RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced GCE **A2 H421**

Advanced Subsidiary GCE **AS H021**

OCR Report to Centres

June 2012

Oxford Cambridge and RSA Examinations

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, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

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CONTENTS

Advanced GCE Biology (H421)

Advanced Subsidiary GCE Biology (H021)

OCR REPORT TO CENTRES

Chief Examiner's Report

Reports on previous sessions have included a table that indicates the relative weightings of the assessment objectives in each of the examined theory units. It is also included in this report, as it contains key information that is applicable to both teachers and candidates.

Unit	AO1		AO2		AO3		Synoptic		Raw mark
	raw mark	%	raw mark	%	raw mark	%	raw mark	%	→ UMS
F211	28	46.67	28	46.67	4	6.67			60 → 90
F212	42	42.00	48	48.00	10	10.00			100 → 150
F214	20	33.33	36	60.00	4	6.67	12	20.00	60 → 90
F215	36	36.00	54	54.00	10	10.00	20	20.00	100 → 150

AO1 *Recall of knowledge and understanding*
AO2 *Application of knowledge and understanding*
AO3 *How Science Works – the formal way by which it is assessed*
Synoptic *Marks allocated within A2 papers that draw on the breadth of material studied in the course and will (normally) form part of the AO2 mark allocation*

It is clear from the table that the percentage weighting of AO1 and AO2 marks only differs slightly between the two AS units. However, the actual number of raw marks that are not purely recall (i.e. not AO1) on F212 is 58, which is almost the total number of marks for a whole F211 paper. Candidates can therefore expect almost 60% of the F212 paper to require them to demonstrate their ability to apply their knowledge either in a theoretical (AO2) or practical (AO3) context, and should not be surprised to be confronted with a number of questions with the 'suggest' command word. Similar comparisons can be drawn between the two A2 units, although it should be noted that the percentage weighting of AO1 marks at A2 is much reduced when compared with the AS units.

It is pleasing to note that Centres are making use of previous mark schemes to inform candidates of the level of precision required in answers. Candidates need to realise, however, that they cannot use a 'one answer fits all' approach to questions. Care is taken in the phrasing of questions and it was evident in a number of cases this session that the context and approach of the question had not been appreciated and that a generic answer would not be applicable. Highlighting or underlining key words or phrases in the question can help provide focus for the answer.

Many learning outcomes lend themselves to testing using differing contexts. This is particularly true of ecology, genetics, classification and taxonomy but also applies to other areas of the specification. It is evident that assessment of AO2 will involve some questions that deal with information provided in unfamiliar contexts. Candidates will benefit from exposure to a variety of examples during the teaching of these topics and should be encouraged to use a wide range of reliable resources in their revision rather than a single text. Active methods of revision are also beneficial and help to highlight those areas where understanding may be lacking. Candidates should also download a copy of the specification and can use it as a check list to ensure that they have understood and revised all the learning outcomes, as it is the specification that is used as the reference when the questions are set.

Candidates are required to demonstrate mathematical and analytical skills in theory papers. They should be capable of performing calculations and giving answers to the appropriate number of decimal places indicated in the questions. Where this is not stated explicitly, answers should correspond to the equivalent data in a table or given to the same number of decimal places or one decimal place more than that of the original data used for the calculation.

Descriptions of trends in data or graphs should indicate the broad tendency of one parameter to vary with an increase or decrease in the other and supported by quoted figures for both parameters together with the appropriate units.

The rubric for QWC questions is clearly stated in italic text next to the pencil icon. Candidates should be aware that the QWC rubric in F212 and F215 is specific to each question and particular attention should be paid to its requirement as it not only set out exactly what candidates need to do for the mark but also helps to keep the focus of the answer.

The information supplied in the stem or introduction to a question often needs to be assimilated before candidates can attempt to answer the various parts of the question. When preparing candidates for examinations, a good idea is to present them with the information but without the associated questions. They can be asked to analyse, interpret and identify links (whether synoptic or within a unit) without trying to 'spot' the isolated word, phrase or piece of data that will assist in answering a particular question.

When candidates use additional pages to continue an answer, they are generally quite good at indicating this. Particular care should be taken, however, in correctly identifying the question on the additional sheets. It is not sufficient to label a question as 1(iii) if this could apply to parts (a), (b) or (c). In the A2 units, where additional time has been allocated, candidates who use this time to simply write as much as they can about a topic rarely benefit. The time is much better spent in considering and interpreting the information given, and thinking carefully about how to present their answers.

With respect to the Practical Skills units (F213 and F216), general feedback is given in the relevant section within this report to Centres. Individual Centre-specific feedback is provided in the Moderator's Report, which can only be accessed by the relevant Centre. Centres are encouraged to seek advice on the application of the mark scheme in the event of uncertainty, either by email or by means of a consultancy. The email address is: GCEScienceTasks@ocr.org.uk

An important aspect of the Principal Moderators' reports is that moderators are aware of the difference in performance and standard of work between candidates who have been prepared appropriately in the skills required to perform the tasks and those who have been given detailed guidance. Where this is observed by moderators, cases are reported to OCR and investigated as suspected malpractice. Centres are asked to note that the tasks remain live for the **entire** life of the specification. It is therefore essential that no tasks are shown to pupils at any time or used as practice tasks *except* those indicated as practice tasks on Interchange.

News round-up for GCE Biology

A level reform

Over the last year, the future of A levels has received extensive interest. Ofqual is currently running a consultation to seek views from higher education, employers, learned societies, colleges, schools and others.

There is a link to all the relevant consultations, debates and reports at http://social.ocr.org.uk/groups/science/conversations/level-questionnaire-and-level-reform (also see http://social.ocr.org.uk/groups/science/conversations/level-timelines). We would strongly encourage teachers to contribute to the consultation (11 September deadline).

Additionally, if you have suggestions of content you would like to see in any revised GCE Biology qualifications please e-mail your comments to GCEScienceTasks@ocr.org.uk, we would be very happy to hear from you.

Keep up-to-date with developments in GCE Biology

- The OCR community, www.social.ocr.org.uk/groups/science, is a useful reference point to help keep teachers up-to-date with GCE Biology (and other sciences). We would strongly recommend visiting the site and registering.

F211 Cells, Exchange and Transport

General Comments

Examiners felt that this examination paper was of appropriate difficulty and comparable to previous sessions. Candidates were able to attempt all the questions and there was no evidence that timing was an issue.

There was evidently a wide range of ability in the cohort. However, the overall performance of the candidates showed a normal distribution of marks, with a slight skew to the higher marks. More able candidates were able to display their knowledge and understanding by attaining good marks in all areas of the specification tested. Less able candidates were able to achieve some of the marks available in each question – notably where AO1 (recall) was being tested. One question did stand out as being particularly challenging for candidates. This was question 5(d) in which they were expected to use their knowledge of the structure of the gaseous exchange system to explain why some air always remains in the system after exhaling. Very few candidates proved able to think around this topic to link the presence of cartilage and elastic tissue holding open the airways and alveoli so that there would always be some air remaining in the system. This understanding of the structures and how they work is an important aspect of Biology and is often tested as AO2 (application of knowledge).

Comments on Individual Questions

1 In this question, candidates were given a straightforward starter question testing AO1.

(a) **(i)** Most candidates knew that asexual reproduction is achieved by mitosis. However, misspellings that appeared to combine meiosis and mitosis were quite frequent (meitosis, miteiosis etc). It was not clear if these candidates were uncertain and guessing or simply could not spell mitosis. Candidates must ensure that they learn the spellings of these two terms very carefully as a single letter misplaced can lose them credit. 'Binary fission' was also seen a number of times.

(ii) Most candidates achieved the first mark point using terms such as 'genetically identical' although a number of less specific terms and descriptions were accepted. Fewer candidates achieved the second mark point about the need for the daughter cells to contain a full copy of the genetic material. Many candidates who did gain the mark described it as having ‘the same number of chromosomes’ or ‘the right amount of genetic material’.

(b) This question was surprisingly poorly answered. This was a direct test of a learning outcome statement and should be well understood. A few candidates gained full credit but these were not always the candidates who achieved good marks overall. It was clear that many candidates were describing sister chromatids rather than homologous chromosomes. This is an area in which teachers need to tighten up their descriptions and explanations so that candidates grasp the difference. The points seen most frequently in responses were mark points 1 – 4. Very few candidates offered descriptions including the position of the centromere, the banding pattern or the pairing in meiosis. There is certainly still some confusion between genes and chromosomes. Some candidates seemed to think that the chromosome and the gene were the same structure and others thought that there was only one gene per chromosome.

Teaching tip: Using kinaesthetic learning or activity learning helps students to visualise things like the difference between the sister chromatids and the homologous chromosomes. Making a pipe cleaner model is a good way to learn about the behaviour of chromosomes during cell division.

(c) **(i)** Most candidates achieved credit here in a question that was a direct test of an AO1 learning outcome. This learning outcome has been assessed before and candidates were able to express themselves reasonably well. Examiners found, however, that when candidates' understanding of the term 'tissue' was tested in context, in Question 6(a), they showed a poor understanding.

Teaching tip: Encourage students to use wider resources for their revision and not to simply learn past mark schemes. Active revision is essential for a good understanding of a topic and making notes, perhaps in the form of *annotated* diagrams, helps students focus on the key points.

(ii) This question seemed to work well and to differentiate across the weaker candidates. It was rare to see completely incorrect responses as candidates tended to leave the boxes blank rather than write incorrect answers. Candidates knew that squamous epithelium forms surfaces and often related this to the need for a thin surface to create a short diffusion pathway. Many knew that squamous epithelium is found in the alveoli and in the blood vessels. The spelling of alveoli was all-too-often not accurate. Vague responses such as 'in the lungs' were not accepted. Again, most candidates knew that ciliated epithelium moves or wafts mucus but some described it as moving bacteria / particles with no reference to the part played by the mucus. Many candidates suggested the bronchi or the trachea as a suitable location, however, some suggested the oesophagus or gave a vague location such as 'throat' or 'lungs'.

