OCR
Oxford Cambridge and RSA

GCE

Biology

Advanced GCE **A2 H421**

Advanced Subsidiary GCE **AS H021**

OCR Report to Centres June 2014

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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.

OCR will not enter into any discussion or correspondence in connection with this report.

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Advanced Subsidiary GCE Biology (H021)

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F211 Cells, Exchange and Transport

General Comments

The examination discriminated well at all levels and the full range of marks was utilised. Candidates found many parts of this examination straightforward. In particular, questions five and six allowed candidates to demonstrate their knowledge successfully. Question five concentrated on assessment objective two and most candidates did well, applying their knowledge of cell signalling within the context of the life cycle of a slime mould. Question six was a straightforward test of assessment objective one. These questions discriminated well at the lower end of the mark scale. Other questions – such as question three, which tested knowledge of transport of oxygen and carbon dioxide in the blood – discriminated well at the higher end of the mark scale.

The use of models to illustrate certain aspects of physiology is an important part of How Science Works. It was clear from the responses to question two that many candidates were familiar with the model of the chest cavity. It was also clear that many candidates need to think through the workings of such a model in more detail. The ability to link simple concepts from other subject areas is an important skill – and the simple physics applied to the action of this working model is an area for development.

One recurrent theme throughout the examination is the need to provide responses that are as specific as possible. Another recurrent theme is the use of correct terminology. The use of appropriate specific terms makes a response much more focussed.

Comments on Individual Questions

Question 1

Candidates performed well in question one with responses that were often phrased very clearly. The topic is well understood by the majority of pupils.

1(a)(i) Candidates were asked to name two characteristics of plant cells that were not found in animal cells. The most common responses were ‘chloroplasts’ and ‘cell wall’. A number of candidates need to be more specific in their responses to such questions, as ‘vacuole’ was not sufficient to gain a mark at this level. Examiners were looking for the more specific response of a large or permanent vacuole.

1(a)(ii) Candidates needed to name one structure present in animal cells that was not found in plant cells. Many candidates gave a correct response. ‘Centrioles’ was the most common such response, closely followed by cilia / flagella. The mark scheme allowed ‘lysosomes’ even though this is a feature that is still being debated - plant cells certainly have small vacuoles that contain lytic enzymes, but they are not always called lysosomes in plants.

1(a)(iii) Candidates were asked to describe the roles of the cytoskeleton. Most candidates were able to give some correct responses. Many stated that the cytoskeleton was involved with transporting vesicles or organelles around the cell. Some candidates need however to be more specific, as transporting ‘substances’ around the cell was not accepted. Movement of cilia or flagella and provision of support for the cell were also commonly stated.

1(b) Candidates were asked to outline how organelles work together to secrete a specific protein. Most candidates gave excellent responses that were well organised and clearly worded. The QWC mark was usually awarded. In certain areas candidates need to be more specific with their wording of responses. For example, they should describe the secretory vesicle as 'fusing to the cell surface membrane' rather than 'binding to the membrane'. Binding does not necessarily suggest that the vesicle membrane becomes a part of the cell surface membrane and that the contents of the vesicle are released through the membrane.

Question 2

Most candidates obviously have a good understanding of how ventilation is achieved in the mammalian lungs. Responses were however not always clearly phrased and candidates should use technical terms to make their responses more focussed. Many candidates also need to think more precisely about what the model is demonstrating. This was particularly obvious in part b)(iv).

2(a) Candidates were asked to explain why the balloons expand when the rubber sheet is pulled down. This question is answered by very simple physics. Many candidates were able to score all three marks within two lines of clear succinct text. Other candidates clearly need to gain a better understanding of the simple physics and consider their response before starting to write. Some candidates described how air is inhaled into the lungs rather than applying their knowledge to the model. These candidates must be encouraged to read the question carefully.

2(b)(i) Candidates were asked to explain the term tidal volume. Most candidates successfully scored one or two marks. Sometimes these marks were achieved for the idea that this volume is measured 'at rest' or that it is the volume 'in one breath' rather than for the idea that the tidal volume is a 'volume of air inhaled or exhaled'. Candidates must try to be more specific with their terminology and use the term 'volume' rather than 'amount'. Weaker candidates should also move away from the idea that oxygen is inhaled and carbon dioxide is exhaled.

2(b)(ii) Candidates who were familiar with this model were able to describe how it was used by the teacher to demonstrate tidal volume. Those who had not seen the model before suggested blowing into the glass tube or attaching it to a spirometer to measure the volume of the air.

2(b)(iii) Candidates were asked to explain the term vital capacity, and many were able to score marks successfully. Again, the use of inappropriate terms meant that some responses were not sufficiently focussed to gain full marks.

2(b)(iv) When asked how the teacher could demonstrate vital capacity most candidates described how to demonstrate taking a deep breath. Pulling the rubber sheet down as far as possible (taking a deep breath) must be followed by pushing it up as far as possible to expel as much air as possible.

Question 3

This question was about the transport of both oxygen and carbon dioxide in the blood stream. Able candidates who had been well taught were able to score good marks with well-worded responses that made good use of suitable scientific terms. They were also able to appreciate how the question developed through parts b, c and d with each successive part getting a little more difficult and requiring a little more knowledge and understanding to answer successfully.

3(a) Candidates were asked why erythrocytes do not enter the tissue fluid. The majority of candidates knew that red blood cells are too large. The better candidates realised that they needed to give a little more detail than simply stating that the cells were too large to 'pass through the capillary wall'. This level of detail is given in the stem of the question. These candidates usually scored the second mark by suggesting that the cells had to pass through

pores or gaps between the cells of the capillary wall. Very few candidates used the term endothelium.

3(b) Most candidates scored some marks when asked about the role of haemoglobin in the transport of oxygen. The command word 'describe' requires a reasonable level of detail in the response. Examiners were looking for the idea of either loading or unloading oxygen linked to where this occurred. Good responses made statements such as: 'oxygen combines with haemoglobin in the lungs where the oxygen tension was high'. Again the use of appropriate scientific terms such as 'loading' or 'binding' enabled better candidates to score where others did not. Candidates also need to be specific in their statements – haemoglobin has 'a high affinity for oxygen' rather than just 'an affinity'. Also, oxygen 'dissociates from haemoglobin' rather than just 'dissociates'. The latter implies that the oxygen molecule splits into two smaller particles. Candidates must also be encouraged to read the question carefully, as many responses gave details of the structure of the haemoglobin molecule and how it loads oxygen which were not required.

3(c) The best candidates could describe the formation of hydrogencarbonate ions in two or three lines and achieve the QWC mark by the third line. Good responses were clear and succinct – often accompanied by correct symbols and equations. A common misconception was that hydrogen or hydrogen ions reacted with carbon dioxide, or possibly haemoglobin. Another common misconception was that hydrogecarbonate ions dissociate to form hydrogencarbonate ions and hydrogen. This is an area where weaker candidates need further support to fully understand.

3(d) Most candidates could name the Bohr effect. Far fewer were able to successfully explain why it occurs. Better candidates started their response where part c) finished, with hydrogen ions having an effect on the haemoglobin. They also related it to part b) by stating that the affinity of the haemoglobin for oxygen is reduced and therefore more oxygen is released where the carbon dioxide concentration is high.

Question 4

This question tested candidate's knowledge and understanding of translocation in plants. Most candidates demonstrated good understanding with responses that were well considered. As ever, there is a need for candidates to use appropriate terms and to think through their responses to ensure they have incorporated a suitable level of detail. Better candidates were able to appreciate how a question can develop through its different parts. Information provided in the diagrams and stem of the question were essential to answering the question – candidates must be trained to read all the information thoroughly.

4(a)(i) Many candidates were able to label the xylem and phloem in the diagram correctly. They could achieve this by writing inside the correct part of the diagram or using label lines. However, a good proportion had the labels reversed or did not draw suitable label lines. Candidates should be trained through their practical work to draw and label diagrams accurately. Some candidates missed the question despite the presence of a statement to remind them to answer this part of the question on the diagram.

4(a)(ii) Most candidates correctly named structure R as a vascular bundle or vein.

4(b)(i) Candidates were provided with the results of an investigation and asked to draw conclusions from the evidence. Most candidates correctly identified the charged particles as hydrogen ions and many appreciated that these ions were moved out of the companion cells. Other candidates seemed confused and referred to acidic substances or alkaline substances rather than to ions. Many candidates tried to describe the process of active loading rather than focus their response on the specific question asked. It is important to train candidates to read the question carefully and restrict their response to answering only that question.

