OCR
Oxford Cambridge and RSA

GCE

Biology

Advanced GCE **A2 H421**

Advanced Subsidiary GCE **AS H021**

OCR Report to Centres June 2016

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

OCR is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support which keep pace with the changing needs of today's society.

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.

CONTENTS

Advanced GCE Biology (H421)

Advanced Subsidiary GCE Biology (H021)

OCR REPORT TO CENTRES

F211 Cells, Exchange and Transport

General Comments:

The paper was an appropriate level of difficulty and generated a good spread of marks. The mean score was higher than last year as might be expected from a cohort of candidates who are all taking the A2 papers at the same time. The good range of question types included many short-answer questions which tested simple recall in assessment objective one and some longer questions testing assessment objective two which proved to discriminate successfully. Some centres are still providing their candidates with extra sheets rather than instructing them to use the additional space provided at the back of the paper. The instruction to use the space provided is given clearly on the front of the examination paper. Giving candidates the instruction to read the examination paper thoroughly should include reading the front page. This should reduce the use of additional booklets as well as help to ensure candidates focus their responses on each individual question. That some candidates do not read and interpret the questions sufficiently carefully was clear from many responses to question 4(b)(ii) in which candidates described parts of interphase before getting on to mitosis which was the topic of the question. Similarly in question 5(b) many candidates described transport in the xylem despite being told that mosses do not have vascular tissue.

Comments on Individual Questions:

Question No. 1

This question tested several important biological concepts such as surface area to volume ratios, cell structure and transport across membranes, but in an unfamiliar context. Candidates generally did well in the early parts of the question but part (e) proved more discriminating.

1(a) was generally well answered with nearly all candidates scoring at least one mark. The vast majority of candidates knew that the Amoeba had a large surface area to volume ratio and many also understood that diffusion would be sufficient to meet all needs**,** however, some candidates were unable to express this clearly.

1(b) was well answered and nearly all candidates gave a correct response as ‘nucleus’ or ‘food vacuole’. Some candidates obviously relied on memorised differences between Eukaryotes and Prokaryotes and provided answers such as ‘different sized ribosomes’. When a question states ‘shown in Fig. 1.1’, candidates should understand that they must refer to the figure rather than rely on memory.

1(c)(i) asked what component of the membrane would act as a barrier to movement of mineral ions – most candidates knew that the phospholipid bilayer would prevent movement of ions but a significant minority apparently misread the question and gave the answer as ‘protein channels’.

In 1(c)(ii), many candidates had not read the question sufficiently carefully and responded by restating the stem of the question. No mark was awarded for describing anything to do with the plasma membrane acting as a barrier between the cell and its surroundings. It is apparent that many candidates do not consider the roles of membranes within cells and concentrate only on the roles of the plasma membrane. However, candidates still gained marks for the ideas of compartmentalisation and cell signalling.

In 1(d)(i) most candidates correctly named the process as exocytosis. The most common error was to name it as ‘osmosis’.

1(d)(ii) Most candidates knew that the cell would burst although a good number thought that an animal cell could become turgid and some confused this with plasmolysis.

Question 1(e) caused confusion for some candidates. Many weaker candidates simply described the process of osmosis to explain why water entered the Amoeba without attempting to explain why more water would enter at the higher water potential. Some candidates described water moving into the vacuole rather than into the cell from its surrounding, while others had osmosis causing water to leave the cell despite the contractile vacuole performing that function several times a minute. It was pleasing to see that stronger candidates did have a good grasp of the concepts and were able to explain why the contractile vacuole had to empty more frequently very clearly and succinctly.

Question No. 2

2(a) The vast majority of candidates responded by saying that stem cells could differentiate. This suggests that many have not understood the concept that cells differentiate to become specialised. No mark was awarded for 'able to differentiate' as the ability to form specialised cells was given in the question. Few candidates recalled that stem cells are able to keep dividing – which is perhaps their main role.

2(b) was a familiar question in which many candidates performed well. It was a little disappointing to see that the common errors were the same as those that have been reported on in the past. There was some confusion for weaker candidates over the role of the smooth muscle with 'provides a smooth surface for the blood vessels/airways' and 'contracting or relaxing the airways' being common responses that were not awarded credit. Squamous epithelium 'reducing the diffusion pathway' was also considered too vague as it did not make clear that the diffusion pathway is short.

2(c) was generally well answered and candidates only lost marks because their answer was too vague. Examples of vagueness include using the term 'sugar' rather than 'sucrose' and not making clear that transport was 'from source to sink'. Some candidates confused translocation with active loading at the source and gave detailed descriptions of how sucrose is loaded into the sieve tubes.

Question No. 3

3(a) Most students recognised that microscope Z was the transmission electron microscope.

3(b) Most students recognised that Fig. 3.1(a) was the image from a scanning electron microscope and were able to justify their choice successfully. The most common response was that the image was three dimensional, but many candidates also stated that it was a surface view. Fewer candidates stated that the resolution was higher than in Fig. 3.1(b).

3(c) Candidates were mostly able to complete this gap-fill exercise correctly. Some candidates did not manage all the gaps correctly but even the weakest candidates usually managed two marks of the four available. A few candidates incorrectly wrote 'epidermis' or 'endothelium' rather than endodermis.

For 3(d)(i) & (ii), the vast majority of candidates realised that leaf C was from a plant adapted to living in an environment with low water availability. Most based their decision on the small surface area of the leaf. However, some candidates confused leaf surface area with its surface area to volume ratio. A significant minority of candidates failed to explain that a small surface area would lead to less evaporation or loss of water vapour (transpiration).

3(d)(iii) Most candidates knew that having hairs or a thick waxy cuticle would help conserve water although some failed to specify that the waxy cuticle would be thick. Other correct responses included sunken stomata and curled leaves.

Part 3(e) provided the most significant differentiation. The best candidates could give a clear and succinct explanation, howevermany candidates described how water molecules leave the leaf but then failed to give a clear link to air movement reducing the water (vapour) potential around the stomata so that there was a steeper water (vapour) potential gradient. Too many candidates referred to water being blown off the leaf, some even describing droplets being blown away.

Question No. 4

4(a) Most candidates knew that staining made cell components visible and many also understood that the stain increases the contrast.

4(b)(i) Anaphase is possibly the easiest stage to identify and the majority of candidates did so correctly.

4(b)(ii) As the question started with 'From the beginning of mitosis..', it was very disappointing to see how many candidates described the processes in interphase such as DNA replication and checking before describing the events in prophase. However, most candidates had a good grasp of the events in mitosis and only a few confused it with meiosis by describing pairing of homologous chromosomes during prophase. Some candidates were able to provide a good number of details. The majority of candidates who described attachment of spindle fibres to the centromere placed this in metaphase after the chromosomes had moved to the equator. In fact the attachment occurs in a sub-stage of prophase known as prometaphase. It should be clear to students that the chromosomes will not migrate to the equator on their own – they need the spindle fibres to pull them. Another misconception held by many candidates was that the spindle fibres contract to move the chromosomes. Some confusion between chromosomes and chromatids was also evident and centres should be sure their students can make a clear distinction such as calling them chromatids while they are still attached at the centromere but chromosomes once the centromere has split. Thus, one chromosome consisting of two chromatids becomes two chromosomes as soon as the centromeres split apart.