2 In this question, candidates were tested on their knowledge of organelles and the differences between eukaryotic cells and prokaryotic cells. The question is again mostly testing AO1 but some components move into testing AO2. This question was accessible to a wide range of abilities and many candidates scored well, with nearly all gaining at least one mark from each section. Candidates needed to be very secure in their knowledge of cell ultrastructure and the role of the Golgi apparatus to achieve the highest marks. However, weaker candidates could still attempt all parts of the question with some degree of success.

(a) **(i)** Most candidates correctly identified the vesicle and ribosome. Many knew that label **D** was a membrane but referred to it as a 'cell membrane' rather than the 'plasma membrane' or the 'cell surface membrane'. Candidates should be encouraged to distinguish clearly between this membrane and the many other 'membranes' in the cell. A less common but noticeable error was naming **E** as the rough endoplasmic reticulum instead of the ribosome. Careful observation of the label line, the enlarged section of drawing, and the absence of a bracket to encompass the *whole* of the RER should have guided candidates to the correct response.

(ii) Most candidates correctly stated 'enzyme' or 'hormone' or gave a correct example such as insulin. Some weaker candidates simply named common biological molecules such as DNA, RNA or various carbohydrates, thus demonstrating a poor knowledge of examples of proteins.

(iii) Most candidates gained the mark for this question. However, some candidates failed to make a suitably detailed statement. 'Active transport' was not accepted as this is a term used to describe the movement of molecules across a membrane by the action of a transport molecule in the membrane. Since the question was set in the context of 'during secretion' examiners were looking for the idea of vesicles being moved specifically towards the cell surface membrane where exocytosis could occur. Many candidates had not noted the significance of the term 'secretion' and, consequently, responses included anything that was connected to protein synthesis and modification. Careful reading and interpretation of the question would have avoided this.

(iv) Nearly all candidates were able to state that the Golgi apparatus modified proteins but fewer gained the mark for stating that the proteins are packaged into vesicles or that the Golgi produces lysosomes.

(b) (i) This was generally well answered – nearly all candidates gained full credit with a range of answers covering all mark points. The most common response by far was the nucleus (or the nuclear envelope/membrane). Mitochondria and Golgi apparatus were also common responses with endoplasmic reticulum and vesicles being seen less frequently. Some candidates lost credit by giving responses that were unspecific such as 'membrane bound organelles' or by ignoring the instruction in the question and naming structures that were not visible in the diagram, such as vacuole, nucleolus and lysosome.

(ii) Many candidates gained the mark here for naming plasmids. Some correctly stated DNA or genetic material but few specified smaller ribosomes. Incorrect responses were more frequent than for **2(b)(i)** suggesting that candidates' knowledge of prokaryote structure is less secure than that of eukaryotyes. Some candidates suggested 'mesosomes' which was not awarded a mark as these are infoldings of the cell surface membrane rather than being in the cytoplasm. Weaker candidates made all sorts of suggestions including 'cell wall', 'chloroplast' and 'flagella'.

3 This question tested candidate's knowledge of the action of the heart and the pressures recorded in the blood vessels. The diagram used is a familiar image in many texts and past papers.

Teaching tip: When reading a question, candidates should consider the positioning of the information supplied. In this question the main information is given *before* (a). This indicates that the information applies to all parts of the question.
In trying to interpret information in diagrams, candidates should be encouraged to read all the information carefully and relate all parts of the figure together.

(a) The majority of candidates were successful in this question. Failure to gain the mark was usually because the candidate had not read the question carefully enough and had not realised that one tick would suffice.

(b) (i) This question was not particularly well answered. Many responses did suggest that systole increased the pressure and diastole allowed the pressure to fall. However, the responses were rarely worded very clearly and many candidates lost credit because they made vague statements such as 'the fluctuations are caused by systole and diastole' without linking each term to an increase or decrease in pressure. Few candidates could specify that it was contraction of the muscle (or wall) of the ventricles that increased pressure and even fewer mentioned that it was the left ventricle that was involved. Examiners were frequently left with the feeling that candidates had only a weak understanding of the processes involved. This was highlighted by the numerous responses that suggested it was the opening and closing of the heart valves or the muscle in the aorta wall that caused the fluctuations.

(ii) Only about one third of candidates understood that the number of fluctuations per minute is the heart rate or pulse rate. Common incorrect responses were 'heart beat' or 'beats per minute' and there were also references to terms associated with breathing such as 'ventilation rate'.

(c) Most candidates managed to pick up the first mark point by stating that pressure decreases as blood moves away from the heart. Correct figures were often quoted. Relatively few candidates made any reference to the decreasing size of the fluctuations at greater distance from the heart and many incorrectly stated that the greatest drop in pressure was as blood flowed along the capillaries. Some candidates attempted to explain the results rather than describe them and so wasted valuable time.

Teaching tip: Ensure candidates understand the difference between 'describe' and 'explain'. A useful exercise is to instruct one student to describe a graph while another student attempts to draw the graph based on the verbal description.

(d) **(i)** Candidates have gained a better understanding of this question since the last time this learning outcome was tested. They are aware that the pressure is affected by the surface area of the vessels; however, too many candidates lost credit because they referred to the diameter of the vessels or the size of the lumen rather the total cross-sectional area of all the vessels. This suggests a poor understanding and many made statements such as 'the capillaries have the biggest lumen' which is clearly inaccurate. Very few mentioned the greater number of (smaller) vessels.

(ii) On the whole, candidates were successful in this question. Mark points one and two were often awarded. References to a potential build up of tissue fluid or oedema were very rare.

4 Testing the interpretation and explanation of practical investigations is part of AO3. Candidates should have gained a wide range of experience of practical work as part of their course and many will have observed the effect of changing the water potential of a solution on the cells in that solution.

(a) **(i)** Most candidates demonstrated a good understanding of osmosis. The majority recognised that the cells had a lower water potential than the water surrounding them and that water moved into the cells by osmosis. Fewer candidates referred to a water potential gradient and some lost credit because they did not describe the direction of movement of the water – into the cells. A small but significant number of candidates still use the terms 'water concentration' and 'water concentration gradient'. There is also some confusion over the meaning of a gradient – with some candidates referring to a 'gradient inside the cell' or 'outside the cell' rather than between the two. Many candidates successfully used the term 'haemolysis' to describe the bursting of the red blood cells but a disconcertingly high number of candidates used the term 'crenated'. Most candidates knew that the cell wall prevents the plant cell from bursting but few actually explained the point by referring to the weakness of the plasma membrane (allowing the red blood cell to burst) or the strength of the cell wall stopping the plant cell bursting. A large number of candidates knew that the plant cell became turgid but did not relate this to stopping further entry of water. Most candidates gained the QWC mark but there was some misuse of terms such as 'crenation' and 'plasmolysis'.

(ii) Many candidates realised that they should use a solution and correctly described this as an isotonic solution or a solution of the same water potential. Weaker candidates used terms such as 'use more concentrated water' or 'water with a lower water potential' which were not credited. Some candidates gave responses such as 'don't add water' or 'add a stain' which suggested that these candidates had not, perhaps, had the opportunity to carry out similar practical work.

(b) This was generally well answered and most candidates knew that oxygen enters red blood cells by diffusion. A small number suggested 'facilitated diffusion' or more bizarrely 'haemoglobin'.

(c) A significant number of candidates think that mineral ions are pulled into the root as a result of osmotic movement of water. Had candidates attempted to link this response to their knowledge of membrane structure and how substances move across membranes they would have known that water molecules can move between the phospholipids but mineral ions cannot – they need a transport protein. Active transport and facilitated diffusion were both acceptable responses. A large number of candidates realised that root hair cells have a large surface area as a result of the hair-like extension. Few, however, suggested that these cells may contain many mitochondria or may have increased numbers of carrier proteins in their plasma membranes. Candidates should understand that cell adaptations go beyond the size and shape of the cell and will include numbers and types of organelles, enzymes and other molecules.

5 In this question, candidates were given a graph showing the volume of air in the lungs over a period of six seconds. Those candidates that read the question understood this. However, there were some candidates (fortunately, only a few) who believed that this was the trace from a spirometer. It is important that candidates are trained to read all the information in a question and do not assume that it is the same as that from a previous year's paper.

(a) **(i)** The vast majority of candidates correctly gave the answer as 'tidal volume.' The most common incorrect answer was 'vital capacity'.

(ii) About half of the candidates gave the correct answer as 'stretching', showing that they had a good understanding of the mechanism of breathing. However, there were some very dubious spellings of the word. Incorrect responses included 'expanding', 'relaxing' and 'recoiling'. A significant number of candidates were, perhaps, uncertain and gave two or more responses – e.g. 'stretching / relaxing / recoiling'. Where a correct response is followed by a contradictory or incorrect response the examiner cannot award the mark. Therefore, candidates should be encouraged to write just one response where one mark is allocated.

(b) The majority of candidates scored well on this question, often hitting all of marking points 1 – 5 as well as attaining the QWC mark. A small but significant minority did not refer to the correct section of the graph, giving answers in the context of 'at B' or 'at C'. Where this occurred, marks were awarded for the correct explanation of the mechanism but the QWC mark was disallowed as the terms were not used in the correct context – i.e. not during expiration. Most candidates appeared to interpret the question clearly, although some gave full details of both inspiration and expiration or gave details about the movement of the chamber in a spirometer. Generally, use of scientific terminology was good with most candidates using nearly all of the listed terms correctly. Spelling of 'diaphragm', however, was often incorrect.