4(b)(ii) Many candidates appreciated that the evidence suggested a need for ATP and an active process to ensure that the hydrogen ion concentration gradient is set up. However, many candidates simply stated that respiration must occur for the process to go ahead.

4(c)(i) Question 4(c)(i) was a gap fill question in which the candidate's knowledge of the active loading process was tested. Most candidates scored two or three marks appreciating that active transport must be required to create a concentration gradient and that the hydrogen ions must move through the membrane by facilitated diffusion, while the sucrose could diffuse through plasmodesmata into the sieve tube. Few candidates appreciated that assimilates are molecules that have become part of the organism and that amino acids are often transported. This part of the question was more difficult as the molecule mentioned had to be an assimilate and one that is transported in the phloem.

4(c)(ii) Candidates were asked what evidence for the active loading mechanism might be gained from observation using an electron microscope. Most candidates appreciated that mitochondria were required to produce the ATP used in active transport. Some did not link the need for many mitochondria in particularly active tissues. Fewer candidates were able to provide a second line of evidence such as the presence of plasmodesmata. Weaker candidates need to be trained to recall what features of cells are visible under an electron microscope as some were suggesting that the movement of sucrose and even hydrogen ions could actually be observed.

Question 5

This question tested knowledge and understanding of cell signalling in the context of the life cycle of the slime mould *D. discoideum.* As this is set in such an unfamiliar context most questions were testing assessment objective two. Most candidates were able to adapt their knowledge very successfully and score good mark totals.

5(a)(i) & (ii) Most candidates were able to identify the type of cell division and the stage of the life cycle where differentiation takes place.

5(b)(i) Most candidates gave the correct term for communication between cells.

5(b)(ii) Most candidates could identify two stages in the life cycle where cell signalling takes place. In this case describing an example of cell signalling needed both the name of the signalling molecule and the response it produced in the receiving cells. A good number of candidates did not manage to provide this level of detail and candidates must be trained to understand that the command word 'describe' does require a reasonable level of detail in the response. Well-trained candidates were able to give full descriptions in clear and succinctly worded responses.

5(b)(iii) Most candidates appreciated that a cell surface membrane adapted for cell signalling would contain receptor molecules. Fewer candidates were able to specify that the receptor molecules must be specific to one of the named molecules used for cell signalling by the slime mould cells.

5(c) A simple calculation was required to determine how many hours it would take a single cell to reproduce a sufficient number of times to produce a mass of at least 100 000 cells. The best candidates achieved this mark. Most candidates, however, were unable to make the calculation which simply needed them to double the number each hour until they reached a total of over 100 000.

Question 6

This was a straightforward question testing candidates' knowledge of terms. Most candidates knew many of the terms but a couple were less well known.

6(a), (b), (c), (d), (f) & (g) These terms were well known to the majority of candidates. In part (d) fewer candidates were able to spell meiosis correctly.

6(e) The term ultrastructure was not so well known and common errors were to write 'organelles' or cytoskeleton'.

F212 Molecules, Biodiversity, Food and Health

General Comments

The paper produced a good spread of marks and there was no evidence that candidates struggled to complete the paper in the time available. Candidates who were well-prepared were able to gain marks across the range of topics covered. There were few instances of candidates misinterpreting what was required by each question. The most common misinterpretation was for candidates to discuss lung disease in 6c, when discussion of only cardiovascular effects was required.

The health and biodiversity topics produced many high-quality answers but a large number of candidates failed to gain maximum marks on questions because of lack of detail and poor use of technical terms. Those candidates who could comfortably use technical terms, such as 'enzyme substrate complex', 'active site', 'amino acid sequence', 'base sequence', etc, generally did better overall.

This year there appeared to be a drop in many candidates' ability to demonstrate a clear understanding of the biochemistry topics and those questions testing protein and polysaccharide structure were answered less well than in previous sessions. A significant minority of candidates were very confused about the terms 'immunity' and, to a lesser extent, 'resistance'. Many seemed to think that 'immune' conveyed some idea of permanent antibiotic ineffectiveness, whereas 'resistance' was merely a temporary phenomenon, but otherwise they were the same thing.

Practical skills seemed better this session, with more candidates being able to talk about 'validity' in 2biii, and 3d was done well. However, there were still candidates who used the term 'amount' in 2biv, which we again stress should not be used. However, accomplished data interpretation was not demonstrated by many candidates. Some answered the enzyme graph question as if it was a rate of reaction against time graph. Many candidates struggled to analyse the data provided in the table in 6bii. Reference to 'deaths' and 'percentage increase in deaths' were clearly in the column headings, but candidates were not able to use these terms in their answers, instead answering with unwarranted inferences such as 'increased risk of developing…'. It would benefit students to develop their critical thinking skills by looking at different types of graph and table and practising drawing conclusions that are supported by the data.

Comments on Individual Questions

Question 1

(a)(i) Almost all candidates answered this correctly, usually for writing 'fins'. A few responses mentioned gills but these were not visible in the diagram and so no mark was given.

(ii) Around a third of candidates got a mark for referencing the position of the eyes on top of the head. Responses that mentioned eyes alone were not awarded a mark as the presence of eyes did not necessarily facilitate life on the sea bed. References to a flat belly were also not credited because the underside of *Tiktaalik* was not visible in the figures.

(b) Most candidates scored both marks. Popular answers were 'cell wall', 'chloroplasts' or 'vacuole'. A few candidates wrote that they were autotrophic, failing to realise that the question asked for *features* present in cells.

(c) Most candidates were able to gain 2-4 marks on this question; 5 marks were scored by a reasonable minority but only rarely were full marks awarded. A large proportion of answers referred to DNA, genetics or molecules, and many used cytochrome C, base sequence and/or amino acid sequence too. Quite a number of students successfully communicated the idea that similarities in any of these biochemical features indicated a close relationship. However, candidates that chose to refer to a common ancestor as a signifier of similarity were not awarded marking point 5 on that basis alone. The term 'common ancestor' does not, in itself, signify a close relationship as all species, it could be argued, have a common ancestor. It was common for candidates to discuss humans and apes as an example of genetic similarity but discussion of this example often failed to clearly reference the idea of a close relationship between the two and sometimes confused apes with monkeys. Discussion of extraction of DNA from fossils or 'ancestral species', which was seen occasionally despite the question stem, was not credited.

Only around a third of responses mentioned non-biochemical evidence; moreover, several candidates who did discuss non-biochemical evidence failed to mention molecules; hence the QWC was rarely awarded. A reasonable minority of responses discussed Darwin's finches but some were too vague to get a mark – referring to birds in general, for example. Comparison of anatomy and behaviour in general terms was seen in less than a quarter of answers but was usually credited when discussed. Reference to pentadactyl limbs was also credited where it was seen.

Very few candidates, much fewer than expected, gained marking point 6. Those that were successful discussed antibiotic resistance in bacteria, insecticide resistance in malaria or the peppered moth. A number of candidates thought that phylogeny itself was evidence for evolution, suggesting a misunderstanding of either the term 'phylogeny' or the term 'evidence'. A few candidates, ignoring the question, wrote about fossils or the process of natural selection and were not given any credit.

Question 2

(a) Most candidates obtained the mark. Those that did not tended to be very uncertain of the nature of an enzyme, or starch, or used the term 'excreted'. A number of candidates wrote that is worked outside the body and were not awarded the mark.

(b)(i) The majority correctly stated 'time'. Some candidates qualified this further, which was ignored unless it became contradictory, which it did on occasion. For example, 'time to break down the product' received no marks. A minority of candidates did not address the concept of rate and wrote 'substrate concentration' or 'enzyme concentration' for no credit.

(ii) This question was poorly done with most candidates getting only 2 or 3 marks. Responses that explained the reasons why an increasing substrate concentration caused an increased rate of reaction, and then explained why that rate of reaction did not increase further after substrate concentration had reached a certain level, obtained high marks. Many candidates wrote detailed descriptions of the shape of the curve for no credit. A large number of candidates understood that the question was asking them to use scientific knowledge to explain and clearly understood the science, but failed to use the key term 'active site' at all, or to distinguish between enzyme and enzyme concentration when necessary, and so failed to gain full marks. Candidates who used the word 'optimum' as a synonym for 'maximum rate' were not awarded one of the potential marks. Some candidates discussed the reaction *slowing down*, clearly misinterpreting the nature of the graph and this made it difficult for them to access many of the marks at all.