Question No. 5

This question was based on moss - a plant that would not have been familiar to most candidates. However, the question tested the application of familiar concepts in this unfamiliar context. This is something that all well trained candidates should be used to.

In 5(a), a good number of candidates spotted that without vascular tissue the moss would lack support and would therefore collapse if it got too large. The absence of vascular tissue and thus a transport system also means that moss plants must remain quite small so that they maintain a large surface area to volume ratio and a short diffusion distance. This is because the plant must rely only on diffusion (and osmosis) to absorb and transport materials. Only the best candidates really appreciated this argument and not many were able to write it clearly and succinctly. Weaker candidates suggested that without a transport system the plant would not be able to transport any water and nutrients or that the lack of vascular tissue meant an absence of meristematic tissue and hence the plants had no ability to grow at all.

5(b) Despite being told three times earlier in the question that moss plants do not have vascular tissue, many candidates described the transport of water through the xylem. Stronger candidates were able to gain marks by describing the apoplast and symplast pathways and linking these to changes in water potential and osmosis caused by loss of water at the leaves. Few candidates, however, referred to changes of water potential in cells and many gave rather

vague descriptions of water potential gradients or hydrostatic pressure gradients existing between the roots and leaves.

5(c)(i) Almost all candidates achieved full marks for this simple definition.

Many candidates gained credit in 5(c)(ii) for naming palisade, epidermal, spongy mesophyll or guard cells. Weaker candidates lost credit as they named companion cells, sieve tube elements or even root hair cells and stomata.

Question No. 6

6(a) As ever, many candidates proved incapable of performing a relatively simple calculation. Better candidates did well and gave the correct response or at least showed they knew how to carry out the calculation. However, too many candidates appeared to have little idea of what to do. Commonly the magnification was left out of the calculation and candidates simply converted mm to µm. Another common error was to convert mm to µm by dividing by 1000 rather than multiplying. This is an area in which centres need to improve in light of the increased maths requirements of the new specifications.

6(b) Most candidates did well here. The most frequent incorrect response was to write B (the pressure is very high) to explain why small arteries have muscular walls (first row).

In 6(c)(i), less than half of all candidates gained the mark. There were a significant number who failed to respond but most drew either a horizontal line that passed through the atria or drew a vertical line through the atria and ventricles. Better candidates realised that the thickness of the walls drawn in Fig. 6.2 meant that the chambers had to be the ventricles.

Question 6(c)(ii) elicited a wide variety of responses, many dependent upon how the candidate had interpreted (c)(i). Thus many candidates labelled K as the atrium. However, many candidates did well and were able to distinguish between the ventricle (K) and the ventricle wall (M).

F212 Molecules, Biodiversity, Food and Health

General Comments:

The paper contained a mix of the popular and less popular topics and the resulting marks reflected this. There were fewer very high-achieving or very low-achieving candidates, which is to be expected on a paper that is taken almost entirely by a re-sitting cohort. As ever, smoking and cholesterol remain popular topics that candidates have learned well. There has been a steady improvement in the quality of biochemistry in candidate answers over the lifetime of this specification. However, that improvement did not continue on this paper. Some very basic errors were seen in the biochemistry questions 1 to 3 and in question 8. Phylogeny, tested in question 6(b), and certain aspects of biodiversity, remain very poorly understood areas of the specification.

While every care is taken to ensure candidates are not disadvantaged because of language issues, there are some terms that are so common and embedded within biology that their use is unavoidable. The term 'level' in the context of biodiversity appeared to be poorly understood by candidates but the term is used in that context in the specification so centres, and candidates, should expect the term to be used in examinations. It was felt that many candidates did not achieve well on question 4(b)(i) because they did not understand this term. Likewise, the use of the word 'duration' is standard in biology when describing the length of time over which an immune response occurs. The responses of many candidates suggested that they were completely unfamiliar with this term.

Comments on Individual Questions:

Question No. 1

(a)(i) was generally answered well. The most common error was describing Z as hydroxide.

(a)(ii) was also well answered by the majority of candidates. If the maximum 2 marks were not achieved, it tended to be for reversing OH and H on C4 instead of, or in addition to, on C1.

(a)(iii) Despite the question emphasising the term 'precise' to naming of the bond, very many candidates stated 'glycosidic' but failed to include the '1-4' detail. Most candidates correctly gave maltose for the name of the disaccharide although sucrose was occasionally seen, along with a variety of incorrect molecules.

(b) Many candidates made a reasonable attempt at this extended answer question although very few gained the maximum 7 marks. The QWC was rarely awarded as this required engagement with the context of the question and discussion of why animals might benefit from faster breakdown of an energy store. Most of the marking points were regularly seen, apart from the 'A' marks. Well-prepared candidates tended to achieve more marks than poorly prepared candidates but what really differentiated responses was the number of mistakes. Some candidates made so many errors with basic biochemistry that, where they had written something that on its own might be creditworthy, they could not be awarded a mark because it was associated with something clearly incorrect. For example, a candidate might have stated that the structure is branched, and thus potentially gain marking point B2; however, if they stated that it is branched because it contains amylopectin (or even amylose) then B2 could not be awarded at that point. The rather imprecise term 'easy' was used by many candidates, which on this occasion did not attract any credit, unlike more precise references to speed.

(c) Few candidates scored full marks for this question. The most common incorrect answer was to describe the left-handed twisting of the polypeptide chain as an aspect of tertiary, rather than secondary, structure. Collagen has an atypical structure that many candidates find confusing and textbooks often do little to clarify.

Question No. 2

(a) The vast majority of candidates achieved this mark.

(b)(i) This question presented a challenge both to the candidates and examiners. Candidates often could not express the difference between viral RNA and host mRNA and many candidates thought that, contrary to the diagram provided, the virus contained DNA. Thus both host DNA and the supposed viral DNA became entangled. Examiners then had to unravel which RNA and DNA was being referred to by the candidates. A little less than half of candidates described RNA as carrying the code for protein, often viral protein, a slightly larger number identified ribosomes as the ultimate destination of RNA. A smaller number correctly suggested a specific role for the viral RNA.

(b)(ii) The first marking point was not awarded often because most candidates failed to mention the link between base sequences and amino acid sequences. Close to half the candidates realised that an alteration in primary or secondary structure would lead to an altered tertiary structure and a similar number linked this to 3D shape. Less than a quarter of candidates gained the second marking point – usually for reference to bonds rather than R-groups.

(b)(iii) was fairly easy achieved by most candidates.

(c) The top row was completed correctly by most candidates. Occasionally, candidates were let down by a poor choice of words that did not clearly convey a comparison. However, very few candidates gained full marks for this question mainly because they did not understand the term ‘duration’ - most appeared to think that ‘duration’ was a synonym for ‘speed of onset’.

(d) was generally well done, with over half of candidates gaining full marks for this sub-question. T-helper cells with their correct role was most commonly awarded, followed by T-killer cells with their role appropriately given. Whilst the role of T-helper cells was solidly embedded, the role of the T-killer cells was less well understood and many weaker candidates lost the mark for saying that this T-lymphocyte acted as a phagocyte or in some way directly attacked the pathogen. Memory cells were occasionally put forward but often their role was poorly understood by those who offered it. Candidates often stated they were for immunological memory or remembering antigens.

