these comments using the science task email system. Should the Centre not agree with the moderator's comments then they are at liberty to retain their original marking on the understanding that this can affect the algorithm that is applied to the Centre in terms of adjusting their candidates' marks. If a Centre has any issues with the moderation of their Centre's work then they have the opportunity to appeal once the results are published and for the work to then be reviewed by a senior moderator.

Adjustment to centre marks:

As with previous sessions the 3 common reasons for adjustments were:

- 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

Teacher support

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

a) Extended Investigation Handbook available online

b) Email support by e-mailing OCR.GCEScienceTasks@ocr.org.uk.

c) Free coursework consultancy on the quality and accuracy of marking; further details can be requested via email at OCR.GCEScienceTasks@ocr.org.uk.

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