(iii) In contrast to part (ii), this question was done well, with most candidates gaining at least 2 marks. There was some good use of scientific terminology such as 'active site' that was not evident in part (ii). Most approached answers from the point of view of pH changing and the effects this caused. All marking points were awarded regularly, even those associated with the more detailed biochemistry. Most candidates appreciated the concept of validity but some did not express it with sufficient clarity or use of appropriate terms.

(iv) Most candidates correctly identified 'temperature' and very many, 'enzyme concentration'. Fewer candidates used the imprecise term 'amount' than was evident in previous sessions. A number of candidates wrote 'volume of enzyme' which was not given a mark unless they mentioned 'solution'.

(c)(i) This question was not answered well. Most candidates gained 1 or 2 marks, usually for identifying α- and β-glucose as subunits, the fibrous nature of cellulose or the arrangement of hydrogen bonding. Few got full marks. A significant minority used terms associated with protein structure and gained no credit. Similarly, many candidates gave differences relating to function rather than structure and gained no credit. A large number of candidates answered as if one of the molecules they were describing was glycogen, as reference to 1-6 bonds and branches was often seen. Candidates who did not compare like with like within a given row were not credited, nor were responses that were written in a 4^{th} or 5^{th} row.

(ii) Many gained 2 marks here for 'strong' and 'insoluble'. Those that attempted to describe binding between molecules sometimes failed to provide enough detail or were not given the mark because of incorrect or contradictory science. A significant number of candidates discussed the permeability of the cell wall and gained no credit.

Question 3

(a) The vast majority of responses were correct. Very few failed to correctly write '*Nypmhaea*' with a capital 'N'. The most common incorrect responses were '*thermarum*' and '*Plantae*'.

(b) On average, candidates achieved 2 out of 3 for this question. Most commonly candidates identified a danger present in the natural habitat and many were aware that the natural habitat itself was in danger. Some of the latter, however, failed to identify a reason for the habitat destruction or used the less precise term 'environment' as a non-creditworthy alternative to 'habitat'. All other marking points were seen but infrequently. A minority of candidates merely listed reasons for conservation in general rather than focussing their answers on the need for *ex situ*, as opposed to *in situ*, conservation.

(c) This question produced marks in the range 1-3 in roughly equal proportions. All marking points were seen, although it was rarer to see reference to less damage to the wild population or the ability to store greater genetic diversity. Many responses discussed seeds being stored for a long time, but without reference to viability the mark was not awarded. A common answer was that in the future, plants could be easily reintroduced back to into the wild; this was not credited because the same could also be said of conserving adult plants.

(d) Most candidates achieved 3 out of the 4 marks on this question, mostly for 'quadrat', 'grid', and 'random sampling'. Those few who discussed using a transect rarely mentioned regular intervals. Many candidates, whose responses were otherwise thorough, failed to mention the need for multiple repeats. All the other marking points were seen, but less frequently. A number of students referred to quadr*ants,* or thought that *throwing* quadrats was a random procedure. Those responses that referred to mark and recapture techniques or net sweeping were not given credit as the question was about plants.

(e) This was generally well answered, with a good balance of marking points. The first marking point was the most common, but some candidates simply listed alternative reasons for all species not having been discovered and limited themselves to one mark. A number of candidates failed to achieve marking point 3 as they often didn't make it clear that extinction was recent or ongoing. Responses that discussed errors in calculating or estimating, and the difficulties associated with the large numbers involved gained no credit.

Question 4

(a) The ability to apply knowledge of the fundamental aspects of protein structure was required for this question but many candidates were clearly uncomfortable with the topic. Part (i) was the part most frequently answered correctly. Only a minority answered (ii) - (iv) correctly and very few scored all 4 marks. A number of responses contained only one letter, when, for parts (i)-(iii), two were required. The most common response to part (iv) was F.

(b) (i) This question was well answered. Candidates frequently used the space available to draw a diagram which was usually accurately drawn and gained 2 marks. Many candidates then gained the third mark for stating the polar nature of the water molecule. Candidates who referred to oxygen or hydrogen as molecules or ions were not awarded one or more of the marking points.

(ii) Most responses were awarded 1 or 2 marks. Reference to transport was the most commonly seen correct response. Marks were also awarded frequently for mention that water is a medium for reactions (processes was not sufficient) or giving examples of transport systems and what is carried in them. Many responses discussed the idea of absorption but used words such as ‘get’ or ‘obtain’ or ‘nutrients’, which were not precise enough. It was common for answers to imply that uptake of minerals was a feature of aquatic organisms only. Further detail of reaction facilitation was rarely seen and dilution of toxic substances was equally rare. A significant minority of responses did not focus on the word ‘solvent’ in the question and discussed other properties of water for no credit. Some responses described the *process* of dissolution despite the question asking about *importance*.

Question 5

(a) The question tested candidates’ ability to link an observation with a reasonable conclusion. Most candidates discussed the inheritance of something. However, those that discussed only genes failed to get the mark because there was no information about genes in the observation. A few responses discussed inheritance of beneficial characteristics, but in order to draw this conclusion a further observation would have needed to be considered.

(b) Around half of responses gained 1 mark, usually for identifying the closer relationship, or more recent common ancestry, of B, C and D. Marking points 2 and 4 were rarely awarded. Responses that discussed a timescale got no credit and those that thought that C and D were somehow more related to each other than they were to B clearly misunderstood the nature of an evolutionary tree diagram. A minority of responses spent some time discussing the relationship between organism 1 and organisms A, B, C and D for no credit, as this is not what the question had asked them to do.

(c) This question was well answered with most gaining the mark for the idea of more evidence often linked to an example, such as DNA. Some also gained the mark for identifying the influence of religion on 19th century society.

(d)(i) Around half of candidates mentioned protein or polypeptide and gained the mark.
(ii) This question required candidates to apply their knowledge of DNA structure and replication, which was, in most cases, very thorough, and identify those aspects of structure which facilitated accurate replication. Many candidates clearly found this challenging and it was rare to award full marks. Most responses merely described DNA replication and scored 2 or 3. Lower scoring responses often veered into discussions of transcription or translation, or described DNA as a polypeptide made of amino acids.

(e)(i) The vast majority of candidates correctly identified speciation as the answer. Variation, adaptation, mutation, and natural selection were also seen.

(ii) Most candidates were able to get the idea of isolation or more varied selection pressures into their answer. The commonest incorrect answers discussed the influence of humans on the islands.

Question 6

(a) A large majority of candidates gained at least 1 mark for citing physical and mental wellbeing, with the majority gaining the second mark for identifying the absence of disease. The most common un-creditworthy answers used the word *state* in place of *well-being*.

(b)(i) This percentage calculation was done well with most candidates getting both marks. A few rounded incorrectly and got 1 mark, and a significant minority simply divided the recorded deaths figure by the expected deaths figure and multiplied by 100. This question was omitted by around 1 in 15 candidates.

(ii) This question tested candidates' ability to interpret data and describe it clearly, and many found this more challenging than the customary 'describe the graph' question. Many gained mp1 for any way of saying that smoking increased the number of deaths from lung cancer or CHD, but those who failed to mention death were not awarded this mark. The other two marking points were rarely awarded. Candidates seemed to have difficulty turning numerical data into a clear unambiguous sentence. A significant minority of responses attempted to describe the greater increase in percentage of lung cancer cases but most of these struggled to express their point clearly enough. Responses that discussed 'a bigger effect' or 'a big increase' or merely quoted percentages without stating that one percentage was bigger were not awarded the mark. Very few even attempted to describe the larger increase in number of CHD cases.

(c) Most candidates were very comfortable with the topic and wrote lengthy answers which often gained 6 of the 7 available marks. Responses that discussed nicotine and carbon monoxide in the context of only the cardiovascular system often got full marks. The QWC mark was frequently not awarded because candidates discussed effects on the respiratory system.

Question 7

(a)(i) Most answers gained this mark, usually for references to milk production or udder size.

(ii) Most responses were able to gain 3 marks for a basic description of selective breeding. Many candidates answered in general terms, missing out on the context of meat or milk production. A small but significant minority gave a detailed account of natural selection, omitting role of humans. The very few candidates who misread the question completely and discussed the use of feeding and hormones to improve productivity gained no credit.

(b)(i) Many candidates gained both marks. 'Correct', or 'right', proportions gained a mark but the oft-seen 'balanced', or 'sufficient' proportions did not. Likewise, food 'types' was not considered precise enough.

(ii) The glycerol and ester bond were correctly identified by most candidates. Slightly fewer, although more than half, correctly identified the fatty acid. However, only a minority described the fatty acid as unsaturated. Many referred to the fatty acid as a hydrocarbon tail.

