

Biology

Advanced GCE A2 H421

Advanced Subsidiary GCE AS H021

Report on the Units

January 2010

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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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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

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Advanced Subsidiary GCE Biology (H021)

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Chief Examiner's report

This January marks the first occasion on which an A2 unit, F214, was offered. The examination of this A2 unit has highlighted the fact that, although many candidates were well prepared for the examination by covering the learning outcomes on the specification, it was not appreciated by some Centres that the style and emphasis of assessment had changed from that of the legacy specification. Section 4 of the new specification gives details of the Assessment Objectives and their weightings in the individual units. Separate details of How Science Works are also to be found in Appendix B of the specification. These aspects, along with the other sections of the specification, need to be considered in conjunction with the learning outcomes in order that candidates are able to gain the suitable experience to deal with the type of question papers that they will encounter.

The following might prove useful as a summary:

- Assessment Objective 1 (AO1) - knowledge and understanding (recall)
- Assessment Objective 2 (AO2) - application of knowledge and understanding (using knowledge from the specification and applying to familiar and unfamiliar contexts)
- Assessment Objective 3 (AO3) - how science works (related to practical techniques)
- Synoptic Assessment - all A2 units must assess synoptic links:
 - all A2 units can assess synoptic links to material in AS units;
 - Unit F215 can assess synoptic links to material in Unit F214;
 - Unit F216 can assess synoptic links to material in both F214 and F215.

The implications that the weightings and involvement of synoptic assessment will have on the nature of the individual theory papers in the specification are summarised in the table below:

unit	time allowed	mark total	AO1	AO2	AO3	synoptic	notes
F211 (AS)	1 hour	60	28 (46.67%)	28 (46.67%)	4 (6.67%)	-	<ul style="list-style-type: none"> • structured questions and extended writing
F212 (AS)	1 hour 45 minutes	100	42 (42.00%)	48 (48.00%)	10 (10.00%)	-	<ul style="list-style-type: none"> • more emphasis on extended writing
F214 (A2)	1 hour	60	20 (33.33%)	36 (60.00%)	4 (6.67%)	12 (20.00%)	<ul style="list-style-type: none"> • structured questions and extended writing • includes synoptic links to AS units • includes Stretch & Challenge
F215 (A2)	1 hour 45 minutes	100	36 (36.00%)	54 (54.00%)	10 (10.00%)	20 (20.00%)	<ul style="list-style-type: none"> • more emphasis on extended writing • includes synoptic links to AS units and F214 • includes Stretch & Challenge

In addition, each paper will try to address as many of the How Science Works statements (see Appendix B of the specification) as possible, over and above the AO3 mark weighting.

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When considering F211 and F212, it is clear that the emphasis and weighting of the two papers is different – F211 is a paper consisting mainly of shorter structured questions while F212 has a greater emphasis on extended writing, application of knowledge and practical techniques (in the legacy specification, the weighting had been 50 AO1:50 AO2). Questions in F212 can be expected to require some longer responses and contain more application of knowledge.

The A2 unit F214 is similar to F211 in that the paper is of the same duration, makes the same contribution to the A Level qualification and consists mainly of shorter structured questions. However, it differs from F211 in that there is a much lower ratio of recall to application and there is also the inclusion of synoptic references in F214 (the A2 core paper (2804) of the legacy specification had no synoptic marks). This means that, even though the paper might appear very similar to F211 at first glance, it will require different skills to complete it successfully. Progressing through the externally assessed units will put greater reliance on application of knowledge and will introduce synoptic links to other parts of the specification. The final theory unit, F215, only increases the proportion of AO1 slightly and the remainder of the marks deals with application and an increased proportion of marks relating to practical techniques.

Candidates can expect to encounter new and unfamiliar contexts in the assessment of AO2 skills. It should be stressed, however, that candidates are expected to use the knowledge that they have accumulated in the study of a unit in order to provide suitable suggestions or explanations including, where appropriate, synoptic material from other units. The inclusion of a particular scenario does not indicate that candidates are expected to have had prior knowledge of that specific context. Candidates are not expected to cover content that is beyond the specification either in breadth or level of detail. They should be prepared to use the question topic and information given in the question to act as triggers to access the relevant information for their response. Those candidates who have had experience of applying their knowledge, making links between material within units, and building on and linking to material in previous units will be better prepared to deal with the demands of these examination papers.

A2 papers contain some part-questions that include Stretch and Challenge marks. In summary,

Stretch and challenge is:

- demonstrating a deeper knowledge and understanding of the subject
- bringing together associated parts of the specification without prompting
- showing ability to think through the question and presenting a clear, logical development of ideas
- demonstrating understanding by applying biological knowledge to unfamiliar contexts

Stretch and challenge is not:

- prompted or identified within the question paper
- usually assessed as a whole question e.g. Q5.
- a need to cover material, off the specification
- a need to cover specification material in greater depth

Synoptic and Stretch and Challenge material will be assessed using a variety of question types and command words. Therefore, candidates should not assume that a particular command word is indicative of a Stretch and Challenge question, or use the command word to determine whether it would be appropriate to include synoptic material in their response. Questions that require candidates to make use of synoptic material have traditionally been challenging and, generally, only the most able or most experienced candidates perform well on these questions.