Question No. 3

This question blended familiar recall, that suited candidates who had spent time learning the specification, with some AO3 questions that many candidates found challenging.

(a)(i) was generally done well. Candidates had learnt how to carry out a Biuret’s test. Where candidates lost marks it was for failing to recognise that the key addition was Biuret *solution*, not just ‘Biuret’. Some candidates mentioned heating and received no credit.
(a)(ii) This mark was rarely awarded. The words ‘in solution’ were emboldened in the question in an attempt to get candidates to link enzyme structure to solubility. Few candidates appeared to recognise which aspect of knowledge they were being asked to apply.

(b)(i) The majority of candidates could read off the graph but only half could convert ‘mg cm^{-3}’ to ‘g in 250 cm^3’. There is a higher proportion of mathematical skills in the new specifications which

candidates will need to master. Most answers were given to the correct number of decimal places.

The most common answers in (b)(ii) described testing more concentrations. Again, with an eye to the new specifications, it was worrying that very few candidates suggested that the key concentrations to test would be those near the original value of 1.4 mg cm^{-3}. Many candidates just suggested the usual 'more repeats', 'calculate a mean', 'identify anomalies' answer, which meant they had not read or did not understand the question.

(b)(iii) Most candidates gained some credit, usually for doing something without any enzyme present. Many did gain both marks for, additionally, carrying out the Biuret's test or zeroing the colorimeter.

(c) This question differentiated well between candidates of differing abilities. Most candidates understood that cofactors etc. were to be discussed and gained between 2 and 5 marks depending on ability. Only a few missed the point, usually discussing pH or kinetic energy, and failed to score or picked up only a single mark for discussing enzyme substrate complexes. More candidates than usual discussed the role of specific coenzymes, presumably reflecting a large proportion of year 13 candidates re-sitting the paper.

Question No. 4

(a) Both marks were given, more often than not, in this question. Most candidates cited climate change or global warming and many were able to link this to a specific local event, most commonly the drying up of damp mud.

(b)(i) Performance on this question was surprisingly poor. The question tested AO1 with wording that matched, almost exactly, the second learning outcome in the biodiversity section of the specification. However, many candidates appeared not to understand the question. Common misconceived answers were: local and global, in situ and ex situ, and species richness and species evenness. Serendipitously, 'species richness' did satisfy the requirements of the first marking point.

(b)(ii) Most scored a mark here for a potential medical use of plants. A few discussed nutrition, or the benefits to health of the aesthetic aspect of nature or the release of oxygen, for no credit.

Part (b)(iii) was not done well. Again, the wording of the question matched one of the learning outcomes almost exactly and yet many candidates did not seem to understand the question. Many candidates wrote a lot about the dangers of monoculture and gained the first marking point but few achieved marks beyond that. A minority of candidates discussed selective breeding, genetic engineering or pollination but other marking points were rarely seen.

(c) differentiated well between candidates. Most were able to outline a valid investigation and achieve 3 or 4 marks. Time references were often too vague for the award of the second marking point and, when measuring the dependent variable, many failed to specify what was being measured beyond the ambiguous term 'growth'. Most candidates were aware that some variable should be controlled, but often their cited variables were too vague, such as 'light availability' or 'nutrients'. Some took a 'field work' approach and were able to get some credit.

(d)(i) Most candidates achieved the mark but some failed to answer entirely.

(d)(ii) was less well known than CITES and had a slightly higher omit rate. Some candidates hedged their bets and wrote CITES for both answers.

(e) This was generally done well. All marking points were seen but the most common mark was for reference to a range of values or the lack of discrete categories.

Question No. 5

Most candidates were well-prepared for a question on this popular topic. The vast majority of candidates were able to gain 3 or more marks but the question, nevertheless, discriminated well between candidates. A small minority of candidates strayed into unrewarding areas such as CHD, atherosclerosis, nicotine and carbon monoxide. Many candidates seemed to know the basics but failed to gain the marks because they did not give sufficient precision in their answers. For example, the releasers of elastase were often described as 'white blood cells' rather than the more precise 'phagocytes'. Given that lung cancer is the most well-publicised result of smoking, it was surprising that only around a quarter of candidates gained any of the 'L' marking points. Those who achieved L1 invariably achieved L2 and often L3 also.

Question No. 6

(a)(i) Almost all candidates were awarded this mark.

(a)(ii) Compared to parts (i) and (iii), this was rarely awarded. Many candidates just wrote 'cell wall' and not cellulose. Many candidates wrote about autotrophic nutrition or photosynthesis, suggesting that candidates are not aware of the existence of autotrophic prokaryotes.

(a)(iii) Most candidates were awarded this mark, mostly for reference to a nucleus, although the alternatives in the mark scheme were also seen. The most common wrong responses referred to heterotrophic nutrition.

(b)(i) Candidates who were aware of the classification hierarchy tended to get both marks, whereas those who didn't tended to make wild guesses, often referring to vertebrates and invertebrates or even mammals, birds and amphibians. Some got the wrong starting point, not realising that 'kingdom' had been given in the stem of the question.

In (b)(ii), about half of all candidates managed to say that slime moulds must be eukaryotic. Few candidates scored more than one. Those few candidates who achieved full marks did so by addressing marking point 1 and 4, which automatically meant they were awarded marking point 2 as well. Generally, most statements were about cell walls and chloroplasts, rather than DNA or amino acid sequences. Marking point 3, which was key to the context of the question, was rarely awarded.

Few candidates scored marks in (b)(iii), and where marks were awarded they tended to be for citing and, more often, exemplifying key differences between bacteria and archaea. Some came close to marking point 4 but stated only that bacteria and archaea were different with no suggestion that these differences were significant enough to justify a change in the classification system. Many candidates appeared to be offering a mark scheme from a previous, but fundamentally different, question on the same topic. Candidates who achieved no marks often made vague statements about it being simpler, easier to use, or more accepted.

Question No. 7

For (a), most candidates drew an accurate diagram and gained all 4 marks. The most common mistakes were only having a single bond for the C=O in the carboxyl group, writing COH for the carboxyl group, or having 3 Hs in the amine group.

(b)(i) Again, most candidates scored 2 marks here with the first 2 marking points being by far the most common. Non-creditworthy responses tended to suggest that saturated fats *contained* LDLs. Some candidates put the answer to part (ii) in this section - a case of not reading the question properly.

(b)(ii) was generally well answered with many candidates achieving full marks. Marking points 1, 3 and 5 were the most commonly awarded. There were many references to fat being deposited *on* the artery wall, which did not gain the second marking point. References to a narrowing of the lumen were less common and fewer referred to this taking place in the coronary artery. Very few candidates referred to heart *muscle* and thus the final marking point was rarely awarded.

(c) A small majority of candidates achieved the mark. Some just wrote 'inhibitor' without saying it was the enzyme that was being inhibited. Many of the incorrect answers discussed absorption or indirect effects on breakdown. Something that careful reading of the question might have prevented.

Question No. 8

(a) A small majority of candidates achieved the mark but almost as many wrote 'volume'.