(iii) Most candidates gained some marks but few got all four. All marking points were seen. Many answered in terms of the development of atherosclerosis, rather than obesity as a form of malnutrition, but were still able to gain 2 marks. Some candidates missed out on the first marking point by stating that beef contained a lot of unsaturated fat. The minority of responses that merely defined malnutrition without placing it in context gained no credit.

(c) This question was a good discriminator between candidates. Many answers were well expressed and demonstrated clear understanding of the processes involved, gaining all 3 marks. A minority wrote in general terms about salt drying out food without reference to water potential or osmosis and did not score marks. A few stated that salt changed pH or denatured enzymes. A significant minority of candidates thought that beef contained only protein and milk contained only calcium and, despite having been told they both contained triglycerides, neither contained any fat. Such statements were not given any credit.

Question 8

(a) This question was very well done, with most candidates getting at least 4 marks, and almost everyone getting at least 1. The commonest mistakes were 'receptor' for 'antigen', 'active for 'specific', 'phagocytes' for 'antibodies' and 'strand' or 'species' for 'strain'.

(b) This question differentiated well between candidates. The vast majority of candidates knew that 'resistant' was the correct term. A few mentioned resistant, but were not awarded the mark because they went on to state that resistance was a form of partial or temporary immunity. Around half of candidates knew that immunity involved an immune response and were able to give enough detail to get a mark. Very few candidates referenced the fact that, in order to have an immune system, an organism needs to be multicellular.

F213 Practical Skills 1

General Comments

Candidates' performance was better than previous sessions in some areas, such as tabulation and graphing. Fewer graphs showed incorrect scaling or plotting than previously seen and many showed correct use of units and unit symbols. In other cases there was a basic misunderstanding on how to plot error bars from standard deviation data onto graphs, with a large number plotting range bars or half a standard deviation instead of one standard deviation each side of the mean plot as required. It was clear that candidates found the maths questions especially difficult and incorrectly calculated the Simpson's diversity Index for Evaluative task 1 and the relative activity calculation for Evaluative task 3. In some cases this was not attempted at all.

Candidates need to be prepared on how to follow the instructions given in the question, such as drawing a set number of cells, or choosing a single response when required to do so, instead of responding with several. Where answers continue onto a different section of the paper or onto separate sheets this must be clearly indicated both at the end of the first part of the response with an indication where it is continued and at the start of the continued answer. Securely attaching extra sheets is also vital.

Centres are requested to securely fasten the three tasks, used for submission, together with a treasury tag and a summary front sheet correctly filled in with all required details.

Comments on Individual Tasks

Qualitative Task 1

Part 1 required the completion of the table with correct headings and unit symbols such as (min) and volumes correctly recorded with consistent decimal places. The colours recorded although subjective were most successfully recorded when candidates made clear observations. Other candidates confused the enzyme and the substrate, in this experiment, resulting in incorrect results recorded or incorrect responses in both part 1 and part 2.

Part 2 was best answered when candidates had a good understanding of the enzyme involvement in the reaction. Where there was incomplete understanding of the enzyme role and the effect of the inhibitor the questions were not answered well.

Qualitative Task 2

Most candidates gained marks for Q 1, where they understood the structure of the root and correctly described the structures.

The drawing skills for Q 2 and 3 were demonstrated well in most cases with a good understanding that a low power plan requires tissue layers whilst high power cell drawings require cell detail. Where candidates did not gain full marks they had incorrectly included cells in the low power plan with too few correct labels or had drawn too many cells in the high power drawing and had not understood the difference between the tissue and cell labels. Xylem is the tissue whilst xylem vessel is the correct label for the cell. Good diagrams had ruled label lines.

Correct answers were achieved where they described the arrangement in the photomicrograph and not in slide J which had already been assessed in question 1.

Qualitative Task 3

The drawing skills demonstrated for this task were frequently good although marks were lost where the instructions have not been followed and only the individual leaves or the roots had been drawn.

The best marks were achieved for the table only where the comparative nature of the points for the four areas was fully understood.

Part 2 Q 1 was usually well achieved since there were a number of different possible options, whilst in Q 2 the idea that the rate of transpiration was being reduced was not achieved by many candidates and a number had not used their knowledge successfully to realise that the leaves would be grazed by small invertebrates such as slugs and snails.

Quantitative Task 1

The bar chart graphs were completed well for this task with few problems of labelling the axes or scaling. Marks were lost when the Y axis label was missing the word mean or when the bars did not occupy at least 50% of the available paper.

In Q 3, marks were gained when the comparative nature of the question was fully understood. In some cases the last mark was lost because there was no appropriate comment about the overlapping of the ranges.

Quantitative Task 2

Very few candidates lost marks for table 1 or 2. Where marks were lost, the instruction to calculate the changes in mass against the original mass were not followed.

Part 2. The graph in this question required three lines to be drawn on the same axes which defeated some candidates with one or more lines missing or different style being used to draw each line. This was not accepted as it is not possible to compare the lines if they are drawn using a different style. Use of incorrect unit symbols was another loss of mark points. On the other hand many achieved full marks for the graph with axes correctly scaled and correct units and symbols used.

Questions 3 and 4 were usually correctly answered although a few candidates had not transferred their skills fully and so did not demonstrate the ability to read off the data from the graph correctly.

Quantitative Task 3

Most candidates gained full marks for correctly recording the data in tables 1 and 2 to the nearest 5 seconds. Only a few candidates missed this point and recorded other time values.

The graph in Part 2 was successfully scaled and labelled in most cases and the lines were well drawn. Others lost marks for using two different styles for each of the two lines or for use of incorrect unit symbols. Some Centres incorrectly awarded marks for graphs that had not been scaled so that the plotted area was at least 50% of the paper.

Q 2 was well answered although some candidates had not read the question fully enough to realise that it required time not rate.

Q 3 is a discriminating question, especially mark point 3 as for many candidates it had not been fully realised that both substrate and enzyme are of protein and so both would be denatured.

Evaluative Task 1

In Q 1 the response frequently did not relate to the area in marking points 1 to 5 with marks being therefore lost. This did not apply to marking points 6 to 11 where it is the difference that is the important aspect needed in the response. This question was one where Centres often had awarded marks incorrectly.

In Q 2 the idea of a comparison between the ranges was frequently missed for mark point 1 and for mark point 2 the need to discuss the overlap in the range was not seen.

There were a variety of responses for Q 3 (b) but frequently it was missed that only one factor should be changed so that all others should be removed. Some candidates did seem to be confused and used incorrect terminology but the centres had awarded the mark anyway.
Q 4 and 5 were well answered in most cases. On the other hand many candidates made miscalculations in Q 6, so lost the first and sometimes the second mark, however a final error carried forward mark was usually possible. Other candidates, if mathematically–minded, gained three marks here even those who were weaker biologists.

Responses to Q 7 demonstrated that the terms had not been fully understood and in question 8 it was quite frequent that only 1 mark was achieved due to an incomplete understanding of the uptake of water into the root hair cells.

Evaluative Task 2

For Q 1 there was a misunderstanding of the question, with candidates missing that the *increase* in mean mass was required in the response. This resulted in the inappropriate use and application of their knowledge. In this question especially centres awarded marks that were not always fully justified.

In Q 2, few candidates understood that the tubing itself was the partially permeable membrane. However other candidates successfully gained three marks for this question.

In Q 3 (a) two marks were frequently awarded for two graph responses, whereas one comment on the graph and one on table 1 were required.

Q 3 (c) was subject to a number of differences as candidates had been incorrectly awarded the mark without a clear reference to the idea that the model cell would weigh more due to more water on the surface and for the second point the candidate needed to demonstrate that if the balance was wet or the reading above zero it should have been tared first.

For Q 5 (a) successful candidates highlighted the incorrect value as 3 and then compared this to the other replicates which showed an increase.

Q 6 (a) the question required an understanding of the cellular structure of the root epidermis with reference to the root hair cells. Candidates gained marks where they mentioned an example of an ion and its specific use in the plant. Q6 (b) was well answered in most cases with only a few losing marks for failing to mention ATP or protein carriers.

Evaluative Task 3

Q1 showed quite a variety of responses with those with a poor understanding not fully explaining the suggestion to correct their given limitation. Where the understanding was good four marks were easily obtained.

For Q 2, many candidates had not read the question fully and so responded with two entry errors instead of one entry and one calculation error as required. Centres often awarded four marks incorrectly for this type of response.