Understanding and Answering the Questions

All AS and A2 theory papers have two marks available for the Quality of Written Communication (QWC). Questions in which QWC is assessed are indicated with a pencil icon. The assessment

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of QWC does not automatically indicate that an essay-style response is required. This would definitely not be the case in the two shorter papers, F211 and F214, as there is a limit to the amount of extended writing that can be included. In these shorter papers, both marks are awarded for the appropriate use of correct scientific terms with correct spelling.

The QWC marks in the longer papers, F212 and F215, will have different criteria for awarding, depending on the nature of the question. The requirements for the QWC mark are clearly set out in the questions to which they apply. As with all questions, the amount of writing and detail required in the response is indicated by the command word, the available space to answer the question and the mark tariff.

Common features in the reports of all examination papers this session include:

- the limited way in which some candidates are able to respond to questions that require application of knowledge (AO2), especially when presented with an unfamiliar context. Teachers can assist their candidates by introducing topics in context and/or relating to different contexts rather than in isolation.
- evidence that some candidates do not read the question fully but focus on single words or short phrases resulting in responses that relate to a general area of the specification rather than to the question that is asked. Candidates need practice in identifying the requirements of questions. Giving candidates the opportunity to self-assess their performance in assignments or tests can really bring this home to them.
- candidate answers that are lacking in detail and not of the required AS or A2 standard.

INSET

OCR has a full programme of training events. Further details can be obtained from the OCR website <http://viewer.zmags.com/publication/0e50e32c#/0e50e32c/1>

F211 Cells, Exchange and Transport

General Comments

Examiners were pleased to see that candidates were able to perform well in almost all areas of the examination paper. There was no evidence that candidates had insufficient time to complete the paper. The majority of responses demonstrated that candidates had been well taught and showed a good level of knowledge. The application of that knowledge was not always achieved with the same degree of success and candidates must be given wider opportunities to learn how to apply their knowledge in unfamiliar situations. These questions testing AO2 are an integral part of any Biology examination paper at this level. One general point that should be made is that many candidates gave responses that were rather vague in places and perhaps more suited to GCSE level responses. A typical example was the response to question 5(b)(i) in which candidates were asked how hydrostatic pressure is created in the heart. Many candidates responded with 'contraction of the ventricles' while examiners were looking for the idea of the ventricle walls or muscles contracting. Responses at AS level need more specific detail to gain full credit. Candidates would also benefit from greater use of suitable technical terms rather than statements that are often vague and difficult to understand.

Comments on Individual Questions

Question 1

- (a) Nearly half the candidates achieved full marks in this section. Those that achieved just one mark often quoted the magnification of a light microscope at 400X which is probably the magnification of the microscopes they have been using at school.
- (b) Nearly a quarter of candidates had little idea about the meaning of 'resolution' despite this being a learning outcome in the specification. Of the remainder, the majority knew that resolution was the ability to see two objects as separate from each other but only a few candidates could extend this response to say that a good resolution allowed more detail to be seen.
- (c)(i) The vast majority of candidates were able to state that xylem transports water. Occasionally this response was spoilt by candidates suggesting that water was transported 'up and down' the plant or that sugars were also transported.
- (c)(ii) A third of candidates failed to score a mark in this section, with many suggesting that lignin supports the plant. Other candidates gained credit for suggesting that lignin waterproofed the xylem wall or supported the xylem wall preventing collapse due to the tension inside the xylem. Few candidates gained all three marks as many failed to appreciate that it is the wall that is waterproofed and supported.
- (c)(iii) Many candidates lost marks as they were insufficiently specific in their responses. Many knew that the pits allow water to move sideways but often stated that this allows water to move out of the xylem (tissue) rather than out of the xylem vessel. Many candidates also seemed to confuse the pits in the xylem vessel wall with pores in the sieve plates of phloem or, more commonly, with stomata in pits on the lower epidermis of a leaf.

Teaching Tip:

When teaching the use of microscopes, emphasise the difference in order of magnitudes that can be achieved by each type of microscope.

Candidates must be clear about the meanings of *adhesion*, *cohesion* and *tension*. Making models of xylem vessels using cardboard tube and pipe cleaners can help candidates fully appreciate the structure.

Question 2

- (a)(i) The majority of candidates were able to score two marks here and knew that a tissue is a group of cells performing a similar function. Few added that the cells were specialised in any way.
- (a)(ii) The majority of candidates could name a suitable epithelial tissue in the lungs. However, a good number seemed to believe that 'alveoli' was a type of tissue and others quoted 'bronchi' and had clearly misunderstood the meaning of the term 'tissue'.
- (b) Most candidates gained one mark as they knew that an organ was a collection or group of tissues. The question asked them to explain why the lungs can be considered to be an organ and it was hoped that candidates would do more than simply state a standard definition of an organ. Therefore candidates did not gain credit for stating that an organ performs a function. Examiners were looking for candidates to appreciate that the lungs perform the function of gaseous exchange – only the best candidates were able to gain the second mark here. It was noted that many less able candidates stated the function as 'breathing' or 'respiration' and it is essential that teachers make clear the difference between gaseous exchange and respiration.
- (c) The majority of candidates achieved at least two marks here and many candidates achieved full marks. A common error was to suggest that the centrioles moved the cilia.

Teaching Tip:

Consider the wording of the questions in some detail. In particular, compare (a)(i) with (b) to appreciate that (a)(i) refers to a general tissue while (b) refers to a specific organ and therefore requires a more specific response.