(b) Around half of candidates achieved at least 1 mark for recognising that breeding does not cause mutations and some went on to describe either what mutations are or what the problems with inbreeding might be. Some candidates, even those from year 13, are still confused about the relationship between breeding and mutations. This question also differentiated well.

(c) The majority of students achieved the first marking point, but fewer achieved either of the subsequent marks.

(d) Although the mark scheme was rigorous, it was nevertheless surprising to see few candidates achieve more than 1 mark on this question. A significant minority of students believed that enzymes are indeed denatured by low temperatures. Of those who understood the correct science, few wrote answers that were detailed or precise enough to gain all 3 marks. Many answers failed to gain credit because they stated that food will *not* decay because there will be <u>no</u> kinetic energy and *no* collisions.

F213 Practical Skills 1

General Comments:

This year there was a significant change in the cohort of candidates since the cohort consisted mostly of resit students. As a result, many students demonstrated a greater understanding of the nature of the tasks and a greater sophistication in their responses which was as expected given the students would be in their second year of the GCE course and had experienced greater exposure to the tasks. In addition, they would have been expected to have covered an increased level of demand in the associated theory. It was pleasing to see that this in turn generated a better level of response for most of the tasks.

Many centres maintained the high standard expected in terms of marking, annotating and collating the sample of work sent to the Moderators. This was generally sent together with centre data, the Centre Authentication form and the MS1 form. All of these are required in order for the Moderator to proceed with the moderation process.
It was also pleasing to see so many centres maintaining a high standard of marking, closely following the mark scheme. Unfortunately this did not occur across the whole cohort and there were examples of centres that had not followed the correct procedures, either by not following the mark scheme or by not following the correct administrative procedures.

Some centres had submitted candidates with all three tasks from previous sessions which cannot be allowed if the candidate has submitted in a previous session. It is also unnecessary because the marks would already be on the system and that mark will be carried forward to the current session. Only if at least *one task* from the current session has been completed, together with remaining tasks from previous sessions, can a resubmission be accepted.

Comments on Individual Questions:

Qualitative Tasks:
The standard of these tasks submitted was generally high and well-marked. The exception was Task 3: Identification and Study of Broad Leaved trees where candidates in some cases failed to correctly record the species name. This must be recorded with a capital letter for the generic name and a lower case letter for the specific name. Drawing skills were also not well implemented with some drawings awarded marks without the necessary skills demonstrated. All drawings must be executed with a sharp pencil line that is clear and continuous and does not include any form of shading. Label lines must be drawn with a ruler and labels written clearly at the end of the line not along the line.

In Qualitative Task 1: part 2 Question 3 was of greater demand and discriminated well as some candidates had not seen the required focus of the question.
In Qualitative Task 2: the use of the correct unit symbols was not always correctly followed in the tables. For the most part however tabulation was much improved on previous sessions.

Quantitative Tasks
These tasks were well marked and the responses were of a high standard. The only exceptions were the graphs where some basic graph errors were accepted as correct. It is worth checking the required graphing rules are fully understood by all candidates.

In Quantitative Task 1, there were fewer instances of incorrect graphing. Generally the graphing skills were much improved, although there were still some candidates who did not correctly distinguish between error bars and range bars or who did not know the correct way to illustrate

these on a graph. In Question 3, the level of demand meant that only the better candidates gained all three marks.
Quantitative Task 2: again the graphs were better executed, although unit symbols were often incorrectly recorded.
Quantitative Task 3: in part 2, Questions 2 and 3 were not well covered by many candidates as there was only a little understanding that, whilst Question 2 required enzyme activity at the different pH values, Question 3 required the viscosity of the cellulose solution at the different pH values. In Question 4 there must be a demonstration that the candidate understands smaller molecules are actually not the same as shorter chains.

Evaluative Tasks
Unusually this session saw many more candidates achieving a very high standard in the Evaluative Tasks with a better understanding of the terms and so the responses to the questions were clearer and of a better standard. However a large number of candidates did not approach this task type with the same ability as the other types of task and so it was more likely that this task type scored less well.

Evaluative Task 1: in this task Questions 2 and 8 proved to be the most difficult and were good discriminators. A large number of candidates tackled the statistical test well.
Evaluative Task 2: Questions 1 and 2 proved to be the ones with the greatest degree of difficulty. Errors and limitations are still being confused but this was less of a problem this year.
Evaluative Task 3: Question 4 had two straightforward marks and one mark with a much greater level of demand. As a result this third mark (marking point 2) was not always achieved. I was surprised that a relatively large number of candidates did not answer Question 5 well as this was a simple experimental design question.

F214 Communication, Homeostasis and Energy

General Comments:

This paper, once again, produced a good spread of marks. Most candidates attempted all the questions, there being very few 'no responses'.

Centres are advised to encourage candidates to spend a little time reading the question and ensuring that they supply information that relates to and answers the question. Even if the science is correct, if it does not answer the question then it will not be awarded marks.

Examiners were pleased to note that candidates were indicating when an answer extended onto the additional answer space or additional booklets. Centres are reminded to instruct candidates to clearly identify the additional work by question and part number, e.g. 2(c)(ii). This particular paper had 3 additional pages available so it would be unlikely that they would have needed additional paper or answer booklets.

Comments on Individual Questions:

Question No. 1

(a) Most candidates identified the presence of the pancreatic duct, however, poor expression such as 'the pancreatic duct secretes enzymes' or inappropriate reference to hormones tended to limit them to 1 mark. The mention of the pancreas seems to provide a knee-jerk response of insulin and glucagon.

(b)(i) Most candidates correctly identified the islets of Langerhans. Some candidates, however, mentioned only alpha or beta cells (although had both been mentioned the mark would have been awarded).

(b)(ii) Erythrocytes were commonly seen, although some candidates identified a blood vessel instead.

(c)(i) Poor communicators were not able to convey the idea of a timeline as the account was muddled. Some excellent accounts were seen, however, although many went into excessive descriptions about the mechanism of secretion of insulin that the mark tariff did not warrant. Some otherwise good answers failed to mention that insulin was secreted by the beta cells or that they were also responsible for detecting the increased glucose levels.

(c)(ii) was challenging for many candidates. Some just referred to axis labels and scales but others attempted to describe the way in which the lines should have been portrayed. It was all too tempting for many candidates to refer to what was happening before, during and after a meal and they then launched into details of insulin and glucagon and their effects on the cells. Few conveyed the idea that the fluctuation of the blood glucose and insulin concentrations were out of phase. The Quality of Written Communication mark (QWC) was rarely awarded.

(d)(i) Most candidates appreciated that a base blood glucose concentration was required. Some did not get the mark as they referred to glucose being broken down, the need to remove all the glucose from the blood or that the participants needed the same blood glucose concentration at the beginning of the test.

(d)(ii) referred to finding the iAUC for glucose but many candidates interpreted it as referring to the different foodstuffs. The question also asked them to indicate how the variables could be

controlled but a significant number just stated the variables. Some felt that the blood samples should have the same volume or be taken from the same part of the body. Consequently, this question proved to be quite a good discriminator.