Q3 frequently gained only 1 mark as a maximum out of the 3 possible marks as range bars were frequently drawn instead of error bars or half a standard deviation was plotted each side of the mean instead of correctly plotting one standard deviation each side of the mean plot.

Q 4 (a) and (b) caused no problems at all with the majority scoring both marks..

In Q 5 candidates frequently did not achieve the second mark as they had incorrectly read the data points from the graph, whilst Q 6 was not understood and was often not answered. However those that correctly saw the relative activity was needed scored well as the mathematics required was not difficult.

For Q 7 the main problem was a lack of understanding of the question so that there was no reference to the validity of any response made, nor to the original statement nor any other wording that suggested the conclusion was correct or incorrect.

F214 Communication, Homeostasis and Energy

General Comments

Some excellent answers were seen that indicated that candidates had been well prepared for the examination, both in terms of the material covered in the unit and the ability to apply their knowledge in unfamiliar contexts.

Candidates need to ensure that they take all of the information given in the question into account when preparing to answer questions relating to this information. Questions where this would have been particularly beneficial included Q2(a), Q3(c) and Q4(a). The questions asked will most likely require candidates to make use of this information in developing their answers rather than expecting candidates to simply recall particular facts or processes. Candidates who simply recall information will be unlikely to address the particulars of the question.

Care needs to be taken in the use of technical terms used in answers. In Q3(d)(ii), terms were to be used that would need to be either defined or spelled unambiguously. Terms such as glycolysis, glyogenolysis, glycogenesis and gluconeogenesis need to be expressed clearly and a clear distinction needs to be made between glycogen and glucagon. Such terms that are spelled incorrectly or described incorrectly will not be credited. This principle was also important in Q4(b)(iii), being able to clearly distinguish between mitosis and meiosis.

Comments on Individual Questions

Question 1

(a)(i)
Most candidates named chlorophyll a as the primary pigment although some simply stated chlorophyll without any further clarification and very occasionally chlorophyll b was given. A small number of candidates suggested chlorophyll alpha or gave P680/P700 as a response, neither of which were credited.

(a)(ii)
Most candidates were able to name a suitable accessory pigment, most frequently either carotene or carotenoid, although there were some references to xanthophylls (with various spellings). However, those candidates who had given chlorophyll b as their answer to (a)(i) frequently supplied an incorrect response to this section.

(a)(iii)
The advantage of a plant having a variety of accessory pigments was generally well understood. The most common reason for not achieving the mark was to refer only to light frequencies or to simply state that more light could be absorbed.

(a)(iv)
Most candidates correctly named ATP. The most common incorrect answer was NAD/NADP or water, indicating that the question had not been read carefully. Several candidates lost marks for incorrectly defining ATP - typically as adenine triphosphate or adenosine triose phosphate.

(b)(i) - (iii)
Well prepared candidates were able to identify all the relevant enzyme and compounds at the different stages of the Calvin cycle although a common mistake was to give the acronym followed by the incorrect name, such as GP - glycerol phosphate, glucose phosphate or glycerate triphosphate. TP was also a common error. A few candidates muddled RuBP and rubisco.

(b)(iv)
Few candidates were able to name both starch and cellulose as the two polysaccharides that could be synthesised from the end products of the light dependent stage of photosynthesis. Many suggested either monosaccharides or disaccharides, glycogen, or even lipids and amino acids.

Question 2

(a)(i)
While many candidates understood that the Pacinian corpuscle is described as a transducer because it transforms one form of energy into another, they often negated their answer by naming the wrong from of energy, such as kinetic or chemical. Inadequate responses stated that the corpuscle would transform the stimulus into an electrical impulse.

(a)(ii)
The reason why deformation of the plasma membrane of the tip of the neurone causes the membrane to become more permeable to Na^+ was frequently poorly understood. The most common correct response was that deformation would open the sodium ion channels. While some candidates appreciated that the bilayer might develop temporary gaps, they did not specify the phospholipid bilayer. Answers that suggested that the voltage gated channels would open, or that the channels, or the plasma membrane, would be damaged or denatured by the pressure exerted upon them did not gain credit.

(a)(iii)
The meaning of the ‘All-or-Nothing’ law in the generation of an action potential was generally well understood, with most candidates recognizing that the an action potential would only be initiated once the threshold potential was reached or exceeded. However, some incorrectly stated that the action potential would have to reach threshold or simply said that the action potential would either happen or it wouldn’t. Some referred to the strength of the action potential, thereby negating their answer.

(a)(iv)
Good answers showed an appreciation that the information about the strength and intensity of a stimulus is communicated to the brain by way of the frequency of the action potentials. Many commented that a greater stimulus strength would lead to a greater number of action potentials but without reference to a time element, or that they would travel faster. Answers that simply described how action potentials would be relayed to the brain did not gain credit.

(b)
Few candidates were able to suggest why action potentials are not generated constantly while wearing clothes. Most responses concentrated on how neurotransmitter would run out in the synaptic bulb leading to acclimatisation or that weak stimuli would be filtered out by the synapse, which failed to answer the question. Some candidates suggested that generator potentials would not exceed the threshold or that insufficient sodium ion channels would open. Answers were expected to reflect the context of the question and reference the continual pressure on the membrane and so the fact that the sodium ion channels would remain open and therefore preventing the generation of an action potential.

(c)
There were some very good accounts of the roles of synapses in the nervous system with well-prepared candidates gaining maximum marks. Many stated that synapses were important in cell signalling and would ensure that the action potential would only be transmitted in one direction, although some then negated their answer by saying that this would be along the neurone, rather than across a synapse. Many also appreciated that low level stimuli could either be filtered out or amplified, depending on the situation, or that synapses would allow convergence or divergence, either stated or described. Other answers referenced the role of synapses in memory or learning, or how they would prevent overstimulation of the postsynaptic neurone. However, some simply described neurotransmitter release at a synapse which was not credited. Candidates are expected to refer to stimuli rather than signals.

Question 3

(a)(i)
Almost all candidates recognised that the condition being tested for was diabetes (mellitus).

(a)(ii)
Few candidates were awarded this mark as most were unable to grasp the idea that time would be needed to for insulin to act and reduce the concentration back to normal levels. Most candidates stated that a meal eaten within this time period would affect the blood glucose concentration and give an invalid result, which did not really indicate why it was important to leave an eight hour period before performing the test.

(a)(iii)
Most candidates were able to calculate the percentage by which the patient's blood glucose concentration was higher than the upper limit for normal concentration, achieving both marks. However, some rounded up incorrectly, or gave an incomplete answer of 118.6%. The common error was to divide 1.1 by 7.0 instead of 5.9.

(b)
Some candidates were able to gain a mark for understanding that red blood cells would only last for a maximum of 12 weeks after which they would be replaced. Candidates failed to gain credit for being too vague, for example stating 'blood cells' rather than RBC's, and several referred to 'haemoglobin' rather than glycosylated haemoglobin. Those candidates who did mention HBA1C being broken down failed to state that it was broken down in the liver. Many candidates commented that eating habits would vary during this period, with different amounts of glucose being consumed on different days, or varying amounts of exercise, which might cause the mean concentration to alter. Others stated that a single test would not allow a mean to be calculated or anomalous results to be identified.

(c)
Few candidates made reference to the patient having consumed a sugary drink, although some mentioned that the patient may have been nervous before the test so secreted adrenaline. Many attempted to answer the question by suggesting that the body would carry out a physiological response to a low blood glucose concentration by stimulating the secretion of glucagon which would then increase the blood glucose level. Others suggested that insulin may not have been able to reduce the concentration following a meal, although they had been told in the stem of the question that the patient's mean blood glucose concentration had been within the normal range for the previous 8 to 12 weeks.

(d)(i)
Most candidates gained a mark in this section for stating that the circumstance under which the patient would need to be given a glucagon injection would be a very low blood glucose level. Some also commented that the alpha cells may not be functioning properly, resulting in an inadequate secretion of glucagon. It was insufficient to refer to 'low blood glucose' or 'below normal blood glucose concentration'.

(d)(ii)
The role of glucagon in the regulation of blood glucose concentration produced variable responses. Better candidates achieved all marks available for a good description of the secretion of glucagon from the alpha cells of the islets of Langerhans in the pancreas and its subsequent effects on liver or muscle cells. Most appreciated that glucagon would stimulate glycogenolysis and gluconeogenesis, or described the processes, although some failed to gain the second marking point for either failing to identify the effector cells or stating that glucagon itself would convert glycogen into glucose. Some contradicted their answers by referring to the breakdown of glycogen to glucose as glycolysis. While many also recognised that more fatty acids would be used in respiration, some simply that fats or lipids would be used. There were comparatively few references to glucagon reducing insulin secretion (most stated that insulin secretion was stopped) and hardly any to negative feedback reducing glucagon secretion once blood glucose levels had been restored to normal.