Question 3

- (a) This section was well answered and many candidates achieved full marks. The most common error was in the final space where candidates believed that protein molecules stabilise and keep the membrane fluid.
- (b) This part of the question was targeted at the higher levels of achievement and managed to discriminate well. There was a wide range of responses from the very brief and vague efforts of the less able candidates to the well-focused and detailed responses of the best candidates. Less able candidates tended to list the functions of glycoproteins with little additional detail. Examiners were looking for suitable detail in the descriptions and not simply a list of functions. The best responses were well organised and often presented as a series of bullet points stating a function followed by additional detail. Candidates clearly understood the role of glycoproteins as receptors in cell signalling and knew that glycoproteins were involved in transport across the membrane (but were often confused about their precise role in making the transport specific or acting as a trigger). Few

candidates clearly appreciated the role of glycoproteins as antigens in cell recognition or as binding sites to hold cells together.

Teaching tip:

When teaching topics such as components of cell membranes and their functions, instruct your students to construct a table with suitable column headings such as 'component', 'function' and 'description / further detail'.

Question 4

- (a) Many candidates realised that a ruler or scale was needed from which to make measurements or that a timer of some sort would also be needed. Less able candidates often suggested the need for a bubble or meniscus in the capillary tube – perhaps not observing that one was already shown.
- (b) The majority of candidates achieved two or three marks here, with most suggesting that the apparatus should be assembled underwater, checked for leaks or that the end of the stem should be cut at an angle.
- (c)(i) Almost all candidates proved able to calculate the simple mean. Those that failed to get the correct answer usually rounded the answer incorrectly or gave more than one decimal place.
- (c)(ii) Many candidates suggested that three readings were taken in order to calculate a mean and that this would make the results more accurate. This is not correct and is something that has been dealt with at length through the practical tasks. The reason for taking three readings is to make the results more reliable and to enable the student to recognise an anomalous reading. A good number of students gained one mark but only the best scored two.
- (c)(iii) A disappointingly high proportion of candidates suggested 'changing levels of light intensity', despite being told not to in the stem of the question. This was often tied into a response suggesting that the plant did all its transpiring in the morning and then had a rest in the afternoon! Many candidates were able to pick out changes in air movement or relative humidity as reasons why the transpiration rate may change but some failed to give a comparative statement e.g. air movement was lower. Unfortunately, many were confused and described lower levels of humidity causing the reduced transpiration. This is, perhaps, a result of learning what factors increase transpiration rate and not applying that knowledge to the given situation.
- (c)(iv) This part of the question was not well answered. Many candidates tried to evaluate the procedure giving responses such as 'the movement of the meniscus could not be measured accurately', or 'the shoot is not a whole plant with roots'. However, the better candidates were able to explain that the potometer actually measures uptake rather than loss and that water may be used in the plant in some way.

Teaching tips:

Teach topics such as transpiration in a practical way – use a simple potometer. Using a potometer is particularly tricky and they often do not work well. This provides an excellent opportunity to understand the potential difficulties and to understand how hard it is to eliminate all sources of error and limitations. When carrying out practical work such as this, students should be encouraged to discuss the possible causes of error and the limitations involved. They should also consider the meanings of the terms: accuracy, reliability and validity.

Question 5

This question proved to be the most challenging question on the paper. Parts **(a)(i)** and **(c)** allowed less able candidates to demonstrate their knowledge but parts **(b)(ii)** and **(iii)** highlighted the strongest candidates. It was, therefore, a good discriminator to pick out the higher ability candidates.

- (a)(i)** The majority of candidates were able to show they knew that the wall of a vein is thinner than the wall of an artery.
- (a)(ii)** Less able candidates did not seem to realise that they had just shown the examiner that a vein has thinner wall than an artery and repeated this difference. Others described the size of the lumen. However, most candidates were able to give one or two other ways in which the wall of an artery is different from that of a vein. Most commonly quoted responses were: 'more muscle', 'more collagen, and 'valves in veins'.
- (b)(i)** Many candidates simply stated that the 'ventricles contract' or 'the muscle contracts'. Examiners were looking for the more specific 'ventricle walls contract' or 'ventricle muscle contracts'.
- (b)(ii)** Few candidates appear to appreciate that as the aorta splits into a number of arteries, the total cross-sectional area of the vessels increases – this is why the pressure drops. Many candidates gave vague responses that simply restated the question: 'the pressure drops because it is further from the heart' or tried to explain why it had to drop: 'the capillaries have very thin walls and cannot withstand a high pressure'. Interestingly, few candidates referred to the ability of the artery walls to stretch despite having described the presence of more elastic tissue or folded endothelium in the section above. Of more concern was the large proportion of candidates who seemed to think that oxygen and other substances such as glucose leave the blood as it moves away from the heart (as opposed to at the capillaries) and that such loss would reduce the blood pressure.
- (b)(iii)** The formation of tissue fluid is not well understood by most candidates. Many confused the effect of hydrostatic pressure (pushing plasma out of the capillary) with the effect of osmosis (tending to move water back into the capillary). They also described what happens as the blood flows along the capillary rather than specifically what happens at point A. Candidates must be trained to read the question and limit their response to relevant material.
- (c)** Many candidates did well here and were able to identify X, Y and Z. Candidates could identify the substances by name or by chemical formulae. Candidates should be aware that if they give a chemical formula it must be correct – however, while names are not always spelt accurately, most phonetic spellings are accepted. Some candidates seemed to believe that haemoglobin is an enzyme.