(c) The vast majority of candidates gave the correct answer as 12. Incorrect responses varied greatly and in many cases it was impossible to follow the logic by which the end result was achieved. There were a few candidates who simply did not attempt the question – even though the calculation was very simple.

(d) Candidates generally found this question difficult and only the most able gained credit. Most candidates misinterpreted the question or could not link it to the knowledge they had acquired about lung structure. Some gave responses along the lines of 'otherwise the lungs would collapse, which could be fatal', or less commonly, 'so that gaseous exchange can still occur'. Linking the detailed structure of the lungs to the process of ventilation allowed the best candidates to gain credit for the idea that the airways and alveoli are held open by cartilage and elastic fibres – ensuring that the alveoli and airways do not become fully compressed – and that, therefore, there must be air in the spaces remaining.

6 This question was about translocation and the evidence to support the proposed mechanism of translocation.

(a) **(i)** The majority of candidates gave a correct response. The commonest error was to mistake glucose for sucrose. Some candidates did not fully understand the concept of a tissue, stating 'sieve tubes' or 'sieve tube elements' instead of phloem. Candidates should be aware that some tissues consist of more than one type of cell – in this case the tissue 'phloem' consists of sieve tube elements and companion cells.

(ii) This question differentiated well between candidates who knew this process and those who did not. It is pleasing to see that more candidates have got to grips with the process and can describe it accurately. Less well prepared candidates wrote vaguely about sucrose being actively transported into the phloem or gave confused ideas about co-transport. A poor use of English and an inability to write clear, concise phrases will limit a candidate's ability to score marks.

Teaching tip: If candidates do struggle to word their responses clearly and concisely they should be encouraged to use short sentences and bullet point their responses. This will help them to keep each sentence focused and bullet pointing helps them to keep track of how many discreet points they have written in their response.

(b) Few candidates gained full marks for this question. In most cases, marks were attained for comments about the increasing kinetic energy or about enzymes being denatured. However, very few candidates linked an increase in kinetic energy to ATP production and increased active transport, and hardly any candidates mentioned osmosis or changes in hydrostatic pressure in the sieve tube. A significant number of candidates were clearly unaware that most of the aphid is removed in order to conduct the experiment and this resulted in a variety of responses concerning the aphid. Many candidates, presumably A2 candidates who had attempted one of the practical tasks, tried to link the changes in flow rate to changes in viscosity of the sugar solution. Weaker candidates simply described the data – suggesting that they had little idea on how to account for it, or had not interpreted the question accurately.

F212 Molecules, Biodiversity, Food and Health

General Comments

The paper produced a wide range of marks and differentiated well between candidates of different abilities. Some questions, such as **1(a)(i)** and **6(a)(i)** were done well by almost all candidates, while some, including **2(c)** and all parts of **6(b)** proved challenging to all but the most able. The inclusion of some *How Science Works* questions about models of enzyme action in Question 1 clearly surprised some candidates, as did questions that included the command word 'suggest'. However, only a small minority of candidates omitted to answer some of these questions. Examiners are aware that some candidates find these challenging and aim to give credit to any correct biology that is consistent with the question wherever possible. It is worth reminding centres that, on this paper, only 42 out of 100 marks are allocated to recall of learning objectives (AO1). Almost half of the available marks test (AO2), using knowledge in context, while 10 marks test AO3, scientific investigation.

On a number of occasions, including questions **1(c)(i)**, **1(c)(ii)**, **1(d)(i)**, **3(b)(iii)**, **3(c)**, **4(d)(i)**, and **6(b)(ii)**, candidates who did not read the question carefully failed to gain as many marks as they were capable of achieving. In some cases, e.g. **6(b)(ii)**, answers sometimes directly contradicted the information they had been given in the stem of the question.

Teaching tip:
Some thought goes in to the wording of questions and candidates would do well to re-read the questions and underline key words.

It is always gratifying to see that some candidates can demonstrate thorough knowledge and understanding and are able to express themselves clearly using technical terms correctly. Some such candidates referred to the monosaccharide residues of agarose being rotated by 180º in **4(a)(ii)**, others discussed a loss of genetic diversity in the wild population in **6(b)(iii)**. Spelling was not generally an issue in this paper; with the exception of 'protoctist' most spellings used by candidates were correct.

Comments on Individual Questions

1 Much of Question 1 required candidates to think and make links between topics. Overall it differentiated well between strong and weak candidates but marks were often missed because of a failure to read the question carefully.

(a) (i) An easy question to start off the paper and only very few candidates failed to score both available marks.

(ii) Clearly this assessment of the *How Science Works* part of the specification and Learning Outcome 2.1.3 (c) troubled some candidates. Around a third managed to get across the idea that models are used to represent and explain scientific processes that are not yet fully understood. Many candidates are clearly confused about the use and meaning of the terms theory, hypothesis and model.

(iii) Only a minority of candidates grasped the idea that the question was about the importance of new evidence. There is a difference between 'because the enzyme changes shape' and 'because there is evidence that the enzyme changes shape'.

Teaching tip: *How Science Works* forms part of the specification and will be regularly tested, although not overtly indicated like the QWC pencil icon.

(b) **(i)** Most candidates seemed comfortable with this AO3 question, gaining at least two marks. The most common correct responses were pH, LDH concentration, substrate concentration and time. As ever, the word 'amount' was used loosely and was not credited. Some candidates put 'temperature', apparently not understanding the nature of the investigation.

(ii) About 50% of candidates correctly picked out the correct response. The most common incorrect selection being '**K**'.

(iii) Most candidates gained one mark here but only strong candidates scored both marks. Some failed to score because of the omission of key terms such as 'optimum' and 'kinetic (energy)'. Stating that enzymes 'work better' is really not a suitable AS level response. The linking of kinetic energy to the fish rather than to activity at the molecular level was seen occasionally and was not credited. A disappointing minority of candidates still think that low temperatures denature enzymes.

(iv) Around half of the responses seen for this question were creditworthy, with the most common correct response being that it would be easier for the substrate to enter the active site. Again, some candidates missed out on a potential mark by poor use of scientific terms, most often for omitting to mention the 'active site'. Some answers suggested it would be an advantage for the LDH of Antarctic fish to bind to a wider range of substrates – clearly not having thought through their answer thoroughly enough.

(c) **(i)** Strong candidates produced fluent answers that linked a changed sequence of amino acids to its consequences for folding the polypeptide chain. Most scripts achieved just 1 mark, which they often gained multiple times through quite detailed descriptions of how the secondary/tertiary/quaternary structure can vary. A number of candidates were clearly thrown by the context of the question and, despite the reference to *structure* in the stem, answered in terms of enzyme function and adaptation.

(ii) This was often less well answered than part **(i)**. Many candidates showed a lack of understanding of DNA structure. Differences in 'genes' or in 'base sequence' were seen in around half of responses, with strong candidates offering both ideas. Some candidates mis-read the question and discussed differences in proteins, despite the emboldened '**DNA**'.

(d) **(i)** Pleasingly, most candidates clearly understood what the question required and many suggested a potential industrial or scientific application for the enzyme. The question was set in the context of the fish having become extinct so it was surprising that the most common error made by candidates was a suggestion that the loss of the enzyme would be undesirable for the fish. This was another example of candidates failing to read the question carefully.

(ii) Many candidates gained both available marks, usually for some reference to fishing restrictions and *ex situ* conservation. Where candidates dropped marks it was often for answers that were not specific enough, as if they had learned a list from a previous mark scheme which did not apply to this particular situation.

2 This question differentiated well overall; however, it was clear that many candidates lack both knowledge and understanding of classification.

(a) Although superficially straightforward, this 'filling in the gaps in the table' question produced a wide range of marks and differentiated well between candidates. Most candidates scored between 3 and 5 marks, but very few, less than 1 in 20, knew that prokaryotes could be heterotrophic or autotrophic. Many realised that one of the missing kingdoms was protoctist, but some struggled with the spelling. Phonetically similar mis-spellings were credited. Candidates had mixed opinions about whether the membrane-bound organelles were present or absent in fungi. Most candidates were much more comfortable with the plant or animal kingdoms.

(b) Approximately half of the candidates were not able to recognise the characteristics of fungi. Many guessed 'protoctist' and some 'prokaryote'.

(c) In the question stem, candidates were asked to compare. However, most candidates simply *described* those features that they could remember, and, in the main, they could remember few. Many answers showed evidence of having learnt the mark scheme to a similar but, crucially, not identical question. A significant minority were aware of the biochemical basis for the domain systems existence but were limited in their use of examples. Few clearly explained that it more accurately reflects the origins of prokaryotes and eukaryotes. Only very strong candidates gained all three marks. Most candidates had at least learnt the names of the domains but there are widespread misunderstandings about the reasons behind the domain system. More than one candidate claimed that '3 groups are easier to remember than 5'.

3 This question used the context of the pipistrelle to test understanding of a number of learning outcomes.

(a) Generally this was well-answered, discriminating between different ability levels. Most students realised that they had to apply natural selection to a specific example and those who did so scored highly. Of those gaining marks, the majority noted that there was a mutation, but only around half specified the randomness of this mutation, failing to make it clear that the origin or existence of "the allele" was independent of the environmental factors selecting for it. Indeed, responses that implied that the mutation was caused by the selection pressure found it hard to gain full marks. Similarly, whilst many were able to describe the genetic trait being passed onto offspring, this was often not developed further into describing how the allele frequency would increase. Those who did not understand how to apply the concept of natural selection often failed to mention genetic factors at all in their answers. It was pleasing to see increased use of the term 'selection pressure', although some candidates struggled when attempting to describe the nature of this pressure. A number of weaker candidates, perhaps re-sitting from A2, described echolocation as a learned behaviour.