Most candidates were awarded the QWC mark for three technical terms spelled correctly and used in an appropriate context.

Question 4

(a)(i)
The vast majority of candidates gave the correct answer acetylcholine, although spelling was not always correct. The only alternative answer commonly seen was dopamine. Some did not appreciate that a named chemical was required and gave the general term, 'neurotransmitter', instead.

(a)(ii)
This was a challenging question for candidates. Despite being told in the question stem that TRPA1 is found on the plasma membranes of neurones, many answered with no specific reference to a membrane at all, referring instead to 'neurone', 'synapse' or 'cell body'. Despite being told that TRPA1 interferes with the transmission of the nerve impulse from one neurone to the next, 'axon' and 'nodes of Ranvier' were suggested by some candidates.
For the explanation, many candidates described the general role of the part that they had named in transmission of impulses rather than attempting to describe how the TRPA1 would affect transmission. There was some confusion about the nature of the TRPA1 receptor. Some candidates described it as if it was a free protein that might bind to ACh receptors in a form of competitive inhibition. Others described two TRPA1 components: the TRPA1 protein which binds to the TRPA1 receptor. There also seemed to be confusion about where ACh receptors are located. A minority of candidates continue to confuse 'nerve' with 'neurone'.

(b)(i)
This was answered well, showing good factual recall. Full marks were commonly awarded. Most confusion arose between C and D - the hepatic portal vein and hepatic artery. Common errors were to describe B including the term 'canaliculus' and D including the term 'portal'. A few candidates gave answers which included references to the pancreas or kidney, despite the question referring clearly to 'part of a liver lobule'.

(b)(ii)
This question was good at differentiating between those candidates who had really read and absorbed the stimulus material and those who had either been confused by it or who had paid only cursory attention to the detail. Good answers appreciated the fact that there might not be enough glutathione and some excellent answers included more than one correct suggestion. Misconceptions included thinking that glutathione is actually formed from NAPQI rather than being used in its metabolism and that sulphate and glucuronide run out rather than the glutathione. A few candidates focused on the toxicity of NAPQI or described a lack of NAD.
(b)(iii)
This question was well answered, although some incorrectly referred to Kupffer cells, meiosis and cell differentiation. Incorrect spelling of mitosis was not credited, but some candidates had obviously been taught to clearly print when giving terms that could be confused.

Question 5

(a)(i)
Most candidates achieved both marks here, demonstrating evidence of sound preparation for this type of question, with good references to data being seen. Most candidates gave a clear general statement to gain mark point 1, although a good number only gave lengthy lists of figures. A few failed to refer to 'rate' of respiration. Very few picked up on the idea of Q_{10}. When quoting data, candidates are expected to use units as stated in the source material.

(a)(ii)
The discursive nature of this question made it a little more challenging. Most candidates, nevertheless, seemed able to access the idea of lower temperatures being better for storage, although, as in part (i), some failed to gain the first mark due to omitting the reference to 'rate'. When using source material such as a table or graph, candidates are expected to quote the precise parameter. Not all made the link to $0^{o}C$ being best and only a few answers clearly discussed the idea of higher temperatures being desirable if ripening was required. Some candidates did mention that data was incomplete for potato/parsnip but did not describe this as a limitation for drawing conclusions. Others thought these vegetables were not respiring at all. Weak answers described the trend (higher respiration rate at higher temperatures) and just quoted data from the table.

(a)(iii)
This was a relatively straightforward application of data question and one which was attempted successfully by most. Many good answers were awarded the first three mark points in one sentence. A few missed the point completely, selecting asparagus, and some mentioned multiple fruits/vegetables. A significant number of candidates appeared to misread or misunderstand the question and answered in terms of the "highest respiration rate", linking this to having plenty of energy to stay fresh.

(a)(iv)
Most recognised that asparagus was the correct answer. Those candidates who failed to gain the mark did so either because they named onion (having already mistakenly given asparagus in answer to part (iii)) or because they omitted the reference to 'rate' of respiration. Reasons were expected to refer to the range of possible storage temperatures.

(b)(i)
This question proved an effective discriminator with only good answers achieving marks. These gained two marks for managing to describe how inaccessibility of oxygen was due to its carriage in erythrocytes. Few candidates seemed to understand that the plasma is also involved, but with very little oxygen dissolved. A significant number of answers failed to gain marks as candidates related the parasitic adaptation to survival either in deoxygenated blood (because they were in a vein or the host was exercising) or after death of the host. Some thought that the parasite simply lacked appropriate enzymes/mitochondria and failed to actually address the question as to why the adaptations had occurred in the first place. Many candidates were concerned that the parasite should not take oxygen from its host as this would damage the host's health or result in its death. The idea of the host having a higher affinity was seen but not always linked to the idea of haemoglobin and a pigment in the parasite. Generally, it was stated that the entire parasitic organism had a lower affinity for oxygen.

(b)(ii)
This question allowed for real discrimination and differentiation. Many candidates accessed the A1 and Y1 marks (together with the QWC mark). Fewer candidates were awarded a fourth mark. There was a lot of confused chemistry. Common misconceptions were that CO_2 was released in the lactate pathway and ethanol was confused with ethanal or with ethanoic acid. Candidates described the importance of re-oxidising reduced NAD but did not focus on the possible 'reverse reactions'. A number thought that ethanol could not be converted back into pyruvate as it was so toxic that it had to be removed from the cell immediately it was produced. Candidates who focused on why the pathways cannot be reversed and ignored the instruction to use their knowledge (and hence give detail) of the difference between the pathways neglected to include enough description of the pathways to be awarded A1 or Y1. There was difficulty in clearly explaining that atoms were either lost or were not and describing the consequence for reversal. Candidates often mentioned lactate dehydrogenase but not in its role of reversing the pyruvate to lactate reaction. Some candidates mentioned pyruvate decarboxylase but hardly any suggested that a carboxylase enzyme would be required to reverse the pyruvate to ethanol reaction.

Question 6

(a)(i) - (iii)
Most candidates accessed 2/3 marks here. The most common error was to reverse the positions of the cortex and medulla. Almost all answers correctly followed the instruction to use letters rather than the names of the relevant parts of the nephron.

(b)
This question was a good discriminator. Most candidates had a good idea of the role of the loop of Henle but they found it less easy to clearly communicate the significance of the loop being 'longer' in the desert mammal. There was often imprecise use of terminology – selective reabsorption of water / movement of salts / greater concentration gradients etc. Reabsorption of water often centred on the descending limb or distal convoluted tubule rather than on the collecting duct as urine formation was often thought to have been completed before this part was reached. The main reasons for marks not being awarded were for not clearly stating locations or using correct comparative terms - more / even more / greater etc.

(c)
In line with the specification learning outcome and the context of the question, candidates were expected to supply more detail than 'steroids'. Some referred to 'steroid hormones', 'testosterone' or 'performance enhancing drugs', which were not quite precise enough.

F215 Control, Genomes & Environment

General Comments

It was pleasing to note that most candidates attempted all questions and the number of 'No Responses' appeared to be low. There was no evidence that time was a constraint for candidates and those who were clearly prepared were able to perform well across the range of topics covered. There were fewer answers that candidates continued outside the answer lines and the majority of candidates who extended their answers onto the additional pages made clear references to this within the allocated response area for the question. Each of the questions worked well and the examination was able to discriminate effectively. Able candidates scored well while all but the very weakest candidates were able to score respectable mark totals.

Certain questions tested Assessment Objective 1 (AO1) and the majority of candidates demonstrated that they had learnt their facts very thoroughly. However, those questions testing Assessment Objective 2 (AO2), again revealed the weakness seen in many candidates of middle to lower ability. This assessment objective tests the ability of candidates to apply their knowledge. To do this effectively, the candidates need to stop, read and think through the information they are given, before framing an appropriate answer. Unfortunately, candidates often wrote generalised statements about a topic, rather than answering the question given. This was particularly evident in answers to questions 2 and 5. A significant minority of candidates failed to use the correct terminology in answering questions, which led to the loss of several marks.

Comments on Individual Questions

Question 1

This question proved more challenging than expected and only those with a clear understanding of reproductive cloning approached full marks.