In (d)(iii), a common misapprehension was that by calculating a mean it would identify or eliminate any anomalous results rather than reducing the effect of an atypical result or the risk of using a single unrepresentative result. Some vague answers and those quoting reliable, accurate or precise did not score without a more specific answer that related to the question.

Question No. 2

(a) This was a deceptively difficult question that required candidates to appreciate the higher light intensity in the sunny conditions resulting in a higher rate of photosynthesis which produces oxygen and makes the pondweed more buoyant. While the concept is not inherently difficult, the stretch and challenge aspect of this question was to recognise the principle involved. A common misconception was that the weed moved towards the surface in order that it could access as much light as possible. Some confused the roles of carbon dioxide and oxygen in photosynthesis.

(b) Many candidates related the presence of the pump to providing warmer water. Attempts to describe the fish as ectotherms (although a significant number used the term exotherms) were frequently contradicted by references to the fish maintaining their body temperature, some even going on to state that they did this by homeostasis. A number became side-tracked and answered in terms of obtaining more oxygen – not too much of an issue in cold conditions.

Question No. 3

(a) Some excellent answers were seen to this question with points being made in quick succession and awarding of the QWC mark. Common mistakes were to state that ribose is present in both ATP and DNA (seeming to treat ribose as synonymous with pentose), ribose described as a hexose or not recognising that adenine is a base and stating that DNA doesn't contain adenine but does have a nitrogenous base. Some had not read the question carefully enough and attempted to distinguish between ATP and a DNA molecule rather than a nucleotide.

(b) parts (i), (ii) and (iii) were well answered, indicating the candidates' good knowledge of respiration.

In (b)(iv), detail of oxidative phosphorylation was good, although there was some confusion as to where the protons were pumped and whether they moved down or up a gradient. The detail on substrate level phosphorylation was lacking. Candidates were expected to indicate that the phosphate to phosphorylate ADP came directly from a compound in glycolysis or Krebs cycle. The only information offered by most candidates was that ADP added a phosphate to become ATP.

Question No. 4

(a)(i) Many candidates scored well on this question. It was generally recognised that the rate of photosynthesis increased and then decreased. Some experienced difficulty in deciding when the peak would occur in each carbon dioxide concentration and so expressed this poorly. In situations such as these, it is important to indicate which set of data is being quoted – in this case by referring to the concentration of carbon dioxide.

The calculation in (a)(ii) was performed correctly by many candidates. Some of those who took the route of finding the rate at the higher carbon dioxide concentration as a percentage of the lower neglected to subtract 100 and so only scored 1 mark. Few candidates were unable to express their answer to 3 significant figures.

(a)(iii) Many candidates supplied a suitable observation here, although weaker responses simply repeated that a higher temperature resulted in a higher rate.

(a)(iv) Many candidates found this challenging. A frequent comment was that the enzyme rubisco would be denatured, failing to appreciate that as photosynthesis occurred at higher temperatures in higher concentrations of carbon dioxide it cannot have denatured. Those who mentioned a lack of carbon dioxide often did not use the term 'limiting'.

Part (b) allowed candidates to demonstrate their knowledge of the light independent reaction once they had established that there is a low level of rubisco. They found it difficult to express the reason for this. Few recognised that rubisco availability would be a limiting factor.

Question No. 5

(a)(i) Most candidates answered this correctly, although some did only mention B and so were not awarded the mark.

(a)(ii) Candidates often only stated E, less frequently D alone, while both were required for the mark.

(a)(iii) Candidates did not appreciate that the sodium ion pump is not voltage-regulated and so is actively pumping the whole time. Allowance was made for this in the mark scheme and various combinations of letters were credited.

(b)(i) Candidates frequently scored 1 mark for this question. The most common error was to decide that the final statement was false.

(b)(ii) Candidates who simply described the role of the SAN in coordinating and regulating the rate of heart beat did not score as this did not answer the question. Answers needed to link this to the effect that hormones would have on either the SAN or individual cardiac muscle cells.

(b)(iii) Many knew this well, but a lack of precision in expression meant that marks were not awarded. They were expected to refer to receptors on the cell surface membrane, activation of adenylyl cyclase and the formation of cAMP. The terms 'activation', 'production' and 'synthesis' seemed to be used interchangeably, so not always appropriately.

Question No. 6

(a) Most candidates answered both parts of the question correctly.

(b) It was not uncommon to award full marks here. Occasionally candidates just suggested water rather than carbon dioxide while liver, gall bladder and waste were incorrect suggestions for the final three gaps.

(c) Most candidates supplied a suitable suggestion. It was clear that some either did not read the question properly or did not realise that enzymes are protein as they suggested protein synthesis or enzyme synthesis. Others suggested a function of the liver which was unrelated to amino acids.

F215 Control, Genomes & Environment

General Comments:

This paper gave a good spread of marks and the vast majority of candidates attempted all questions with no suggestion that candidates had struggled to finish the paper. Candidates who were well-prepared were able to gain marks across the range of topics covered. However, it was clear that some candidates did not focus their answers on the question being asked, but instead gave as much information about the topic as possible.

Centres are advised to encourage candidates to spend a little time reading the question and ensuring that they supply information that relates to and answers the question. Even if the science is correct, if it does not answer the question then it will not be awarded marks.

Examiners were pleased to note that candidates were indicating when an answer extended onto the additional answer space or additional booklets. Centres are reminded to instruct candidates to clearly identify the additional work by question and part number, e.g. 2(b)(ii). This particular paper had 4 additional pages available so it would be unlikely that they would have needed additional paper or answer booklets.

The correct use of technical terms was evident in many of the responses given by candidates, and it was pleasing to see the number of candidates who achieved full marks on the statistical analysis in Q6(a)(i).

Comments on Individual Questions:

Question No.1

(a)(i) Most candidates correctly gave the term 'carrying capacity' though some other terms seen included climax community, maximum capacity and stationary phase, which all gained no credit.

(a)(ii) The majority of candidates were able to pick up one mark, usually for mentioning food/prey as being a limiting factor, butpredators and competition were also common correct responses, with disease and nesting sites less so. Frequent vague references to space, territory, water and nutrients failed to gain credit.

(b)(i) Candidates often failed to appreciate that a two mark question needs two answers. Most got at least one mark, usually for reduced biodiversity or the alternatives. Habitat destruction was also commonly seen, and by linking the two together, candidates could achieve both marks. Other acceptable answers such as disruption to food chains and soil erosion were more rarely seen.

(b)(ii) This was answered well by those candidates who had read the question carefully enough to give social, aesthetic and ethical reasons. The specification and textbooks give clear indications of mark-worthy responses for this type of question but many candidates still answered with a vague, though often lengthy, response, often focusing on biodiversity which was not creditworthy. Despite instructions to the contrary, economic benefits were also often mentioned which also gained no credit. Candidates who scored well on this question often got the idea of improving the aesthetic value of the woodland. Other common correct answers were improved recreational use - usually walkers, tourism, and bird watching. All other marking points were seen occasionally.

(c)(i) This was answered well with many candidates gaining both marks in a few words. It was pleasing to see many candidates using correct terminology, i.e. 'root suckers' and 'clonal patch'. Some candidates had the right idea but could not use terms precisely enough, talking about suckers, runners, root buds etc. which failed to gain credit.