Teaching tip:

When describing differences as in part **(a)(i)**, ensure that the candidates use comparative statements such as 'thicker', 'more' or 'less'. In general, it is important to be very specific and to use technical terms where suitable – in part **(b)(i)**, examiners expected to see 'ventricle walls contract' and did not accept terms such as 'pump', 'squeeze' or 'beat'.

Question 6

- (a)(i)** Generally, candidates did well with this section. This was pleasing to see after the poor efforts made at a similar question last year. There was much less confusion over the roles of the diaphragm and intercostal muscles and Centres have obviously made good use of the examiners reports to pick out areas of the specification that need more thorough teaching. However, spelling is still an issue and many otherwise good responses failed to achieve the mark for spelling and use of technical terms. Less able candidates described the action of the spirometer rather than describing the mechanism of inspiration – they should read the question.
- (a)(ii)** Most candidates understood that as the subject inhaled, the lid of the air chamber would go down.
- (a)(iii)** Most candidates could name a suitable chemical to absorb carbon dioxide – soda lime being the most commonly quoted. A good number of candidates incorrectly suggested 'calcium carbonate' or 'limestone'.
- (b)** Many candidates realised that without a nose clip, the subject could breathe in or out through their nose and that would affect the readings taken. However, the majority of candidates referred to this as causing the readings to be inaccurate or false. In fact, this does not affect the accuracy of the readings which is a factor associated with the spirometer scale. In this case, the readings would be invalid.
- (c)** Most candidates gained one or two marks here. The most commonly awarded marking point was the mark for ensuring the apparatus was working correctly. Candidates also mentioned the health of the subject and the need to have a sufficient air or oxygen in the spirometer.

F212 Molecules, Biodiversity, Food and Health

General Comments

It was pleasing to see that there was only a relatively small number of questions in which there was no attempt at a response by candidates. This suggests that it was possible for most candidates to comfortably complete the paper in the time allowed.

In the report on the June 2009 paper, it was noted that many candidates lost marks through a lack of understanding of question rubric, specifically the difference between the command words 'describe' and 'explain'. There was some indication of fewer candidates making this mistake in the current session but many still find the distinction a difficult one. *Describe* answers often take the form 'A happens, then B happens'; *explain* answers generally contain the word 'because'.

Many candidates found it difficult to complete responses within the number of answer lines given for each section. Teachers are reminded that, while every effort is made to award candidates marks for creditworthy material, responses written in unexpected places may be missed. Many candidates wasted a lot of space by 'setting the scene' before beginning the answer to the question. If candidates need to write more, additional sheets may be used (or the additional answer lines at the back of the examination paper).

While it was often clear that some less able candidates knew the material, they failed to go into sufficient detail to gain many marks. Many candidates, who wrote long enough answers, lost marks by using colloquial, rather than scientific language or by using imprecise terminology. Candidates are being assessed at AS level in a scientific subject and the correct scientific terms are expected.

Ecology questions often results in vague answers and Q7 was no exception in this paper. Most of the *How Science Works* part of the specification was tested in Q7, but it seems apparent that candidates were not thoroughly prepared for questions about tables or graphs.

Question 1

This was generally well answered and was likely to boost candidates' confidence at the start of the paper.

- (a) The vast majority of candidates gained 3 marks in - a few put calcium or sodium instead of iron.
 - (b) Few candidates achieved 2 marks in as they failed to read the question - some omitted to square the height and some answered to 2 decimal places.
 - (c)(i) A surprisingly large minority of candidates read the category as 'acceptable', a few tried to hedge their bets by writing 'acceptable/overweight' and gained no credit.
 - (c)(ii) Most candidates were able to discuss the idea that BMI does not take into account the different proportions and densities of fat, muscle or bone. Pregnancy, gender and closeness to the borderline were also regularly cited.
- Q1(d)** This question was generally well done, although a small number of candidates think that the 'C' in CHD stands for 'chronic'. A few failed to score both marks by putting a CHD-related statement on both lines.

Question 2

- (a) It was pleasing to see a significant proportion of candidates gain all three marks in this question. The vast majority of candidates knew the bond in question was a hydrogen bond, although 'covalent' was a regular incorrect label. Most candidates drew a bond between one O and one H, although some drew a solid line, which did not gain credit. Some candidates failed to include the 'delta' symbol or failed to show charges on all the atoms they had drawn and some candidates showed more than one bond either between the same O and H, between one O and two Hs or at two different places between the same two molecules.
- (b) Many candidates found this question to be a challenging question. Many repeated the information in the stem of the questions such that it formed a large part of their answer. Not only did this not gain credit but it also wasted time and space. Many lost sight of the question, forgetting to relate the properties of water to living organisms. Rarely did candidates refer to the molecular configuration of water as ice forms. The idea of the ice layer acting as insulation so water below doesn't freeze was often stated but rarely was this sufficiently explained as a means of survival. Many candidates merely stated "so animals can survive" without elaborating on how, e.g. ability to swim. Few candidates appreciated the polar nature of ions and therefore their attraction to water allowing them to dissolve, even though the charge was shown on the nitrate ion in the question stem. The question was in the context of ponds as a stable environment for aquatic organisms; therefore the many candidates who described either the importance of ion solubility in terms of transport of ions within the body, or the benefits to animals living on the surface of water or ice gained no credit. Few candidates accurately stated the use of such ions in the organisms. Many gave very weak statements about needing 'nitrates for growth/photosynthesis'. With regard to temperature stability, a significant number referred incorrectly to latent heat capacity and only a few appreciated the high energy required to break hydrogen bonds. Similarly, many candidates expected the water temperature to remain perfectly constant rather than showing some degree of variation (albeit small). Some appreciated the importance of temperature stability in metabolic and enzyme activity, often referring to the denaturing of enzymes with significant rises in temperature. Some candidates delighted in writing about protection from air-borne predators, and a few stated that if ice was not less dense then animals would be struck/squashed by falling ice!
- (c) This question was generally well answered, despite regular poor spelling of 'hydrophilic' with a double 'l'.