(a) (i) The majority of candidates could correctly identify a phenotypic characteristic which showed a continuous pattern of variation, but, surprisingly, many could not give an acceptable example of discontinuous variation. Some failed to use the information given, stating colour as an example, or blood group, neither of which were allowed.

(a) (ii) Most candidates performed well. Others described factors that affected the type of variation and didn't write 'environmental' or address the question 'Discuss the extent to which' and so lost marks as a result.

(a) (iii) This was a challenging question, with many candidates suggesting that albino frogs were being used as they were endangered or possessed a desirable characteristic, rather than the idea that the offspring would be visibly different to the egg donor, but identical to the genetic parents or other clones.

(b) (i) Genetic profile 2 was often correctly identified, but many candidates mixed up profiles 1 and 3. *Teaching tip - candidates may find it useful to draw horizontal lines between the genetic profiles to see how they relate to each other.*

(b) (ii) Many candidates remembered that mitochondria are found in the cytoplasm, and have their own DNA, but failed to apply the information from the start of the question to identify the correct frog which had the same sequence as D.

(c) (i) Whilst many recognised that benefit was due to clones being genetically identical and therefore all responding in the same way, fewer candidates could describe a disadvantage correctly. Many invoked ethical issues, and a few introduced the idea that the clones would be expensive to produce, or that the cloned mice would not show the range of responses to be expected of the general (mouse) population.

(c) (ii) Generally well answered with most candidates gaining 2 marks.

(d) Most candidates got full marks for this question. However, some answers had values such as 99% or 49%, indicating that the idea of inheriting half of each parent's alleles had not been applied correctly.

Question 2

This question managed to link a number of learning outcomes from different areas of the specification. All parts of the question were connected by applying knowledge of competition, speciation, behaviour and gene probes to the context of two species of Bumble Bee.

(a) It was surprising how many candidates did not know the answer genus. Common suggestions were phylum, taxonomic group, same species or general comments about them just having common ancestors, which failed to gain credit.

(b) (i) Most candidates got the idea that there was some degree of competition, and successfully gained 1 or 2 marks, but generally answers were poorly constructed with many candidates using the space available to explain just one or two marking points. For example, many candidates achieved marking point 5, referring to numerous examples of competition in their answer, but only able to achieve one mark. Candidates were good at using data from the graph and table, but often in a vague way - eg. 'peak in the summer months' - and without relating it to the question. Common errors were giving the wrong time scale from x axis, not mentioning both nectar and pollen for mp3 and saying that bees competed as they visited flowers of similar or same depths, or that one species outcompeted the other species of bee.

(b) (ii) Again the majority of candidates scored well on this question. Most recognised the need for isolation/barriers and mentioned seasonal and/or behavioural differences. However, few mentioned the idea of restricted gene flow and specialisation in the two separate populations leading to the evolution of the new species.

(c) (i) This was generally a well-answered question with many candidates gaining 2 marks. Most common answers were learned and innate behaviour. Common errors included giving latent or insight learning for mp1 or even reference to conditioning on its own. There were problems with some candidates offering multiple answers one of which was incorrect, therefore negating their marks.

(c) (ii) A well-answered question with the majority of candidates getting the mark. Many of those who did not achieve the mark were writing vague references to the bees increasing their chance of survival.

(d) (i) Surprisingly few candidates could correctly identify the enzyme. A variety of incorrect answers were given, including DNA /RNA polymerase, restriction endonuclease and ligase.

(d) (ii) This was a challenging question, which few candidates scored full marks on. Many missed the point of what an active gene means in terms of mRNA transcription, and so referred to the gene binding to the gene probe, rather than mRNA. Some candidates did not understand the use of a gene probe in this context, and referred to gel electrophoresis and automated gene sequencing, or just restated the question by saying the most active gene fluoresced the most.

(d) (iii) Many candidates did not link dopamine to its effect on humans, but rather stated it was the receptor or gene alone causing the effect. However, most did gain credit for identifying a common mechanism in both humans and bees.

Question 3

The common theme in this question was animal and plant responses to changes in their environment. This was a well answered question, with the majority of candidates scoring highly on the later sections, but less well on the sections involving interpretation of experimental results.

(a) (i) The majority of candidates could correctly identify at least 2 control variables, but the use of imprecise terms such as 'amount' frequently led to candidates losing marks. Teachers should advise candidates that this word should be avoided in the construction of exam answers as it is rarely considered creditworthy.

(a) (ii) Most candidates had the right idea of comparing the results to the controls or using the controls to show the response without treatments. However, a significant number still mentioned fair test, or improved reliability.

(a) (iii) Although the hormones were correctly identified by the majority, several candidates lost marks by not relating the functions of the hormones to the results given. Where candidates missed out on MPA2 it was often because they had said '*bent* towards the light' or missed saying *positive* when they had given phototropism. Others had not mentioned greater increase in stem length and some had also included group 6 as a result for gibberellins.

(b) (i) This was well answered, with most putting 'protein'. Those that didn't tended to write calcium or sodium ions.

(b) (ii) Again the majority of candidates correctly identified the region as the synaptic cleft.

(b)(iii) Surprisingly, a large number of candidates failed to correctly identify the enzyme. The most common error was to identify it as acetyl choline or acetylcholinerase.

(c) This question proved to be a good discriminator, with less able candidates scoring 2 or 3 marks and stronger candidates scoring 5 or 6 marks. Almost all candidates correctly got the mark for mitochondria, and most also got the mark for myosin. The most common mark missing from this question was for creatine phosphate.

Question 4

This question was a straightforward question testing mostly AO1 – recall of knowledge. The majority of candidates were able to demonstrate a good level of knowledge, and scoring highly.

(a)(i) Almost all candidates achieved this mark by correctly stating '3'.

(a) (ii) The majority of students correctly stated either 4^3 or 4x4x4. Students who did not achieve this mark usually tried to explain methods to identify the number of combinations of bases.

(a) (iii) Most candidates understood what the question was asking, but lost marks because they repeated the wording of the question, using the term 'base combinations' rather than triplet or codon for mp1. The most common marking point awarded was for stop codons, and more able candidates also achieved mp3, though this was less common.

(a) (iv) It was clear that some candidates did not know what the phase 'common to' meant and answered which ones were common in DNA and RNA (AGCTU). Many wrote 'AGC' correctly, but those who also wrote the full names sometimes negated the mark by writing argenine/adensine/adenosine or cysteine.

(b) Candidates had obviously revised this topic and demonstrated a clear understanding of transcription and translation, often scoring in excess of the 6 factual mp's required and very few did not also gain the QWC mark as well . Some candidates began their answer by talking about the ribosome and giving a detailed account of translation. Such candidates failed to realise that the question required an explanation of both transcription and translation, and thus did not access several marking points. Other candidates gave superficial explanations of transcription and translation that lacked sufficient detail. Sequencing activities using statements written on cards that need to be arranged in the correct order can help students develop a logical and detailed understanding of protein synthesis as a whole.

Question 5

Candidates found the first part of this question the most approachable. Perhaps reflecting the discomfort of some candidates with the biochemistry of respiration.

(a) (i) This question was generally done very well with candidates often gaining 3 out of the 4 available marks. Most candidates knew the terms lag and log phase and could describe the growth occurring there. However many could not accurately quote the days at the beginning and end of each phase. Many also read the values wrongly from the graph or failed to express it correctly i.e. 2 x-y readings, and so failed to gain mp5. Only a very few candidates gave a comment that the rate of increase slowed down during day 3. A significant number also described the pH, sugar and ethanol changes shown by the graphs, or explained reasons why the growth rate was slow or fast, which gained no credit.

(a)(ii) It was pleasing to see that the majority of candidates could relate the decrease in sugar concentration to the fact that the yeast is converting it to ethanol in anaerobic respiration. Good responses went on to describe the steps involved in the conversion of sugar to ethanol to gain full marks.

(a) (iii) Many candidates successfully gained a mark for stating that ethanol was produced as a normal product of metabolism or that it followed the growth curve of yeast. A common error was to say that ethanol was produced during a specific phase rather than in all growth phases, or that ethanol is needed for growth.

(a) (iv) It was surprising that more candidates did not score 2 marks on this question. Many referred to pH but did not discuss it being too low or refer to denaturing of enzymes, and some thought it would go too high. A number of candidates incorrectly referred to the presence of ethanol as being responsible for pH changes. Only a few referred to sugar concentration going too low, and many just used the term sugar alone or just said it would decrease. The term 'amount' was often used instead of the required more precise term 'concentration'.