(c)(ii) The majority of candidates correctly identified the new sprouts as being clones or genetically identical to each other. However, many candidates lost the second mark because they wrote that the new sprouts were clones and this meant they were equally susceptible to Dutch elm disease, implying that they were as susceptible as each other, rather than as the parent plant.

Question No.2

(a) Examiners were surprised by the number of candidates who failed to score well on this question. Often chromosomes and genetic material were given as the incorrect answers to DNA for the first 'fill in the blank'. Many answers named proteins instead of polypeptides for the second, which gained no credit. Lack of detail such as just mentioning shape and not extending their answer to tertiary structure/shape or 3D structure/shape meant that many candidates did not gain this mark for the third blank.

The mark for (b)(i) was rarely awarded. The most common mistake seen was to write animal and plant, but then miss out the fungi kingdom. Some answers incorrectly included protoctista and quite a few answers listed domains or classes instead of kingdoms.

(b)(ii) The majority of candidates got this correct, noting the head-tail orientation or position / development of limbs and segmentation. Very rarely was the development of an eye seen. A common error was to mention head at one end and legs at the other, instead of head and tail orientation. Some candidates just mentioned polarity but didn't qualify their answer and vague answers often included references to changes to the body plan, whilst a few misinterpreted the question and talked about genes switching on at different times (this cannot be seen so gained no mark).

(b)(iii) For stages A to B, few candidates indicated that the tail disappeared, instead mentioning other body structures. Candidates often incorrectly wrote about the head becoming detached from the body or about the eyes opening, which gained no credit. For stages B to C, most candidates got the idea of the webbing being removed from between fingers and toes but some did not phrase it accurately enough, instead talking about apoptosis and not what apoptosis meant, or only going so far as to mention the formation/development of digits, which actually occurs in stage B.

In (c), it was clear that the majority of candidates understood the concept of selective breeding. Strong candidates were able to score 5 marks for clear coherent answers. The majority of candidates gained marks for stating that two grey mice would be selected and bred together and many also correctly referred to this breeding being repeated over many generations and were therefore also awarded the QWC mark for logical sequencing. Although many identified that homozygous dominant mice were needed to consistently produce grey offspring, very few mentioned the use of a test cross with a homozygous recessive black mouse to determine the exact genotype of the grey mouse. Some candidates drew punnett squares, but not always annotated, to indicate the heterozygous nature of the parent mice, and so failed to gain credit. The majority of candidates who touched upon the issue of black mice offspring responded along the lines of killing any black offspring without mention of preventing the parents breeding again, and so were not awarded the marking point. Weaker students missed the idea of artificial selection altogether, and gave a detailed explanation of gene therapy/genetic engineering, involving genes being located, removed and re-inserted etc.. Many described artificial insemination and nuclear transfer, which also did not gain marks.

Question No.3

(a)(i) Many candidates did not answer the specific question about motorway central reservations and just gave generic biotic and abiotic factors. Many also seemed to confuse biotic for abiotic. The most common correct biotic factor given was the lack of pollinators. Candidates were generally more successful gaining the abiotic mark, identifying the lack of space, soil pH, pollution from cars and wind from vehicles, though again some candidates missed the mark for not being specific enough, for example, just stating air pollution/high wind and not linking it to the vehicles on the motorway. Those candidates who thought about the specific circumstances of the position of the habitat were along the right lines with correct answers.

For (a)(ii), a very common error was to see the shoot 'bending' towards the light but the vast majority achieved this mark. Also a few candidates stated the shoot grew towards the sun instead of light, and so did not achieve the mark.

(b) Surprisingly few candidates gained full marks. The ethene mark was given most often and ethene and gibberellin were the commonest responses that gained two marks.

(c) Many candidates got the idea that microbes or named microorganisms were present but did not realise the microorganisms were on the explant. A number of candidates stated that the explant was contaminated and not the growth medium, but equally many candidates did understand that the growth medium became contaminated and this often lead to the awarding of the competition mark. Weaker candidates wrote about disease rather than microorganisms and there were general statements about contamination not linked to microorganisms, which did not gain credit. Quite a few said that the contamination would lead to mutation or cause the cells to become differentiated or undifferentiated, again gaining no credit.

(d)(i) This question was well answered by most candidates. The fact that *Rhizobium* was a nitrogen fixer was the commonest correct response. Unsurprisingly there was some confusion between nitrogen fixing/nitrifying and even denitrifying, but this was rare. Some candidates just said that *Rhizobium* is found in roots and would therefore not survive in water, which did not gain credit.

3d(ii) This question was not well answered. Many candidates missed getting the mark by giving a generalised and vague definition of biotechnology, e.g. microbes that are used for human benefits, rather than linking it to commercial or industrial processes.
Those candidates who chose to discuss this example of biotechnology rarely gained the mark as they wrote about microorganisms being used to keep fish alive, rather than to remove ammonia.

(d)(iii) The vast majority of candidates did not really understand that the desired product was the *Nitrosomonas* bacteria, though plenty still gained the point for saying the bacteria would die. Many gained a mark for denaturation of enzymes, though it was obvious they were talking about enzymes associated with nitrification rather than the enzymes used for processes in growth. Quite a few discussed a change in tertiary structure though many talked about the shape of the active site, which wasn't specific enough to gain that mark. When candidates recognised that hydrogen bonds were broken, many didn't gain the mark as they didn't link this with the effect of hydrogen ions.

(e)(i) The vast majority of candidates gained this mark, though some talked about the need for a column of means, which did not gain credit.

(e)(ii) This was a poorly answered question. Most responses were carbon dioxide concentration or even oxygen concentration; pH was another common incorrect response. Those candidates who did gain the mark said concentration of bacteria, concentration of ammonia solution or size / mass of plantlet.

Question No.4

For (a)(i),the majority of candidates were able to calculate the theoretical percentage of a heterozygous individual being produced in a cross between two heterozygous individuals.

(a)(ii) Good responses were able to comprehensibly explain how individuals homozygous for the q allele would come to dominate the gene pool of the *Brachycereus* species of cactus in the Galapagos Islands. It was essential to refer to the local conditions where the cactus is subjected to salty sea spray. Candidates realising the prevailing conditions, correctly referred to the qq individuals being able to obtain water from the salty spray, giving them a selective advantage and allowing them to survive. A few acceptable alternative arguments were also seen for the other cacti with the Q allele being unable to thrive. A number of responses failed to go as far as explaining that this selective advantage would result in the frequency the q allele rapidly increasing. Rarely was it mentioned that this was directional selection or that the cactus was geographically isolated with no new alleles coming into the population.

In part (b), candidates were requested to describe sampling techniques to investigate the distribution and abundance of grasses in a typical succession from the beach up a dune. Most correctly chose a belt or line transect, laying a tape down across the zones. The use of quadrats was also well known, but the description of how these would be used was frequently spoiled by reference to random sampling techniques. Many accounts included the use of a key to identify the species found, although the term ‘key’ did not always appear to be familiar to candidates. The methods used to assess the distribution and abundance were generally described well, with a reference to percentage cover being most common. Repetition of sampling rarely scored a mark as it was usually only vaguely mentioned: repeats over time or in the same area having been omitted.