Question 3

This question cost candidates marks for lack of specificity. It also posed problems in terms of which part of the question was being answered. Many candidates wrote scientifically valid sentences about enzymes and inhibition, but in the wrong section of the question. It seemed as if candidates had identified that the question was about enzyme inhibition and wanted to tell the examiners what they knew about the subject, rather than attempting to answer the specific parts of the question.

- (a)(i) This question was generally answered correctly.
- (a)(ii) A large number of candidates missed the point of the question, which was about the fact that sulfonamide's similar shape allows it to act as a competitive inhibitor. Many wrote very good descriptions of how a competitive inhibitor works but gained no credit, other than a mark for saying that it fits into the active site.

- (b)** In both parts of this question, it was clear that, while the majority of candidates understood how enzymes and inhibitors worked, few were able to express themselves precisely or unambiguously enough to gain all the marks. Many in part (i) gave a general statement about enzyme action and did not refer to what processes would increase at a higher substrate concentration. More commonly, marks were lost for failing to refer to the active site, candidates simply stating 'enzyme'. Many seemed to have a grasp of the idea that high substrate concentration can overcome competitive inhibition but some were unable to express it clearly enough to get the mark.
- (c)** Very few candidates gained full marks. Surprisingly few referred to genes or alleles being passed down generations. Some misinterpreted the question and discussed how a mutation would work in terms of modified enzymes rather than how the mutation would lead to the spread of resistant bacteria. A few less able candidates wrote about how 'immunity' in the bacteria would be passed on, even referring to B-lymphocytes and antibodies!
- (d)(i)** Most candidates gained a mark in this question but a few suggested there were no bacteria there, without explanation. Some candidates had clearly never seen a multidisc and described a lack of agar. A few resorted somewhat unnecessarily to dramatic language and claimed that the bacteria had been 'taken care of'.
- (d)(ii)** The majority of candidates obtained a mark for this question.
- (d)(iii)** It was not uncommon for candidates to achieve 1 or 2 marks in this question, usually for pointing out that the method was quick or cheap or both. Some suggested that the use of the correct antibiotic first time could prevent antibiotic resistance. Other marks were rare. Many candidates wrote about the ability of the test to select the most suitable antibiotic but, since that was in the stem of the question, did not gain any credit.
- (e)** Most candidates did well but some failed to mention the natural environment and instead discussed the development of drug resistance. A few seemed to think that all of the potential antibiotics had already been discovered.

Question 4

This question was reasonably well answered with the exception of Q4**(c)(i)**.

- (a)(i)** This question was answered well by most candidates. The majority of candidates identified the components correctly, with the occasional one failing to identify the R group.
- (a)(ii)** On the whole, this question was well done. Even the lower ability candidates got the condensation reaction, only a few missed the peptide bond and gave a wrong bond type. Some candidates lost a mark for referring to a dipeptide bond rather than a peptide bond. Confusion arose in the minds of a small number of candidates when they were describing the reaction between the amine group and the carboxyl group - a number thought that the double bond on the carboxyl group would break and the resultant bond would join the two amino acids through an oxygen atom - reminiscent of a glycosidic link. Most correctly made the bond linking between the carboxyl group and the amine group, but many lost the mark by referring only to the acid group, rather than to the carboxylic acid group. While it was possible to gain credit from diagrams, in order to describe a process it was difficult to convey enough detail from a single diagram to gain full marks. Only a small minority of candidates mentioned that the peptide bond is a covalent bond.

- (b)** This question was a good discriminator between less able and more able candidates. While most of the candidates knew the bond types, many failed to explain them adequately. The less able candidates wrote vaguely about shape and bonding, some resorted to secondary structure and others wrote a list of the different types of bonds that they could remember. Only the best candidates were able to describe in detail the reasons behind the bonding that forms between the R groups. Very few mentioned that the ionic bonds were between oppositely charged R groups, and only a few qualified the hydrophobic and hydrophilic interactions in relation to the position of these R groups on the protein molecule.
- (c)(i)** This question was very badly answered, even by the more able candidates. Most of the time candidates failed to compare equivalent items in the same row, for example, comparing a glucose unit with polypeptides, and branched chains with helices. It was clear that the majority of candidates are just not able to compare two structures with any modicum of success. Centres should be reminded that such questions are usually marked by the line, not by the box and are based on direct comparisons. A significant number could not distinguish between structure and function and gave differences that were not structural. A surprising number did not recognise collagen as a protein and glycogen as a carbohydrate and therefore a number of marks were unavailable to them. Many confused collagen with cellulose, with, again, a surprising number thinking collagen was made of glucose. For example, many people wrote alpha glucose for glycogen and beta glucose for collagen. For the benefit of teachers, it is worth noting that a correct and incorrect statement within the same box means no credit is given for the correct response.
- (c)(ii)** In contrast to Q4(c)(i), this question was generally well answered, even by the less able candidates. Many recognised 'strength' as an important feature and 'insoluble' popped up occasionally. A significant number of candidates knew that collagen was flexible but many also thought it was elastic.