(b) This was a challenging question, which few candidates grasped, often simply reciting the information given in the stem of the question. Many thought that glucose needed to be broken down before it could be used. There was a lot of reference to breaking the disaccharide or trisaccharide down before use, but many answers were vague and did not mention hydrolysis or glycosidic bonds, gaining no credit. Only a few candidates realised that enzymes would need to be produced to carry out the hydrolysis and that this would involve enzyme induction and protein synthesis.

(c) This question worked well as a discriminator, generating a full range of marks. The weaker candidates often wrote about the chemical method rather than the advantages or disadvantages of using yeast. Good answers often referred to the advantage of using lower temperatures and less energy, but only a few mentioned the idea that the process did not use fossil fuels and left no carbon footprint. The disadvantages were more clearly understood, with many knowing it was a time consuming process with a higher risk of contamination and the need for purification of the product. Some candidates thought it was a continuous process and that it produced a more natural form of ethanol.

Question 6

This probed candidates' understanding of inheritance and the Hardy - Weinberg principle.

(a) Most candidates showed a good understanding of the explanations of each of the examples of inheritance given, and gained full marks for this question. If mistakes were made it was with examples E and D.

(b) (i) Candidates still struggle with the application of the Hardy - Weinberg principle, and few candidates gained any marks. Often students used BB, Bb and bb instead of the p and q, and an obvious misunderstanding was not recognising the need to start with q^2. Many candidates calculated p instead of q and many also wrote a p answer above the value 1 which demonstrated a lack of understanding that $p + q = 1$.

Those who got the 3 marks usually laid out their mathematics clearly, making it easy to award the three marks, and quite a few gained one or two ecf marks after not calculating q squared correctly, but calculating the q and p values from this.

(b) (ii) It was good to see that the majority of candidates scored both marks on this question. The most common answers were a small population combined with non-random mating.

Question 7

This question was a good discriminator, with higher-scoring candidates giving clear comparisons between the pairs of terms. However, some candidates still struggle to understand the different steps in the nitrogen cycle, and to apply comparative statements.

(a) Almost all candidates got one mark on this question - usually that the pioneer species was first to arrive, and the climax community last. Occasionally a candidate would gain a mark for a comparative statement about biodiversity, but the issue with gaining that second marking point was the lack of comparison (e.g. lower/greater biomass, more stable/less stable) which only the most capable candidates achieved.

(b) The majority of candidates got a mark for their description of decomposition. Most candidates knew what denitrification was, but talked about ammonia being converted into nitrogen as opposed to nitrates, or confused denitrification with nitrification.

(c) It was pleasing to see that the majority of candidates could correctly describe conservation, but the idea of preservation leaving a habitat untouched / undisturbed was not always made clear. Some candidates lost marks for the use of the term environment or area when meaning ecosystem or habitat when talking about both conservation and preservation.

(d) This question showed some confusion amongst many candidates in terms of these two processes. It was not uncommon to see nitrogen being converted into ammonia and nitrates in nitrogen fixation, and for ammonia to be converted into nitrates and then nitrites for nitrification. However, those candidates who had a clear understanding of these processes scored both marks easily and often named the micro organisms involved correctly.

F216 Biology Practical Skills 2

General Comments

Most Centres are well versed in compiling packs of scripts for moderation, taking care to use treasury tags of a sensible length to secure candidates' work while ensuring it is still possible to physically access them to work on. Similarly most Centres annotated the scripts clearly and used a different coloured pen, usually green, to counter-mark as part of the process of internal standardisation. Many Centres helpfully gave credited marking points numbers from the mark scheme to assist with internal standardisation. Unfortunately a few Centres did not exercise this good practice.

This year there have been a number of Centres who had their sample returned because moderation generated an invalid order of merit amongst the candidates in the sample. The purpose of this procedure is to preserve the Centre's rank order of its candidates which is assumed to be the fairest measure of candidates' achievement. When the sample is returned, the Centre is expected to remark the whole cohort so that it comes in line with the moderator's recommendations. The Centre is not told which candidates are the subject of the review since all candidates have to be considered by the Centre, and not just the sample submitted for moderation. Understandably, Centres are disappointed to have their sample returned. However, the moderator provides enough information to guide the Centre towards which questions or part questions are the source of the difference between the original marking and the moderation process. After remarking, should a candidate's marks for a particular Task now not be his or her best score, then the Centre has the option to submit the better score. The whole sample must be returned to the moderator so that the moderation process can be completed. The Centre is not obliged to remark the scripts. However, the moderated marks will then be used by the OCR algorithm to make decision about the final marks to be credited to the candidates. At this point, without Centre input, some candidates may be disadvantaged as a result of the difference between the Centre and the moderation process. Irrespective of this, the Centre has the option to request a remoderation of the original sample.

Comments on Individual Tasks

Task type and number

Qualitative 1
The Task is a straightforward exercise in the use of biochemical reagents to determine the qualitative presence of reducing sugars and protein in three given fluids. Most candidates were able to complete the analysis and presentation of results. Some candidates were unable to produce correctly structured tables. In Part 2 of the Task, candidates are expected to correctly refer to data that they had collected. Some were unable to do this to an effective level.

Qualitative 2
Observations using a microscope and drawing skills were assessed in this Task. Question 1 required accurate drawing, a significant number of candidates were unable to produce diagrams of adequate quality to gain the single mark for that skill. Candidates were required to annotate a drawing of the microscope slide in question 3a. A few candidates had little idea of how to respond to this.

Qualitative 3
The use of immobilised yeast and invertase together with the qualitative analysis for reducing sugars and protein was generally well executed by most candidates. Correct presentation of data and the drawing of conclusion were more problematic for a few candidates. Part 2 was generally well-completed by most candidates.

Quantitative 1
This is the first Task where microbial growth is at the Centre of the exercise. The majority of candidates were able to complete the Task adequately, but a number did not fulfil the outcomes on page 3 to an appropriate standard. Question 5a required some thought and a few candidates simply did not reason through what they had done in order to complete the calculation. The error carried forward principle was correctly used by Centres with candidates who had difficulty.

Quantitative 2
Tolerance of yeast to sodium chloride using respiratory gas production to measure activity was generally a very successful exercise. Most candidates obtained good results and were able to complete the exercise without difficulty. The change to the mark scheme for question 4 since the previous outing of this Task helped marking considerably.

Quantitative 3
Most Centres that used this Task worked with Holly, though it must be emphasised that other plants with a similar leaf characteristic are satisfactory. Candidates were asked to make their own notes on the procedure; quite a few candidates did not demonstrate this skill. Centres are instructed not to dictate notes (F216/Task 3/INST page 6) and should not introduce long pauses as candidates will all end up with the same wording. In such a situation, it is very possible that no candidate would warrant the mark.

Evaluative Tasks are, by their nature, more discriminating than either the Qualitative or Quantitative Tasks. Only the very best candidates are expected to be able to score highly. Grade E candidates typically may only be able to obtain in the region of 9 to 11 marks. A potentially important difference between the Centre's marks and the moderated marks is the failure to insist on the complete sense of a marking point. Generally Centres should avoid annotating scripts with benefit of the doubt. The reason for this is that whilst correct alternative wording should always be credited, an incomplete marking point may not be inferred by either the marker or the moderator; neither have any idea what the candidate's actual intentions were.

Evaluative 1
This Task followed on from Quant 1 being an extension of the study of the microbial population on peas. Several questions required more than one response before a mark could be credited. These were questions 1, 3(a), 4(a) bullet point 1and 7(a) both bullet points. Several Centres did not accommodate this in their marking. This was particularly the case with question 7(a) where some candidates included only one of the halves from each bullet point and were credited with two marks instead of zero. With the marking tolerance now set by Ofqual at +/- 2 for the unit, this error had some unfortunate outcomes.

Evaluative 2
This is the follow-on Task developing Quant 2. Questions 2, 3(a), 3(b), 4(b) and 5(a) were particularly prone to being credited when the complete sense of the marking points was missing. Question 5(a) has several marking points which require close attention to the wording of the responses because candidates were inclined to regurgitate standard improvements rather than developing them to suit the SES; bullet point 4 is a particularly good example of this. Question 6 sometimes provided a pitfall for the unwary; some Centres incorrectly credited responses which included terminology other than water potential.

Evaluative 3
This Task followed on from Quant 3 and was generally well done by many candidates. Questions 3 and 6 were often not correctly marked with incomplete marking points being credited. Remarkably, few candidates made errors in calculation of the chi-squared test. However there were a number of marking errors in 5(d).

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