(c) Many candidates were able to list 3 human activities and describe their effects on the Galapagos ecosystem. Farming, building or deforestation was usually correctly linked to their effect, as was the introduction of new species to the islands. Fishing or hunting was also familiar, being an activity likely to disturb food chains or result in native species becoming endangered or extinct. More vague responses were usually seen where the activity referred to tourism or shipping, some candidates only stating the effect with no real link to a human activity.

Question No.5

(a) Many candidates gave reasonable accounts of the functional relationships between receptors, neurones and effectors of the peripheral and central nervous systems and scored some or all of the marks available. A simple description of a reflex arc involving the transmission of action potentials from a sensory to a relay to a motor neurone and thence to an effector scored four marks, for instance. A significant number however failed to read and interpret the question correctly, and instead of describing how parts of the nervous system interact to enable response to changes in the environment, they gave text book accounts of the classification of the nervous system into different structural and functional divisions, often focusing chiefly on the autonomic division into sympathetic and parasympathetic. Answers that were on the right track were often let down by candidates saying that ‘signals’ and ‘messages’ travelled along neurones, instead of action potentials and impulses. A few poor answers described neurones moving from the periphery to the CNS.

(b) Most candidates correctly focused on the consequences of adrenaline stimulating glycogenolysis in liver cells. Answers often scored all the marks available and linked glucose to respiration and the production of ATP. Some answers however did not relate to the context of the question and were textbook accounts of the various effects of adrenaline on different parts of the body.

The mark most often scored in (c)(i) was for naming cardiac muscle as being present in the heart. Striated muscle for contraction often scored a second mark but candidates were prone to contradict themselves in the third line of the table, saying the effects of arteriole smooth muscle contraction caused dilation or increased blood flow to liver rather than constriction (and reduced blood flow).

(c)(ii) Most candidates correctly identified the thick filaments in the A band as myosin. A few wrote actin instead, and very occasionally tropomyosin was given as the answer.

(d)(i) Avoidance of predation or dessication were the commonest correct answers and were stated by most candidates.

(d)(ii) Many candidates failed to focus on the question asked, and instead of describing an experimental sequence of events to demonstrate habituation they simply described what they thought habituation meant. Those who did say they would expose a slug to light usually failed to say this must happen during darkness. Some candidates realised the need for repeated light stimulation, but the idea of 'continually' shining a light on a slug was not a correct approach to demonstrating habituation. The commonest idea to score a mark was that in a slug habituated to light the slug's normal reaction would diminish or stop. Phrases like 'the slug learns to ignore the light' or 'the slug realises that the light will not harm it' did not score a mark.

(d)(iii) Most candidates wrote taxis or kinesis but a few more general answers such as 'innate' did not score.

(e)(i) All of the options provided attracted some candidates, with the incorrect response 'insight learning' being commoner than the correct response, 'social behaviour'.

(e)(ii) Candidates often stated that the chimpanzees would have longer bones, but the length of the humerus was shown in the diagram to be the same in chimpanzees and humans, so the answer needed to focus on the radius and ulna bones of the lower arm. Some surmised from this that the muscles would also be longer, with more sarcomeres, and that the total mass or volume of muscle was therefore greater. Non-scoring answers ignored the information given in Fig. 5.2 and argued instead that the chimpanzees built up more strength through constant swinging from tree branches.

Question No.6

(a)(i) Most candidates gave the correct answer. Candidates usually gave their answer to 2dp although this was not a required marking point. The main problems were incorrect rounding and not knowing that squaring a negative produces a positive.

(a)(ii) Most candidates correctly concluded that the biologist's conclusion 'could be supported'. However many chose the wrong critical value by using either the wrong degrees of freedom or using p=0.01 to find the critical value. Candidates generally knew they were deriving a probability, but were unclear about what exactly this meant. Many believed they were determining the probability of getting a bigger χ^2 value. A few candidates did not understand the difference between the null hypothesis and the biologist's hypothesis/conclusion. They therefore correctly rejected the null hypothesis but also erroneously stated that the biologist's conclusion was false. It is helpful to give candidates opportunities to calculate chi-squared values for real-life examples where they will have a clear sense of whether the differences seen are due to chance or to some other reason. For example the colour distribution of sweets in a packet (equally distributed or not?) and woodlice distribution in a choice chamber (more woodlice in the dark and wet area?).

(b)(i) was a very simple definition question, but very large numbers of candidates did not seem to have learned the full definition. The most common missing element of the answer was that an ecosystem is *all* of the biotic and abiotic factors. Many candidates also missed the fact that the interactions between these factors was a part of the definition.

In (b)(ii), most candidates correctly identified this as a biotic factor and many mentioned the presence of bacteria, however many of these candidates did not then make it clear that the manure actually *contained* the bacteria. Simply reading the question thoroughly would have allowed more candidates to access the marking point.

Surprisingly, (c)(i) caused more problems than expected. The most common incorrect answers were 'digestion' and 'predation'. More rarely, there were also incorrect references to productivity and trophic levels.

(c)(ii) Most candidates gained one mark for identifying the least efficient energy transfer level (most identifying kingfisher to hawk). A few candidates did not read the question carefully and wrongly suggested the aquatic producers to protoctists transfer,thus gaining no marks, as the answer requires a transfer between *animals*. Such was the challenge of the mark scheme that very few candidates got the second mark. Many candidates discussed losing energy by activity and indigestible parts, however very few identified losing energy as heat or giving the important distinction that they lost *more* energy as heat, or had *more* indigestible parts than other animals. They simply explained that more energy was lost further down the food chain, which did not answer the question.

Question No.7

(a)(i) The majority of candidates were able correctly to identify that steps 2 and 3 were not in the correct order; however, some thought that step 2 should come after step 4.

(a)(ii) The majority of candidates correctly identified the step and the incorrect enzyme used in the step. However, a few candidates didn't identify the step or incorrectly identified step 4 or 5, and so did not gain the mark. A significant number thought 'digesting the gene' was the incorrect term preferring the term ''cutting the gene''. Several errors came from not recognising that *Taq* polymerase was a type of DNA polymerase so identifying this as the incorrect term.

Common wrong answers in part (b) included using a gene/DNA probe, transcription, reverse transcriptase and PCR. Very few suggested making an artificial/synthetic gene, or using polynucleotide sequencing.

(c)(i) Full marks were usually achieved through gaining mp1 and mp2. Mp3 was rarely awarded. A number of answers spent time rewording the question and failed to gain marks e.g. '*bacteria take up plasmids with antibiotic resistance and transfer resistance*'. A lot of candidates wrote about antibiotic resistance but failed to link it to a gene and so did not gain credit. Few candidates used the term 'immunity' which was pleasing to see since this misconception has often been seen in the past.

(c)(ii) Most candidates gave the correct DNA ligase. Those that gained no marks typically gave no response or DNA polymerase as their answer.

(d)(i) This proved to be a difficult question for two marks. Most students scored one by recognising that *phytoene synthase* was the limiting factor because it was the enzyme that catalyses the first stage in a metabolic pathway. However the question asked why the other two enzymes were not limiting and only a few candidates were able to answer this.