Question 5

- 5(a)(i)** The majority of candidates seemed to imply that an individual could have more than one risk factor, but many found it difficult to express this clearly and unambiguously, resorting to vague statements like 'some risk factors overlap'.
- (a)(ii)** This question was generally well answered although some candidates lost marks for lack of precision, e.g. failing to state that the fat in the diet should be saturated or that alcohol intake should be to excess. Teaching needs to emphasise formation of LDL's in the body as many candidates seem to think they are ingested.
- (a)(iii)** The table in this question was completed well by candidates who scored badly on other sections of the paper. Few gained all four marks, the most common incorrect response being that nicotine damages the lining of arteries.
- (b)** This question was generally poorly answered, with very few candidates appreciating the role of the damaged endothelium in the formation of an atheroma. Similarly, many failed to identify accurately where the fatty substances are deposited – by stating 'in the artery' or 'on the artery walls'. A significant number described in detail the formation of blood clots without reference to the question (i.e. the role of LDL's).
- (c)** Many candidates understood the principle behind this question and were able to gain 2 out of the 4 available marks. Some were let down by a lack of precise terminology, not referring to the lumen. Most candidates got the idea that more blood would be able to

flow but did not go on to complete the story and explain how this would reduce symptoms by allowing cardiac muscle to perform aerobic respiration. Few candidates referred to the benefits of increased carbon dioxide removal.

Question 6

This was fairly straightforward recall question which provided those candidates who had learnt their work an opportunity to display their knowledge and comprehension.

- (a)(i)** Many scored maximum marks on this question. A few candidates confused nucleotide with the whole DNA molecule. Others were imprecise about the nature of the sugar or lost marks by using unacceptable spellings such as dioxyribose or thymine. Some also seemed to think that all four bases are found in a single nucleotide.
- (a)(ii)** This was very well done with many candidates giving three differences. Many gave good comparative statements here – unlike the responses to Q4**(c)(i)**.
- (b)** It was clear from this question that candidates had clearly learnt DNA replication and most scored well in this section. Many candidates showed an ability to organise their work in a coherent way and gave a well structured account of the key events in sequence. There was evidence that they had gone beyond the basic requirements and had good knowledge of the details of the process and the range of enzymes involved. To gain the QWC mark, the candidates needed to give a clear idea of the stages right up to the reforming of the hydrogen bonds and the sugar-phosphate backbone and these last points were sometimes missed. Less able responses started off with the unzipping idea but then veered off into protein synthesis with descriptions of transcription and translation at ribosomes. More than a few seemed to think that the mRNA went out of the nucleus and then returned to join on to the unzipped strands, thus giving two new DNA molecules. There were a few who described mitosis.
- (c)(i)** This question was surprisingly poorly answered. The idea that genes code for polypeptides or proteins is a fundamental concept that many will have covered at GCSE. There were many vague responses in terms of a phenotypic characteristic such as blue eyes; equally many candidates seemed to think a gene was connected with making DNA, others stated that it coded for a single amino acid.
- (c)(ii)** It was rare to see both marks achieved in Q6**(c)(ii)** and many candidates failed to score. For some, this was due to the relatively poor understanding shown in the previous question. Some candidates had the right general idea but were too vague in their answers with responses such as ‘different product’ being common. The links from nucleotide sequence to amino acid sequence to tertiary structure to specific function did not seem to be embedded in candidates’ minds.

Question 7

Although many candidates scored marks in the easier ecology parts of this question, they did not perform well on the more challenging parts of the question either due to lack of precision in language or a poor understanding of the *How Science Works* part of the specification.

- (a) The vast majority of candidates were able to define *habitat* and say enough to gain one of the two marks available for *biodiversity*. However, answers often lacked the precision of language to access the 2nd mark.
- (b) Most candidates found it difficult to gain full marks in this question. It was common to gain a mark pointing out that lack of randomness in the method was a problem. However, the rest of the answer was often a differently worded re-statement of this point, e.g. 'it is not random, the technique is biased'. The most common 2nd mark was for a comment on the effect of lack of randomness on the results. A small number of candidates observed that the technique would create an over-estimate of biodiversity or may miss certain species. Many candidates think that 'bias' is an adjective.
- (c)(i) This question was poorly answered with few candidates identifying what was wrong with the table. Some of those who correctly suggested that units should go in the table heading omitted to say they should be removed from the body of the table. A significant number failed to give an answer.
- (c)(ii) The vast majority of candidates who attempted Q7 this question gained all three marks but a significant number, failed to draw anything, presumably because they didn't notice the question.
- (c)(iii) Although many candidates gained at least one and often two marks on this question, their descriptions of change over a distance were very weak. Many seemed to have great difficulty in expressing the fact that percentage cover, or even the amount of, bracken increased with increasing distance from the bottom of the slope and some seemed to lack an understanding of the word 'distribution', using it to mean 'abundance'. Some used 'distribution' unqualified (not even referring to bracken, but simply that the distribution was best at the top of the slope).
- (d)(i) This responses observed in this question suggested that many candidates had a very hazy concept of the Simpson Biodiversity Index, some of them thinking that area or percentage cover came into it. Most marks were lost because of failure of candidates to express themselves precisely enough to state that you needed both the total number of species and the total number of individuals in each species. This latter concept seemed to prove almost impossible to put into words!
- (d)(ii) Very few candidates understood the potential consequences for a habitat with very low biodiversity, many defined low biodiversity or simply stated that the biodiversity would be low.