(b) **(i)** Most candidates were credited with this mark. Notable exceptions wrote 'pipistrelle' or 'pygmaeus', and a lesser number gave the answer as 'soprano', showing a lack of understanding of the nomenclature. A number of candidates gave the names of other taxonomic levels, e.g. mammal, or included the species as well as the genus name through not understanding what was required. It was pleasing to see a majority of candidates use an upper case 'P' to begin the generic name.

(ii) Students generally did well in this question. Those who failed to gain the mark tended to suggest that they merely had similar 'features' without qualifying their answer further, or simply quoted the definition of species without relating it to the example given. A few candidates included the idea that previously echolocation could not be measured due to lack of specialised equipment and were awarded the mark.

(iii) Candidates were asked to give molecular evidence that would be used to identify the species as different species. Most students referred to comparative DNA studies but many failed to gain the second mark, referring vaguely to enzymes or proteins. Where a second mark was awarded, it was generally for stating cytochrome C, with some candidates referring to amino acid sequences. A significant number did not register the term molecular in the stem and wrote about behavioural or anatomical features. On several occasions candidates referred to amino acid sequences **in** DNA.

(iv) Some candidates were clearly confused by the 'over a longer period of time' instruction and described reconstructing phylogenies from fossil evidence or observing behaviours. Around half of candidates had the correct idea that if two organisms breed and produce fertile offspring they belong to the same species. Some candidates lost a mark for not explicitly stating that only animals of the same species would produce fertile offspring in this way. Creditworthy references to the phylogenetic species definition from re-sitting A2 candidates were rarely seen.

(c) Candidates were informed in the question that variation within and between species can be displayed in two different forms, and were asked to describe how these two forms of variation are displayed. This should have directed candidates to discuss continuous and discontinuous variation. Where candidates understood this concept, this led to some impressive answers where the key features were described, examples in the context of the two species of pipistrelle bats were offered, and these were linked to the impact of genetic and environmental factors on these types of variation. However, despite the QWC instruction, the relative contribution of genetics and the environment was frequently missing in a significant proportion of good answers. Limited credit was afforded where candidates failed to mention continuous and discontinuous, but could correctly discuss bat-related examples of variation in the context of genetic and environmental impact. Often candidates did not understand that the question was asking about the presentation of different forms of variation – despite the reference to the way variation is 'displayed' in the stem - and instead discussed intra/interspecific variation, speciation or merely repeated the stem and part (a) by citing genetic or environmental variation in evolutionary terms. It cannot be emphasised enough that careful reading of the question gains marks.

4 Candidates seemed comfortable with food tests but the focus on applying knowledge of carbohydrates in an unfamiliar context caused problems for some.

(a) **(i)** Only a minority of candidates appeared to understand that a carbohydrate made of a chain of sugar sub-units was a polysaccharide, although nearly all the candidates who did, spelt 'polysaccharide' correctly. There was, however, a worrying range of incorrect responses.

(ii) Candidates found it easier to state a similarity than a difference. The most common correct response being 'glycosidic bonds'. Amylose was often incorrectly described as being branched, either in the context of a similarity or a difference. In the differences section, the most common error seen was saying that the subunits were made of (α or β) glucose. The most frequently seen correct response referred to the coiled and linear structures of amylose and agarose respectively, followed by the rotation of the sugar residue in agarose. Candidates who confused 'monomer' with monosaccharide' residue were, on this occasion, given the benefit of the doubt.

(b) A majority of candidates gained this mark. However, many incorrect responses referred to the covalent bonds being too strong to be broken or that the lack of water in bacteria meant the bonds could not be hydrolysed. Stronger candidates tended to discuss the lack of a bacterial enzyme with a complementary active site for the agarose, whilst weaker candidates, who were nevertheless awarded the mark, simply said the bacteria did not have the correct enzyme.

(c) **(i)** The vast majority of candidates gained at least 1 mark for either recognising that tube B was the control or successfully explaining its role. Over half of candidates managed to do both.

(ii) Although almost half of the responses gained a mark, quite a few candidates had difficulty expressing themselves clearly enough. Worryingly, there seemed to be a significant number who thought the temperature was sufficient to allow the breakdown of agarose into reducing sugars. The most commonly seen accepted answer was the idea that the bacteria had previously been grown in a starch solution that could have been broken down to produce a reducing sugar.

(iii) One mark was most frequently awarded for this two-mark question. 'Repeating the experiment' gained the first marking point for all but a few candidates who were let down by ambiguous wording – 'do more tests' could mean 'different tests' or 'tests at different temperatures'. The second mark, 'multiple samples from each tube' was very rare. Most candidates offered suggestions of how to assess reliability rather than improve it. This question again highlighted the widespread misunderstanding of the terms *reliability*, *accuracy* and *validity*.

(d) **(i)** This question was well answered by the vast majority of candidates but nevertheless differentiated well. The mark scheme allowed flexibility in practical details with respect to temperature and the duration of heating time. Only the weakest of candidates did not use Benedict's reagent. The Benedict's test was usually well known and fully described, although weaker candidates did not mention precipitate or specified an inappropriate temperature. Most candidates made some creditworthy attempt at estimating the amount of reducing sugar, with the 'degree of colour change' being the most frequently seen correct answer. Despite the question's reference to the lack of colorimeter availability, a large minority of candidates insisted on describing the use of a colorimeter – yet another example of the value of reading the question carefully. The terms 'residue' or 'precipitate' were often mixed up with the term 'filtrate'.

(ii) Most candidates knew the non-reducing test for sugars well and many got full marks. This question also differentiated well.

5 This question differentiated well between candidates.

(a) **(i)** About 50% of candidates gained both marks here. For those that did not, it was a minority that gained 1 mark for correct working but failed to round the answer to one decimal place. Of the other candidates, most did not seem to know how to work out a percentage decrease, while some ignored the starting point on the y-axis and measured FEV as the difference between the data point and 2.4 dm^3.

(ii) It was pleasing to see that the recent trend towards candidates successfully *describing* graphs, when asked, rather than *explaining* has continued. Most candidates scored at least 2 marks, commonly for smokers showing decreasing FEV over the 5 years and former-smokers' FEV going up then down. What should have been two easy marks for figure quotes were too often not awarded when attempted. This was usually because units for FEV or years were not given.

Teaching tip:
In the context of most exam questions, trend means a change over time. Examiners will always expect **two pairs** of figures, with units, for correctly describing a change.

(b) (i) This question allowed differentiation across the range of ability. The majority of candidates were able to describe how the effects of tar on cilia and goblet cells lead to an accumulation of mucus. Rather fewer were able to adequately describe a build-up of pathogens or explain the advantage of coughing in these circumstances. At this point, many otherwise strong candidates went off at a tangent and provided descriptions of the development of emphysema or even lung cancer and therefore did not gain full marks. It is possible that such candidates had not read the question, although it is also possible that they were using the opportunity to discuss the material that they had learned. Only a minority of candidates discussed the consequences of prolonged coughing and hence only a minority were awarded the QWC. Those who did discuss consequences were most often awarded the mark for discussing damage to alveoli or airways.

(ii) A little over half of candidates achieved both marks. Spellings were often incorrect, e.g. 'bronchitus' or 'emphesima' but were phonetically similar and so were credited. It was fairly common to see a mark denied for omitting 'chronic' and less commonly for 'emphysemia'. 'Asthma' was rarely seen. Completely incorrect responses tended to refer to coronary or circulatory issues e.g. atherosclerosis.

(iii) This question also differentiated well across the ability range. Strong candidates achieved full marks within a few lines. Weaker candidates picked up 1 – 2 marks from those points that were common to the lock and key and induced fit hypotheses. Attempts to encroach into induced fit territory often gained a middle ability mark for 'enzyme changes shape'. A small number of candidates omitted to answer this question, perhaps lacking confidence in discussing elastase, rather than enzyme-action in general. It is worth reminding candidates that almost half the marks on this paper are awarded for applying understanding to an unfamiliar context.

6 Most candidates found part **(a)** very accessible, scoring very well but found part **(b)** extremely challenging, with few scoring full marks in any of the sub-questions.

(a) (i) The majority of candidates gained all three available marks and it was rare for a response to earn less than two. Candidates have clearly learned about selective breeding since the last time it was tested in this component.

(ii) Few failed to gain a mark. 'Antibiotics' was the commonest correct response but most others were seen occasionally. The most frequently seen incorrect answers were vague references to an improved diet or selective breeding. Other techniques that could also have been used in the 18th century, e.g. restricted movement, were occasionally seen but not credited.

(b) (i) While most candidates clearly understood what the question was about and had some strategy for answering it, the widespread use of imprecise terms and wording meant that only about one-third of responses scored any marks. Most candidates used phrases along the lines of 'nutrients are added to the soil and the plants use them for growth' which, while not incorrect, was not sufficiently creditworthy at AS level. The alternative response 'minerals, such as nitrate, phosphate and potassium, are added to the soil. Plants use nitrate to build amino acids' would have gained all three available marks.

(ii) This question was very poorly answered. Around half of candidates clearly ignored the statement in the question stem that 'fertilisers are not directly toxic' and began their answers 'fertilisers are toxic'. The part of the question that mentioned 'biodiversity of farmland' was similarly ignored by many as candidates went on to discuss eutrophication. Some confused fertilisers with pesticides and wrote at length on the toxic effect of these chemicals. Fewer than 30% of responses were awarded a mark and fewer than 5% were awarded both marks.

(iii) As this question was towards the end of the paper, one wonders if time was a factor in some of the poor answers offered. Only a minority gained any marks at all. The candidates tended to focus on the reduction of genetic variety in the domesticated population, i.e. the crop, and did not realise the importance of the loss of genetic diversity in the wild population. Hence their answers seemed to be concerned with a disease that wiped out an entire farmer's crop with no mention of the loss of a genetic resource from the wild variety. Some candidates did appreciate the potential problems due to climate change and quite a few candidates did recognise that the loss of pest predators or pollinators would subsequently affect agriculture.