(d)(ii) The biochemistry required for this answer was surprisingly elusive. Some candidates tried to link their answer with active sites, but most of these failed to mention that it was the shape that was important. Of those candidates who recognised they needed some biochemistry here, most did not use the term 'sequence' when suggesting differences in DNA or protein primary structure. Many proposed different environmental conditions affecting the different plants, which did not gain credit.

Part (e) was a straightforward question about advantages/disadvantages for GM crops but note two areas for improvement:
For – candidates must read and answer the question being asked. Answers in terms of making food more nutritious or supplying more vitamins were not credited as this question asked about golden rice and needed the advantage to be linked to reducing vitamin A deficiency, or symptoms of vitamin A deficiency.
Against – it is disappointing that a significant minority of candidates still thought 'playing God' was a legitimate scientific objection to genetic modification. If they did write about unknown consequences it was often in generalised terms such as a loss of biodiversity, or unknown long term effects, which did not gain credit. Some candidates correctly talked about hybridisation with wild rice species or unknown long term effects on human health. A few mentioned the cost of seed to farmers.

(f) Most candidates managed to identify size of organs as the issue. Few talked about temperature differences between humans and rats. Occasionally, candidates wrote about the immune response causing rejection, and disease being more common in rat organs, both of which did not gain credit (as they could be applied equally to pig organs).

(g) Many candidates reworded the stem of the question, saying that germ line gene therapy affects embryos and somatic gene therapy affects somatic cells. Others missed the term 'insertion of gene', instead writing about manipulating cells, or manipulated/altered DNA, which did not gain credit. The most common correct mark seen was the idea of no need to repeat the treatment for germ line gene therapy, or insertion of genes into embryos. Quite a few candidates then went on to discuss the ethics and legality between the two types of treatment, which gained no credit. Another common error was genes being altered or replaced. Some candidates found it difficult to specify the cells involved, giving the impression that they think a sperm cell is undifferentiated or not present in an adult's body.

F216 Practical Skills 2

General Comments:

Again 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. 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 OCR to make a 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 marking and the moderation process. Irrespective of this, the centre has the option to request a remoderation of the original sample.

Comments on Individual Tasks:

Qualitative Task 1: Enzymes and Biotechnology – The Activity of Immobilised Invertase
This task was generally well done by the majority of candidates.The use of glucose test sticks and biuret reagent in the testing process was straightforward and seemed to cause few problems. Candidates reported colour outcomes well and were able to collate the data in appropriately drawn tables. Where the results were at odds with those expected, this sometimes caused difficulty with the Part 2 questions. Here, candidates who knew what should have happened, occasionally lapsed into recall and failed to answer in the context of their results.

Qualitative Task 2: Investigating Substances Found in 'Mock' Body Fluids
The correct use of Benedict's and biuret reagent were tested in this Task. A significant minority of candidates heated the biuret and body fluids thereby obtaining colours which were not indicative of the presence or absence of protein. Some centres attempted to mark this as correct instead of referring the issue to the OCR queries service. Other centres used ready mixed biuret reagent and found that this occasionally lead to very pale colours. In this situation centres should have used solutions of the separate compounds; this would have enabled a more appropriate balance to be achieved along with a darker more convincing lilac/purple. Again advice with this difficulty could have been obtained from the email query service.

Qualitative Task 3: An Investigation into the Distribution of Photosynthetic Organisms in Relation to an Abiotic Factor
Ecologically based tasks are very popular with those centres which have easy access to appropriate habitats. The Task was generally very well done with perhaps the exception of Step 8 on page 7 where candidates were expected to describe the method used to a third party. The quality of the field drawings and descriptions (step 7 on page 6) were generally of a higher standard than in previous years when this Task was used.

Quantitative Task 1: Photosynthesis: The Effect of Different Wavelengths of Light on the Rate of Photosynthesis
Centres that used this Task clearly benefitted from previous experience of it. There were comparatively few email queries about filters and light sources and candidates seemed confident

in the manipulation of the apparatus. Part 2 question 1, however, again produced a number of suggestions which were merely repetition of the method given and not a statement of what additional steps candidates inevitably did use since they were missing from the instructions supplied. Given the prompt on page 5 of Part 1, and the bold text in the stem of the question, it was disappointing to find that more candidates were unable to obtain both marks available. The graph on page 4, a now well established feature of these Tasks, was generally very well done, although there were some candidates who, it is supposed inevitably, made errors right across all parts of all of the marking points. This comment also applies to Quant 2 below.

Quantitative Task 2: The Effect of Sodium Chloride Concentration on the Activity of Yeast Cells
This is a straightforward laboratory investigation into respiration in yeast and how it is affected by increasing concentrations of sodium chloride. Some centres had difficulties with generating enough carbon dioxide to give satisfactory results; very few of these centres asked for assistance. Even with low volumes of gas generated, as long as they were not mostly zero values, there were no marks that were not available in the remainder of the paper. Where a Task doesn't work adequately on the day, centres are expected to offer a different Task as set out in the FAQs and Practical Skills Handbook.

Quantitative Task 3: An Investigation of Leaf Variation in a Terrestrial Plant
There were few areas of difficulty in this Task, but again, some candidates found it challenging to explain the procedure they used adequately (see Qual 3 above). The table containing eleven sets of date and calculation outcomes was usually completed well by the majority of candidates. Question 4 did generate some unexpected suggestions for the biotic factors but most candidates scored well on the question as a whole.

The Evaluative Tasks, in general, are designed to offer more grade discrimination and challenge than either the Qualitative or Quantitative papers.

Evaluative Task 1: Photosynthesis: The Effect of Different Wavelengths of Light on the Rate of Photosynthesis
Question 3b responses about light intensity and temperature very often lacked detail and precision resulting in poor scores for many candidates. Questions 5 and 6 were also more demanding in the quality of the response required; candidates frequently omitted an essential component required for a satisfactory answer.

Evaluative Task 2: The Effect of Sodium Chloride Concentration on the Activity of Yeast Cells
The explanations for questions 2 and 4(b) were often incomplete and expected the marker to assume what had been intended. In question 3(b), candidates frequently failed to convince the marker that they understood the difference between precision and accuracy. Question 6 required an answer written in terms of water potential. Some candidates either failed to include that level of detail or used other terminology. Where candidates attempted to explain an outcome of plasmolysis, their attempts were usually of a good standard and often included some quite unexpected and pleasing suggestions.

Evaluative Task 3: An Investigation of Leaf Variation in a Terrestrial Plant
Having completed Quant 3, it was common for centres to follow that success with this evaluative task. Generally it was well executed with comparatively high scores resulting. Question 3 proved to be challenging to many candidates who simply couldn't adequately explain the skewing of identical ranges. Similarly question 6 left many candidates struggling to clearly separate the first marking point and the first explanation point. Very few attempted to explain the outcome in terms of statistics, in spite of successfully completing most parts of question 5.

Centres can seek advice on the implementation and marking of Tasks in future sessions by e-mailing GCEsciencetasks@ocr.org.uk. Please include your name and centre number, state clearly which Task your query relates to, and describe which points of the Task, Technician's Instructions or Mark Scheme you would like to receive clarification for. Having completed the marking process, centres may submit up to four complete sets of Task scripts for each Task; which will generate a report outlining any differences between the Principal Moderator's marks and the centre's marks.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553