F214 Communication, Homeostasis and Energy

General Comments

This is the first time that this unit has been assessed and it has a different format and assessment objective proportions when compared with the AS units of this new specification and the core A2 unit of the legacy specification. The most obvious difference is that this paper has 60 marks; but there is also a greater emphasis on application of knowledge (AO2) and how science works (AO3) than previously. Candidates are expected to apply their knowledge to unfamiliar situations and will encounter specific questions addressing How Science Works. Candidates are expected to use the knowledge and skill that they have developed during the course in answering those questions. This means that, inevitably, there will be a smaller proportion of straightforward recall questions.

Teaching Tip:

A good way to prepare candidates is to teach as many topics as possible in context. It is useful to introduce a topic in a particular context and to then reference as many contexts or case studies as possible that would apply to that material. Candidates will then be more comfortable with encountering unfamiliar material and would be accustomed to looking at such information and identifying the knowledge that they need to deal with it.

Some very good scripts were seen, indicating that those candidates were coping well with the slightly different emphasis in the method of assessment. However, some candidates experienced difficulty in answering specific and detailed questions about certain areas of the specification. An apparent lack of care in reading the question led to misinterpretation, resulting in some candidates relating correct facts but not relevant to the question that had been asked. This was particularly evident in Q5**(b)**. The facts supplied often showed good understanding of the subject area but did not address the question that had been set.

Teaching Tip

Encourage candidates to go into the examination with a pencil or highlighter. It is useful to highlight **a few** key words in the question so that the focus of the question can be identified. It is also useful to indicate the command word in this way.

Comments on Individual Questions

Question 1

- (a) This question discriminated quite well, with candidates having to apply their knowledge in order to complete the comparisons. Some candidates experienced problems with expressing the differences and similarity clearly.
- (b) Candidates needed to read the question carefully in order to answer the question often referring to only one way in which the equation was an over-simplification. When a question specifies 'one', then examiners are instructed to mark the first answer only.
- (c) Responses to **(i)** and **(ii)** were generally good. Most candidates were familiar with the causes of Type 1 diabetes and could also describe three factors that contribute towards

the development of Type 2 diabetes. Few candidates confused the two types. Some imprecise factors, such as 'bad diet', were stated in **(ii)**.

Question 2

- (a)(i)** This question was well known and few candidates gave the incorrect answer. The greatest number of errors occurred in **(i)**, with significant numbers of candidates incorrectly suggesting the mitochondrion as the site of glycolysis. Most candidates were able to identify at least two of the compounds correctly in **(iii)**.
- (b)** Answers to this question varied in quality. Some excellent answers were seen, easily supplying all the essential information in a clear and concise manner. Weaker responses supplied vague or incorrect details. Common errors were to state that pyruvate was dehydrogenated or oxidised or decarboxylated to form lactate. The description of the role of reduced NAD was frequently confused. Some candidates had either not read the question carefully enough or had limited biochemical understanding, as they made vague statements or described ethanol fermentation. Some answers went beyond the scope of the question and went on to discuss the way in which lactate is dealt with once a supply of oxygen becomes available.
- (c)** This question was intended to be testing for the candidates and proved to be so. Candidates were expected to use information from various areas of the specification, possibly from this unit or from AS units, to suggest reasons for the seal being able to remain underwater for such a long time. Candidates were not expected to be familiar with this example, as the question was testing application of their existing knowledge, making use of material from different areas of the specification and thus contributing to Stretch and Challenge. A wide range of possible answers was accepted but should have been of a higher standard than 'large lungs', which is essentially of GCSE standard. A significant number commented on the use of lipid as a respiratory substrate – these candidates failed to recognise that a lack of oxygen was the problem.

Question 3

- (a)** This question was intended to be a relatively straightforward beginning to the question. While candidates obviously knew quite a lot of information about the myelin sheath, it was disappointing that a significant proportion did not relate their answers to the question that had been asked and instead digressed to answer in terms of function rather than structure.
- (b)(i)** Most candidates made a good attempt in this question, with many being awarded full marks. Most candidates were able to quote suitable figures, with correct units, comparing the speed of conduction of myelinated with unmyelinated neurones. Some candidates did not recognise the trend and, instead, tried to describe and explain a higher speed for unmyelinated. Few candidates stated that a much higher axon diameter in an unmyelinated neurone was required in order to attain the same speed of conduction as a myelinated neurone.
- (b)(ii)** Some responses to this part question were poorly expressed with statements such as 'axon diameter increases the speed of conduction' without specifying an increase in axon diameter. The figures to be quoted in support in this part of the question should have compared 'like' with 'like' i.e. two myelinated neurones with different axon diameter or two unmyelinated neurones with different axon diameter. Examiners were looking for correct units given for each figure quoted and a significant proportion did not state the units. The question had asked candidates to use only the information in the table but many were unable to resist the urge to explain why the speed of conduction had increased or decreased.

- (c) The responses to this question indicated a degree of insight but they were often vaguely expressed. Weaker responses provided general information rather than linking their knowledge to the particular questions. This was illustrated, for example, by references to 'enzymes are denatured' with no indication to the specific enzymes involved or their location. Consequently, very clear and specific responses were required in order to be certain that candidates were aware of the significance of the increase in temperature and its consequence in this particular context.
- (d) This question was answered well by the majority of candidates. The sequence of events was well known and understood. Some references, such as the release of the neurotransmitter into the synaptic cleft, were imprecisely or incorrectly expressed and the calcium ions were regularly incorrectly referred to as 'calcium', 'Ca' or 'Ca⁺'.