7 Candidates were given a break from writing at the end of the paper but the question tested the precision with which they understood the meaning of, and often subtle differences between, ecological terms. However, many candidates did not always recognise the need to pick the most appropriate answer from the list and mistakes were made. Most responses scored between three and five marks. Only the strongest candidates realised that 'percentage cover' is not quite the same as 'frequency of occurrence' and many candidates mixed up 'species richness' with 'species evenness'.

F213 Practical Skills in Biology 1

General Comments

This year, new tasks were introduced to the choices offered. All tasks were of the same level of demand as those used in previous sessions. Although there were different topics for the tasks this year, they were of equal demand for each task type.

The majority of centres are marking the scripts well, using the mark scheme accurately and carrying out the clerical procedures correctly, which is appreciated. However, there are still a number of clerical and marking issues that need to be addressed by some centres.

Clerical Issues

Some centres are still not securing each candidate's script with a treasury tag and providing a front sheet to summarise the three tasks and the marks for each candidate. It is hoped that centres can be encouraged to use this method rather than use folders or plastic wallets. The correct form can be found on the OCR website at:
http://pdf.ocr.org.uk/download/forms/ocr_51707_form_gce_ccs361.pdf?

Centre trial data is important as it helps to support the marks awarded by the centre, especially where the results obtained differ from the expected results in the mark schemes. Additional annotations on the scripts are also important in supporting the marks given. There are still some centres that do not include trial data for all the tasks carried out and who do not use annotations on the scripts.

A number of centres are still not using any method of internal moderation to verify the marks awarded and to check for clerical errors. Centres are requested to check for clerical errors as part of the internal moderation process to ensure that candidates are awarded the correct marks and to reduce delays in the moderation process. In addition, a number of centres are not ensuring that **candidate numbers** are written on all the scripts and in some cases, marks are not being transferred to the front page of the task either – making it extremely difficult to identify the candidates and the marks awarded.

Marking issues

As with last session, there were a few misinterpretations of the rubric of questions; for example, where candidates did not appreciate the difference between 'describe' and 'explain' or between 'error' and 'limitation', but where nonetheless, marks were still awarded by the centre.

Fewer centres than last session used marking points to identify the marks being credited on a particular script. This omission frequently resulted in the same marking point being awarded twice. It is recommended that a single tick together with the mark point awarded is placed on the script where the response has met that criterion. The numerical mark awarded should then be written in the 'for teacher's use' column. This avoids confusion, as well as ensures that the correct marks are awarded by both the centre and the moderator.

As in previous series, moderators identified that some centres are coaching students to the mark scheme to improve results. This is not permitted under any circumstances and moderators will report any such instances to OCR's Malpractice team for investigation.

Centres are also reminded that data may not be given to candidates, nor may data be shared between candidates. Please see FAQ 24 for further amplification of this point. Centres are also to be reminded that any second attempt at an answer, including tables and graphs, can only occur if the student requests it at the time of completing the task and not at a subsequent date. The original answer must be clearly crossed through by the candidate and not be left to the teacher and/or moderator to make the choice. This last point also applies to any question where two answers are given – where the first answer only will be marked.

Post-series

Centres are encouraged to make arrangements to ensure that a responsible member of staff at the centre is available during the summer period to receive the moderated coursework from the series. This should be stored securely until required by the Head of Department.

Centres are reminded to retain tasks securely until such time as they are clear that candidates will not wish to re-submit work to OCR in future series. At this point, the work should be securely destroyed. Work should not be returned to candidates under any circumstances.

Guidance on resubmission in a future series can be found within the FAQ document within the GCE Biology area on Interchange.

F214 Communication, Homeostasis and Energy

General Comments

Some excellent answers were seen and those candidates who had been well prepared, particularly with reference to AO2 and synoptic material, performed well.

Candidates need to pay particular attention to the spelling of words which can be confused with other words or terms that have a distinctly different meaning. This was particularly evident in **Q1(b)(i)** and **Q3(c)**.

In **Q3** and **Q4** good candidates showed a detailed knowledge of the processes of respiration and photosynthesis, whereas others got them very mixed up. Perhaps, as well as looking separately at the details of the two processes, teaching needs to emphasise the 'big picture' and how the processes are connected.

As noted in previous reports, it is very important for candidates to indicate clearly if their answer to a question extends beyond the boundary of the lines or space allocated for the response, and also to indicate where the rest of their answer is to be found. The initial view that examiners see is of the allocated space that follows the question, and so guidance from the candidate will ensure that any extension of their answer is found. Candidates should also use the additional lined pages at the end of the question paper for their extended answers and not use separate answer sheets or answer booklets. This situation is becoming an important issue with the additional time that is now allowed for Biology A2 papers. Candidates are expected to use this additional time to assimilate the information and to consider the quality of their answers rather than to write extensively for a question with a mark tariff of only two or three marks.

Comments on Individual Questions

1 This question was designed to be an accessible start to the exam, covering a number of familiar topics.

(a) This question was well answered by most candidates. The most common incorrect answers referred to homeostasis or included the word ‘communication’, which had already been provided in the question.

(b) **(i)** This part of the question was answered correctly by most candidates, although it should be noted that ‘synapse’ should more correctly refer to the gap and the end portions of the neurones involved in the junction rather than applying the term to just the synaptic cleft. Answers which appeared to state ‘synoptic’ were not credited.

(ii) Most candidates performed well on this question, often scoring maximum marks. One of the key points to make clear in such an account would be reference to the release of the neurotransmitter into the cleft – a significant proportion of answers either implied or stated that the vesicles passed from the presynaptic neurone into the cleft and then reached the postsynaptic neurone. Such statements or inferences were not credited. Diffusion is a key term to use in connection with the movement of the neurotransmitter across the synaptic cleft. It is important for candidates to appreciate that the receptors are embedded in the postsynaptic membrane. Many candidates failed to score marks in the first four or five lines of their answers as they started the account with the arrival of the action potential at the synaptic knob, which did not strictly fall within the scope of the question.

(iii) Although this is a direct question relating to a stated learning outcome, many candidates experienced problems in expressing their thoughts in a clear enough manner. One of the two main areas of difficulty was in the use of 'messages', 'signals' or other vague terminology to refer to impulses or action potentials. While they were not penalised for the use of such terms, they would not gain credit without a more suitable term being used. Another misconception, or possibly a result of poor expression, was the description of weak stimuli as *small* action potentials, when they individually all have the same value. The terms 'convergence' and 'divergence' required further clarification.

(c) **(i)** Most candidates gave the correct answer as endotherm or homoiothermic, although other less precise terms were not credited.

(ii) This was another question in which candidates needed to be careful in the use of terminology. Answers relating to 'arterial' dilation were not credited.

(d) **(i)** Examiners were looking for the main hormones involved in increasing metabolic rate. A variety of suggestions were offered by candidates who may have thought that the only hormones that could feature on this paper would be those involved in the regulation of blood glucose.

(ii) The most common incorrect answer was 'medulla oblongata', but a majority of candidates gave the correct answer.

2 **(a)** Many candidates were able to correctly identify the regions of the nephron.

(b) This part of the question discriminated well. Weaker answers suggested a variety of incorrect answers but the most common incorrect answer was that for the last row. Only the very best answers were given by candidates who recognised that most of the water (in fact approximately 65%) is reabsorbed in the proximal convoluted tubule.

(c) This question proved challenging for many candidates as it required a clear understanding of the principle and the ability to clearly convey the information. This was further complicated by the fact that the logical way to teach and explain the mechanism is to start with the events in the ascending limb and then move back to the events in the descending limb. As stated in the learning outcome, candidates are also expected to provide a description in terms of water potential and this also proves to be challenging as they find the relationship between water potential and solute concentration difficult to equate. The question discriminated well with some very clear and accurate accounts seen.

3 This question related to respiration in plant cells. Despite this being clearly stated in the question on a number of occasions, some candidates assumed that plants photosynthesise and so answered in terms of photosynthesis rather than respiration. **Q3(b)(i)** and **(c)** required careful thought.

(a) This was answered well by many candidates, although a significant number of candidates incorrectly referred to the inter-membrane space or to the matrix.

(b) **(i)** Candidates were generally able to provide an appropriate description. The command word was important to recognise, as explanations were not credited unless the variation in colour was also described.

(ii) Although most candidates were able to understand what was happening in the seeds in group A, answers did not always relate the respiration of the cells to a suitable *temperature* or to the staining of the tissue. Some detail of the source of the electrons was required, which would include the hydrogen acceptor and the reaction that provided the hydrogen. Candidates were not credited for simply repeating information given in the stem of the question. A common misconception, both in this part of the question and in **(c)(iii)**, was that TTC was only absorbed by the cells that were respiring.

(iii) This question, particularly when relating to the seeds in group C, yielded better answers.

(c) The variety of answers to **(i)** to **(iii)** indicated that anaerobic respiration is not well understood, even though candidates may well have been able to write a 'story' type account. Although 'after glycolysis' was in bold in the question, it appeared that some of the answers related to glycolysis or to anaerobic respiration in animal cells. Some suggested reduced or oxidised NADP as answers to **(i)** and **(ii)**, justifying their choice by stating that it was NAD**P** because it is in plants (rather than the more appropriate 'because it is in photosynthesis')..

(i) Ethanal was not a frequent answer, with candidates often suggesting a hydrogen acceptor from glycolysis or the Krebs cycle.

(ii) More answers suggested ethanal in response to this question. Care needed to be taken to write the answer clearly so that it was not ambiguous and resembled ethanol.

(iii) Despite the question asking for product**s**, a significant proportion of candidates only gave one. With only one mark available, it was only possible to score with at least the two main products.

(iv) Most candidates could score at least one mark for this question but did not go on to give enough detail of, for example, the uses of ATP in the cell.

4 This question proved to be the most challenging for candidates as it related to photosynthesis and involved interpretation of data and an appreciation of the biochemistry of the process to answer competently.

(a) This proved to be challenging to candidates and, indeed, had been categorised as a stretch and challenge question. Candidates found it difficult to indicate that carbon dioxide and oxygen only participated in certain stages of photosynthesis and that some of the gas produced would be used within the plant and so that measurement of either or both would provide an underestimate. One common error was to state that carbon dioxide could be used in other reactions. Some candidates tried to relate a previous mark scheme (inappropriately) to this question.

(b) **(i)** Candidates generally appreciated the need to indicate light *intensity* in their answer. This was possibly prompted by the axis label.

(ii) While many candidates suggested temperature as a factor, some concentrated on carbon dioxide. It should be noted that only references to carbon dioxide *concentration* were credited. Candidates should also be made aware of the difference between a factor and an environmental condition (e.g. the difference between 'temperature' and 'low temperature') and use them appropriately.

(iii) Most candidates supplied a suitable answer. However, it should be noted that there is some confusion between Krebs cycle and the Calvin cycle and, although offered as a suggestion, oxidative phosphorylation does not produce carbon dioxide.

(iv) Answers to this question required candidates to appreciate that, other than at zero, both respiration and photosynthesis take place and that the relative rates of these processes determine whether carbon dioxide is give off or taken up. All too often answers only referred to one process.

(c) **(i)** This question discriminated well. With three marks available, candidates were expected to state the three products of reduced NADP, ATP and oxygen.

(ii) Candidates needed to apply their understanding of the involvement of photosystem I in both cyclic and non-cyclic photophosphorylation. They were then expected to develop this into the impact of a lack of reduced NADP and ATP for the light independent reaction and therefore no respiratory substrate produced. Many candidates found it difficult to express this in sufficient detail.

5 **(a)** **(i)** Most candidates could supply a recognisable version of 'islets of Langerhans'.

(ii) Most candidates correctly stated beta cells, however care should be taken to ensure that there is no confusion with B lymphocytes.

(b) This question discriminated well, with only the most competent candidates giving all five correct answers. The second and third boxes tended not to be awarded marks due to a lack of precision. The most common reason for not scoring in box four was to suggest the incorrect ion, such as sodium.

(c) **(i)** Most candidates answered this question correctly.

(ii) Candidates often seemed to lose the focus of this question, having perhaps misread it; referring to protein synthesis, the mechanism of release from the cell (which they had just answered in the previous question), the control of blood glucose or the mechanism of entry of insulin into the target cells. Answers that related to the question set needed to be couched in terms of the Golgi apparatus and movement towards the cell surface membrane.

F215 Control, Genomes & Environment

General Comments

This year, there was evidence of a wealth of good teaching and preparation for the examination. Candidates are now heeding advice about clearly pointing out their answers that continue beyond the lined spaces allocated, and the standard of handwriting and English seems to have improved compared with previous sessions. There were some instances where candidates were too eager to write down recalled knowledge without fully interpreting the demands of the question, but generally the extra 15 minutes time allowance for the paper has provided candidates with the vital thinking time they need to really integrate what they know with the novel situations presented.

Comments on Individual Questions

1 This was a high-scoring question, covering some basic ideas and definitions in genetics and selective breeding in parts **(a)** to **(c)**, and moving on to more challenging questions in **(d)** and **(e)**, plus some recall of behaviour definitions and enzyme immobilisation techniques.

(a) Most candidates gave clear comparisons of how the two cats differed in fur colour, fur length or eye colour. A small number of responses only stated the phenotypic feature, e.g. fur colour, eye colour, without describing the difference between the two cats. A very small minority drew attention not to phenotypic differences, but to differences related to fight or flight arousal, echoing a question and mark scheme from a previous paper. It is essential that candidates read the question properly.

(b) Candidates with a secure understanding noted the clue 'domestic' in part **(i)** and gave the correct answer, artificial selection, while for **(ii)** the commonest correct answer was mutation. Many candidates found this question difficult however, with evolution, natural selection and speciation appearing in both sections and artificial selection being given wrongly for part **(ii)**.

(c) Epistasis was well-known for **(i)** and most candidates scored this mark. Wrong answers included codominance.

In **(ii)**, candidates made use of the information given to list dihybrid genotypes. Again, most candidates gained full marks, although a few gave the same genotype twice, so a systematic approach is advised. Candidates need to be taught to follow the conventions (dominant allele(s) written first and alleles of the same gene written together) to reduce the risk of such mistakes. A minority of candidates showed a complete misunderstanding of dihybrid crosses, giving one or two letter responses.

In **(iii)** most candidates gave clear definitions, stating that homozygous refers to **both** alleles being the same, while the gene locus is the position of a gene or allele on a chromosome. Careful teaching of the difference in the terms gene and allele is advised as marks are often lost when the inappropriate term is used.

The completed Punnett square was correctly interpreted by most candidates in **(iv)**. A minority of candidates ignored the square given and gave the classic 9:3:3:1 ratio expected when animals heterozygous for both genes are crossed, or a modified version such as 9:3:4. Candidates were given credit for correct ratios carried forward from incorrect phenotypes.

(d) Most candidates recognised the description of innate behaviour and were able to give a characteristic of such behaviour for **(i)**.

Part **(ii)** proved to be challenging however. Candidates were asked to explain why some domestic cats did not show the essential maternal behaviour but most candidates failed to link the essential behaviour to the survival of the kittens. A significant minority ignored their previous answer (that the behaviour is innate) and said that the mother cat learnt not to carry out the behaviour, or never learnt it in the first place. Those who realised the trait was inherited failed to score when they talked about the behaviour itself or the characteristic being passed on without framing this in the context of the correct allele (not gene) being passed on. A typical answer was that the cat realised humans would help and so chose not to perform the behaviour, and then this was passed on to their offspring because they had not seen the behaviour from their mother (and therefore would not perform it themselves). Candidates did not use their biological knowledge about natural selection and population genetics, and answers were frequently very simplistic in their expression.

A few correct references to genetic drift were seen but candidates did not usually comment that genetic drift is of far more significance in a small population like a pedigree cat breed. Possible linkage between the behaviour gene and another gene subject to artificial selection was mentioned a few times, while a similarly small number noted that natural selection would maintain a high allele frequency for the essential behaviour in the wild. The idea of selection or genetic drift altering the relative **frequency** of alleles in a population is an important concept that many candidates misunderstand.

(e) Part **(i)** proved difficult for many candidates, with a few candidates misreading 'physiological' as 'psychological'. Most candidates scored one mark for a reference to inbreeding or to a small gene pool, with only a few extending this idea to the cats being more likely to be homozygous for recessive alleles. There was widespread misuse of the term 'inter-breeding' for inbreeding. More worryingly, a large number of candidates think that inbreeding makes mutations more likely. *See teaching tip below*. Few candidates realised that good and bad genes might be accidentally selected for together if linked or that breeders might be selecting for looks rather than health, although it was nice to see a few candidates displaying knowledge of problems associated with particular breeds of cat or dog.

The methods of immobilising enzymes for **(ii)** were generally very well known.

Teaching Tips:
The conventions for presenting genotypes that should be followed are that the dominant allele is written before the recessive, pairs of alleles of the same gene are written together, and alphabetical order is followed, eg. BbDd.
Candidates should be taught that mutation rates are largely constant, unless mutagens or radiation increases the rate, and that mutation is random and does not respond to environmental pressures.
The idea of selection or genetic drift altering the relative **frequency** of alleles in a population is an important concept that candidates need to understand.
When using question part **(d)** for teaching, attention can be drawn to the fact that in the wild, **stabilising selection** operates to keep cat mothers well-adapted. In the domestic setting there is no selection pressure acting **against** the maternal behaviour as such, but instead there is a weakening of selection **for** the behaviour. Breeders assist the cats at the birth of kittens, removing the amniotic sac by rubbing with a towel and often cutting the umbilical cord as the jaw shape associated with the flat faces of Persians makes it hard for them to chew through the cord.

2 This question involved straightforward recall of the ultrastructure of striated muscle, a calculation, and understanding of the sliding filament theory of muscle contraction. It was generally well answered and the marks scored on this question correlated well with the candidates' performance on the paper as a whole.

(a) This question focused on an electron micrograph of striated muscle.

Most candidates scored at least one mark on **(i)**, the majority naming T or U correctly. V was the least well known, with a number of candidates referring to microfibrils rather than myofibrils.

Many candidates named the sarcomere correctly for **(ii)**, but the spelling sacromere was not accepted.

Candidates scored well on **(iii)**, most stating that glycogen was broken down to produce glucose and that this was needed for respiration. Weaker candidates failed to describe in sufficient detail the sequence of events whereby glycogen provided energy and instead gave inadequate responses about 'releasing energy'.

Many candidates carried out the calculation correctly for **(iv)**. Measurement of the distance between X and Y was usually carried out with precision. A significant number of candidates were unable to convert their measurements into micrometres accurately or failed to follow the instruction to give the answer to the nearest 0.1 μm. *See teaching tip below*.

(b) Candidates showed a good understanding of what happens to the different bands and zones of the myofibril when muscle contracts, with many candidates gaining all three marks.