Question 4

- (a)(i) This question was well understood and answered correctly by a high proportion of candidates.
- (a)(ii) The calculation in this question was answered with varying success. The calculation was not intrinsically difficult and simply required the volume of fluid passing into the renal tubule (125) divided by the volume of plasma (700) expressed as a percentage, as indicated by the information stated in the question. Candidates used various combinations of the figures in various ways to try and perform the calculation. Even though they had been asked to give the answer to one decimal place, many candidates who had performed the calculation correctly gave the answer to two decimal places.

Teaching Tip:

As candidates will be expected to perform calculations of various types, they should be given as much experience as possible in calculations involving percentages, magnification and manipulation of formulae (in line with the mathematical requirements of the specification) in addition to specific mathematical requirements as detailed in the learning outcomes.

- (b)(i) The synoptic element to the question meant that this question proved challenging for many candidates.
- (b)(ii) This question should have been easier as it was more of a recall question. Given the context, candidates were expected to realise that the structures indicated were microvilli and not cilia. A significant proportion of candidates were determined that podocytes should be the answer to either (i) or (ii).
- (b)(iii) This was the second question in which the quality of written communication was assessed. The question was narrowly concentrated on the processes taking place in the proximal convoluted tubule and detailed explanation was required that referred to the specific changes that took place in this section of the tubule. A common error was to state that protein was reabsorbed from the tubule, despite the fact that the information in the table showed that none had passed from the plasma into the glomerular filtrate. The mechanism of reabsorption using co-transporter proteins was understood. Few candidates linked the increase in concentration of ions and the various nitrogenous waste compounds to the removal of water from the tubule by osmosis. It was rare to award full marks for this question.

- (b)** This question covered new learning outcomes of the specification and as such it was introduced with a flow chart and diagram.
- (b)(i)** In **(b)(i)**, candidates were expected to appreciate that blood would be returned to a vein while some flexibility was applied to answers to vessel **L** as various sources differ in this information.
- (b)(ii)** While candidates appreciated in **(ii)**, that the anticoagulant would prevent the blood from clotting, they rarely mentioned that if the blood was to clot then it could cause problems in the blood flow through the machine.
- (b)(iii)** Responses to **(iii)** were frequently poorly expressed, with candidates failing to make it clear whether the explanation given was referring to the situation in the presence or absence of anticoagulant. A phrase such as 'to prevent' or 'to make sure that' would have clarified the explanations.
Many responses to **(ii)** and **(iii)** included references to cleaning the blood or to antibiotics, both of which were inappropriate.
- (b)(iv)** Most candidates appreciated in **(iv)**, that movement across an artificial membrane would be by diffusion, although a significant proportion suggested methods that could only apply to a plasma membrane or suggested osmosis (which had been discounted by the phrasing of the question).
- (b)(v)** Answers to this question frequently mentioned a countercurrent or countercurrent multiplier, often with reference to the loop of Henlé. As the question had asked for a reason, this was insufficient and required further information relating to maintaining a diffusion gradient or similar.

Question 5

- (a)(i)** The vast majority of candidates correctly indicated that the tube serves as a control. Phrases such as 'control variable' were not credited. Some candidates explained the purpose of the black paper covering the tube rather than the covered tube itself.
- (a)(ii)** Responses to **(ii)** were varied. Possible explanations are that the part question related to AO3 practical techniques and that both the precaution and reason were required in order to be awarded the mark. Candidates were expected to explain why the precautions were necessary (e.g. 'to make sure that the light intensity remained the same') but many either failed to state the precaution needed or gave a vague explanation that didn't really convey the principle. It was not sufficient to state, for example, that 'light intensity affects the rate of photosynthesis'.
- (a)(iii)** Answers to **(iii)** rarely specified chlorophyll a, most answers simply stating chlorophyll.
- (a)(iv)** Some good answers were seen to **(iv)** but a significant proportion of candidates incorrectly stated that chlorophyll absorbed green wavelengths of light better than other wavelengths.
- (b)** This question was intended to be challenging and proved to be so. The question context was specifically related to maximising production and so specific ways in which the various factors could be optimised were expected. It was not enough to say, for example, that temperature had to be controlled. Very specific explanations were required. Many answers were general in nature or little better than GCSE standard.

Grade Thresholds

Advanced GCE (Biology) (H021 H421)
January 2010 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
F211	Raw	60	40	35	31	27	23	0
	UMS	90	72	63	54	45	26	0
F212	Raw	100	69	62	56	50	44	0
	UMS	150	120	105	90	75	60	0
F214	Raw	60	40	36	32	28	25	0
	UMS	90	72	63	54	45	36	0

Specification Aggregation Results

Overall threshold marks in UMS (i.e. after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
H021	300	240	210	180	150	120	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
H021	8.8	28.6	54.1	78.4	95.1	100.0	1505

1505 candidates aggregated this series

For a description of how UMS marks are calculated see:

<http://www.ocr.org.uk/learners/ums/index.html>

Statistics are correct at the time of publication.

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

OCR Customer Contact Centre

(General Qualifications)

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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Telephone: 01223 552552
Facsimile: 01223 552553

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