(c) Candidates generally showed good knowledge of the process of muscle contraction. The role of calcium ions in relation to troponin & tropomyosin was well described though some candidates mixed up the two or only partially remembered the names and spellings. A good number of candidates also thought synoptically and referred to low pH denaturing proteins. Few candidates described the power stroke being reduced however, as most incorrectly assumed there would be *fewer* power strokes. The idea of actin filaments being pulled past myosin with less force was, if mentioned, often too poorly described for credit. Many candidates disadvantaged themselves through failing to understand the requirements of the question, wasting time describing the process of muscle contraction from the point at which a nerve impulse reaches a neuromuscular junction, rather than from the point at which calcium ions bind to proteins in the myofibrils. Many also failed to gain the QWC mark by describing a complete cessation of the processes involved in muscle contraction, instead of a reduction in the numbers of calcium ions binding, troponin molecules changing shape, actin-myosin cross-bridges forming, and so on.

Teaching tip:
Candidates should be trained to calculate the size of structure on a micrograph when the magnification is known as follows:
(1) Measure the structure in **mm**.
(2) Multiply by 1000 to convert to μm.
(3) Divide by the magnification.
They should also check to see if they are asked to give the final answer to a specific number of decimal places.

3 Genetically modified 'spider-goats' provided the context for this question covering recombinant DNA technology, vectors and animal cloning. Candidates showed a detailed knowledge of many aspects of this.

(a) The majority of candidates achieved this mark. It was necessary to clearly state that DNA from different sources was being joined. Error included stating that DNA from one organism was being placed in another organism, rather than into a piece of DNA, and that DNA strands were being placed together. Candidates need to distinguish between the terms *molecule* (DNA double helix consisting of two polynucleotide strands hydrogen-bonded together) and *strand* (single polynucleotide) when talking about DNA.

(b) The majority of candidates achieved one or two marks but a relatively small number gained three or four marks as this question probed knowledge of the various applications of genetic modification listed in the specification in some depth. There was a choice of correct answers for each application, reflecting all the possible approaches. Candidates are most familiar with plasmids as vectors, followed by viruses. Some candidates described liposomes but failed to name them, or muddled them with lysosomes. Simple facts to teach are that bacteriophages are viruses that infect bacteria and that the YAC vector can carry more DNA than the smaller BAC or plasmid. Eukaryotic genes tend to be larger, so require vectors that can accommodate more DNA. *Agrobacterium tumefaciens* is used to engineer plants, as seen in Golden Rice™.

(c) The two procedures for cloning animals were well known, with many candidates achieving full marks. Some confusion was seen with reference to gametes from the transgenic goat fusing with an enucleated egg cell and reference to IVF or molecular cloning of the gene. Common errors were failing to specify the type of cell taken from the transgenic goat and confusing the transgenic and donor goat or referring to sheep or unspecified organisms instead of goats. A surprising number of candidates incorrectly stated mammary cell and wrote mammalian. Few references were seen to haploid or diploid nuclei or to growing the embryo on to a 16-cell stage either *in vitro* or in the oviduct of a surrogate that has been tied to prevent the cloned embryos being swept into the uterus. Many candidates referred to embryo splitting, often successfully merged with a description of nuclear transfer.

(d) The advantages were less successfully described than the disadvantages, with the commonest advantage mentioned being that cloning would be faster than building up a herd by breeding from one initial transgenic female goat. Few clearly stated that the silk gene would always be passed on or that all the cloned animals would be able to produce silk in their milk, as candidates were relying too much on reciting remembered facts and not enough on applying their knowledge to the context of the question. Very few appreciated that only by cloning could one ensure that all the goats were female and therefore able to produce milk at all. Candidates have encountered the idea of a sex-limited trait on the specification in studying the dairy cow and the progeny testing of bulls who do not produce milk themselves but who pass on alleles affecting their daughters' milk yield, so this was an opportunity for candidates to apply that knowledge.

Disadvantages scored more highly, although many referred incorrectly to there being less genetic variation rather than none, or to the clones being less able to adapt, rather than being more susceptible, to new diseases and environmental changes. A minority of candidates failed to gain marks by writing only about breeding, not cloning. Candidates need to be taught that the first named factor is the subject of the question, as here, 'Discuss the advantages and disadvantages of **cloning** the transgenic goat', distinguishing the main thrust of the question from the sub-clause.

Teaching tip:
The BBC's Horizon programme 'Playing God' shown in early 2012 includes footage of the genetically modified goats that produce spider silk accompanied by a good explanation. Clips can be accessed via http://www.bbc.co.uk/programmes/b01b45zh or copies of the whole programme also exist on the youtube website, for example, http://www.youtube.com/watch?v=VkNEIXlt8rg. Schools with access to Clickview should be able to access the programme through the Clickview sharing exchange.

4 This question provided candidates with an opportunity to show their understanding of the use of microorganisms in biotechnology.

(a) There was a synoptic link with classification covered in F212 here, and relatively few candidates were able to give a distinctive feature for fungal cells. The cell wall of chitin was the most well-known. Most did describe the circular nature of the DNA or the lack of a nucleus in the bacterial cell, however there are widespread misapprehensions among the candidate cohort as to what plasmids are. *See teaching tips below*. In seeking to specify a distinctive feature of a group, candidates should look for something characteristic of that group **only** (so not membrane-bound organelles in fungi), and preferably positive feature (something they **do** have, like 70S ribosomes in bacteria) and which they **all** share (which rules out flagella and slime capsules).

(b) Fewer than half the candidates could define a pathogen, perhaps because it related to work taught at AS. Many imprecise statements were seen, such as causing harm or infecting hosts. It should be noted that carrying or spreading disease are not the same as causing a disease.

(c) Candidates scored marks more easily on the section related to 'What is biotechnology', listing food and drug products, and giving some details of their production. However, a significant number of candidates failed to name the microbes involved, and many wrongly named *E.coli* as making penicillin or incorrectly identified *Penicillium* and yeast as bacteria. One puzzling mistake was to name the fungus used to make Quorn as '*Mycobacterium*'. Possibly the word mycoprotein is the source of this confusion, triggering the memory of the similar name encountered when studying tuberculosis at AS. There were few references to the production of enzymes as a biotechnological processs, and occasionally some confusion between microorganisms and the enzymes they produce.

Candidates who scored four or more marks often earned the QWC mark by providing a more balanced account which included at least two advantages or reasons why microorganisms are used. The most common advantage marks given were the fast reproduction rate of bacteria and the fact that microbes can be genetically engineered. Many candidates gave unnecessary details of batch and continuous culture, although references to operating at low temperatures gained a mark. This was linked to lower cost in some responses, gaining a further mark, although low cost alone did not qualify for a mark.

Candidates do need to take a moment to absorb all the instructions associated with a QWC question, in order to avoid going off on a wrong tangent. The focus of the question was clearly on microorganisms in biotechnology, and examples like Golden Rice™ and gene therapy did not score.

Teaching tips:
Candidates should be taught that bacteria possess one main double stranded DNA molecule that joins back on itself forming a circle, and that this contains all or most of their genes. This is not a plasmid. Only some bacteria possess plasmids, which are extra, much smaller circles of DNA containing a few additional genes.
Another frequent area of confusion is the meaning of the word 'naked' in terms of bacterial DNA. This term refers to the lack of associated histone proteins, not to the lack of a nuclear membrane.

5 Set within the context of peat bogs, this question explored candidates' knowledge of succession, mineral recycling and decomposition, finishing up with a synoptic link to conservation. Candidates found the parts where they had to integrate their own factual knowledge with the context of the question (mainly **(b)** and **(c)**) surprisingly difficult.

(a) Most candidates recognised the sequence of events described in the flow diagram as succession for one mark in part **(i)**.

In part **(ii)** most candidates used the diagram to state mineral content and pH as relevant abiotic factors. Despite many references to water, these were rarely given a mark as they needed qualifying as the level or depth of water. Some candidates did not follow the instruction to make use of the figure and wrote light and temperature. A few listed biotic factors.

(b) Candidates should be familiar with the term deciduous from the specification section on plant responses. In our temperate climate it is to be expected that all candidates will have noticed that the leaves of many trees change colour in autumn and then fall to the ground, but that over the following year these leaves rot into the soil. Despite this annual event, a surprising number of responses failed to describe chlorophyll breakdown or leaves changing colour as similarities between the bog plants and deciduous trees. In the differences section, some candidates did not specify whether they were referring to the peat bog or to the forest, so their statements could not be awarded credit. Many did, however, state that minerals were held in the plant in the peat bog, or that decomposers were present, recycling minerals in the forest. Many candidates struggled to link this question with their knowledge of decomposition and the nitrogen cycle. Practising questions like this that include unfamiliar contexts is beneficial to candidates.

(c) Most responses scored one mark for saying that decomposers were unable to survive in the conditions in the bog. Disappointingly, few went on to explain why, reasoning either that waterlogging reduces the oxygen content or that acidity denatures microbial enzymes.

(d) The majority of candidates knew that biodiversity would be decreased, a few noting that specialised or rare plants would be lost. A number of responses also referred to the length of time needed to replace the bog and linked this to the idea of unsustainable use of this resource.

6 Question 6 required interpretation of a bar chart and a food web concerning two different ecological scenarios. It was generally well answered, but the use of more subject-specific vocabulary would have helped candidates to access more marks.

(a) Part **(i)** was well answered by most candidates, with only a small number failing to gain the mark. Those that missed the mark 'named' rather than 'described' the relationship e.g. predator-prey relationship, or implied cause and effect the wrong way round by re-ordering the statement, e.g. as the nests predated increased the territory size decreased. (See teaching tip.) A few wrongly described the two variables as being positively correlated.

Part **(ii)** provided a challenge even to the most able candidates. Most candidates did not use the information from the bar chart but simply reasoned that if weasels preyed on great tits then the prey species would decline and decline. More perceptive candidates realised that the great tit numbers would oscillate down and up but it was rare for a response to go on to say that weasels therefore maintain the great tit population around a stable number. Candidates did not make use of the information in Fig. 6.1 to describe the predation as being density-dependent.

(b) Most candidates gained at least one mark in part **(i)** by referring to the need for a control area, for comparison or to demonstrate the effects of removing the starfish. Fewer successfully explained the need for the two areas to be the same size so as to avoid bias. A significant number of candidates are still using phrases like 'more reliable' or 'more accurate' when they in fact mean 'valid' or unbiased'.

The majority of candidates gained both marks in **(ii)** by recognising that chitons and limpets were outcompeted for algae by barnacles and mussels, as these were no longer being eaten by starfish. Many candidates successfully referred to interspecific competition. A few candidates showed a lack of understanding of the results of competition between species by stating that competition between chitons and limpets only would result in the disappearance of both species.

Marks were lost in part **(iii)** by candidates failing to explain that the fall in sponge numbers was due to them being outcompeted for food. The majority correctly observed that the nudibranchs would be short of food, some also realising that sponges were their only food. In a very small number of responses, candidates did not understand that arrows show the direction of energy flow in food webs, so they confused predator and prey species and had algae preying on zooplankton and so on. The more candidates are exposed to a range of examples, questions and materials, including natural history videos, the less likely they are to make this sort of mistake due to them not recognising names of unfamiliar organisms.

Teaching Tip:
When describing the relationship between two variables shown on a graph or bar chart, candidates should be taught to refer to the x axis variable first and to trace its progress from low to high values, eg. as x increases, y (increases / decreases / stays the same).

7 The use of molecular evidence to establish the evolutionary relationship of giant and red pandas allowed candidates to show knowledge of classification, adaptation, techniques in DNA analysis and the relationship between genes and proteins.

(a) In **(i)** most candidates correctly named the two animals that shared the most recent common ancestor as polar bear and brown bear, though a few said raccoon and red panda. It should be pointed out to candidates that time is represented by the length of the lines between the ancestor at the bottom and the species at the top.

Few candidates scored a mark in **(ii)**. A surprising number of responses thought the two pandas did form a distinct taxonomic group, although the cladogram showed that they do not. The candidates who argued *no* needed to back their idea up with clear supporting information from the cladogram, linking one (red) to the raccoon lineage and the other (giant) to the bears. Statements about how recently they did or did not share a common ancestor were not clear-cut enough to gain the mark.

(b) Question part **(i)** targeted ideas about 'How Science Works', which are listed as an appendix at the back of the specification. When teaching the main subject content, it is assumed that these ideas will be covered. However, candidates always have problems with this type of question, which on past papers has concerned the ethics of experimentation or intervention. Here the question was about the nature of scientific enquiry itself, and there was a wide gulf in quality of response, from those who did not understand the question at all to those with a sophisticated knowledge of how science proceeds by hypothesis, experiment, peer review and replication and extension of results. Many candidates did score one mark for realising that the information given shows that knowledge is tentative and subject to change, but few described sufficiently well the collaboration of different research groups around the world in re-testing or checking hypotheses or results. (See teaching tip.)

In **(ii)** many candidates saw that the similarity in the sequence of haemoglobin was related to the pandas' habitat, but some failed to describe this as an adaptation or to say that it could have arisen independently, by convergent evolution, in the two species. Good responses described the pandas' haemoglobin as having a higher oxygen affinity compared with sea level dwelling relations, but fewer mentioned that low oxygen partial pressure is the selection pressure acting on each of the panda species. An interesting misapprehension was shown by candidates who missed the point about the protein sequence of the haemoglobin being under consideration here, but instead talked about a short-term physiological adaptation to high altitude in terms of the animals making more red blood cells or haemoglobin. Candidates need to be encouraged to use all the information they have been given. Another subtle misunderstanding was the assumption that while being related via a common ancestor meant there was a genetic link between two species, an evolutionary adaptation to altitude through natural selection would not be 'genetic'. Candidates should know that successful adaptation to an environmental selection pressure involves change at the DNA level through mutation followed by selection.
Some responses focused on irrelevant features of albumen or cytochrome c.

(c) Candidates interpreted the flow diagram detailing how crystallin protein and DNA are sequenced. Steps 2 and 4 were mostly correctly identified as PCR and electrophoresis respectively. A smaller number of candidates recognised step 3 as genetic engineering, possibly because they believed the answer 'genetic engineering' to be too easy or not a 'technique'. Some had written the correct answer and then crossed it out and tried to write something more specific, such as heatshock or replica plating.

(d) There were many excellent responses to this question. Of concern, however, was the significant number of poorly worded answers which referred to triplets of bases forming or making amino acids, or amino acids consisting of three bases. Some candidates stated that 528 divided by 3 is 175, without checking and finding that this is not the case. Many candidates, however, correctly describe the triplet nature of the genetic code, stated that 525 base pairs were needed to code for 175 amino acids, and went on to say that the remaining 3 bases would be a stop codon. A misunderstanding that teachers need to look out for is the confusion in candidates' minds between the start codon, AUG, which codes for methionine, and the three stop codons which do not code for an amino acid at all.

(e) It was extremely rare to see another animal chosen other than the correct answer, the ox in part **(i)**.

In **(ii)**, most candidates knew that more than one triplet codon could code for the same amino acid. In many cases they also went on to link this to the idea that the nucleotides in DNA might change more than the amino acid sequence in a protein. A few references to silent mutations were seen along with commoner references to the code being degenerate, but candidates need to be taught that the word is degenerate (or redundant), not 'degenerative', and that it is the code itself that is degenerate, not the amino acids or the DNA as such.

Teaching Tip:
The central dogma of DNA → mRNA → protein sequence underpins all of modern Biology and nothing is more important for candidates to get a firm grasp of if they wish to make sense of much of the F215 content. The phrase 'genetic code' does not refer to a piece of DNA but to the system of correspondences between particular triplets of bases and the amino acids they code for. It would be better for candidates to learn that the code is universal than for them to bring up red herrings about this not being the case in all species, as the tiny minority of exceptions to the norm concern bacteria and yeast and were certainly not relevant to a question comparing red and giant pandas.

Students need to be made more aware of the roles of universities, hospitals and research institutes and should not just learn facts out of the context of 'how science works'. Magazines like Scientific American and New Scientist, or websites like www.sciencedaily.com, which reports on newly published research and identifies the researchers' professional institutions, can help.

General Teaching Tips:
With the additional answer lines at the back of the question paper booklet, candidates now rarely need to have extra paper provided. Candidates generally score more marks through writing less and thinking more.

Many candidates had a good knowledge but understanding was less good. Often mark-worthy terms and phrases were supplied but the understanding of what had been written was limited. One tip for encouraging thinking is to set candidates a question with a lengthy stem and stop them after a minute to caution that they should be highlighting words and gathering their thoughts at this point, not writing.

Candidates can peer mark each other's work on occasion, but also write down why they have not given a particular mark to help them understand the level of detail that needs to be included.

It was apparent on questions such as 5 (d) and 6 (a ii) that students are learning a lot from previous mark schemes, but they must read and interpret each new question carefully, as the emphasis or context will be different.

F216 Practical Skills in Biology 2

General Comments

The standard of work submitted for moderation this year has been very good. The great majority of centres will have found that their marking has been endorsed and that any differences have been listed in the moderator's report. Some remaining areas for concern are outlined below.

Administration

Sometimes, as an outcome of the moderation process, the rank order of candidates in the sample submitted could be changed. In this situation, the centre is sent an Invalid Order of Merit document, the purpose of which is to assist the centre in reviewing its marking process. Where the differences between the moderator's mark and the Centre's marks are such that they may adversely affect some candidates more than others, it is desirable that those candidates work is remarked by the Centre. This is an important procedure which is designed to benefit candidates by reducing or removing the impact of, for example, the misinterpretation of the mark scheme. Quite often the problem is caused by different standards being applied across groups of candidates, often by different teachers or between different tasks. Centres are advised to pay particular attention to these areas during internal moderation. It is appreciated if centres could review the work as promptly as possible upon receipt to prevent delays in the moderation process.

Whilst the majority of Centres collate their sample and secure scripts using a treasury tag, some Centres still send loose scripts or put scripts into plastic pockets. This delays moderation and can lead to lost scripts.

Marking guidance

It cannot be stressed enough that effective communication can either prevent or reduce the differences between the centre's marking and the moderator's assessment. Good quality annotation explaining the marker's decisions are a very important part of this process, particularly with the evaluative tasks where judgements are often more complex.

Candidates' skill in preparing graphs is very variable across the cohort and has been a source of concern in two main areas. Where an area of a graph occupied by the lines is less than 50%, centres should not give credit. No changes to the marks have been made in this regard this year. If the lines drawn occupy less than 50% of the paper (although the whole graph does cover more than 50%), is it still possible to reliably extract intermediate values? If not, please do not credit for the size component of the mark scheme. Secondly, the lines on a graph must be drawn through the plots; where the lines are too thick, then the tolerance of +/- one millimetre will be exceeded and so no mark should be credited for this.

Mandatory (underlined) words are kept to a minimum in the task mark schemes. However, the whole sense of a marking point must be represented in a candidate's response before a point may be credited. Alternative wording can sometimes be difficult to match exactly with the mark scheme and care should be taken before credit is given as a benefit of the doubt mark.

Centres are expected to make judgements about points made by candidates that are not listed in the mark scheme. In general, centres are advised to give a good deal of thought to marking points not provided on the mark scheme before crediting additional marks. The Centre must annotate the affected script explaining why such a decision has been taken.

Where candidates are asked to consider precautions they took whilst undertaking a task, they should not repeat information given in the procedure. Repetition of the method supplied was commonly seen this session.

Suspected malpractice

Where it is evident that additional coaching to the mark scheme has been provided by Centres, the scripts are referred to OCR for consideration as suspected malpractice.

Support from OCR

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. A free coursework consultancy service is also available (see FAQs for further guidance). Please allow up to five working days for a response.

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