OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced GCE **A2 H421**

Advanced Subsidiary GCE **AS H021**

Report on the Units

January 2009

H021/H421/MS/R/09J

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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 syllabus 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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REPORTS ON UNITS

Chief examiner's report

The main difference between this specification and the previous one is the incorporation of *'How Science Works'* into the specification and therefore into the question papers. This has meant that the principles of '*How Science Works'*, although present informally in previous specifications, are far more overt. The statements of *'How Science Works'* are outlined in Appendix B of the specification and are given below. These statements should be taken into consideration when covering the Learning Outcomes and when preparing candidates for the examinations. Candidates can expect to find questions in an examination that reference these statements, as each question paper aims to address as many of the statements as possible. Candidates should expect an increase in context-based material, as well as the social, ethical and moral aspects of biology in the F211 question paper.

'How Science Works' statements and where they were addressed in F211:

1. *Use theories, models and ideas to develop and modify scientific explanations*
was addressed in Q6(d);

2. *Use knowledge and understanding to pose scientific questions, define scientific problems and present scientific arguments and scientific ideas*
was addressed in Q2(b);

3. *Use appropriate methodology, including ICT, to answer scientific questions and solve scientific problems*
was addressed in Q1(a)(iii);

4. *Communicate information and ideas in appropriate ways using appropriate terminology*
was addressed in Q5(b)(ii);

5. *Obtaining, analysing and evaluation data:*
- ***a.*** *carry out experimental and investigative activities, including appropriate risk management, in a range of contexts;*
- ***b.*** *analyse and interpret data to provide evidence, recognising correlations and causal relationships;*
- ***c.*** *evaluate methodology, evidence and data, and resolve conflicting evidence*

b and ***c*** were addressed in Q6(b);

6. *Applications, implications and ethical considerations:*
- ***a.*** *consider applications and implications of science and appreciate their associated benefits and risks;*
- ***b.*** *consider ethical issues in the treatment of humans, other organisms and the environment*

a was addressed in Q3(c);

7. *Scientific knowledge in its social context:*
- ***a.*** *appreciate the tentative nature of scientific knowledge;*
- ***b.*** *appreciate the role of the scientific community in validating new knowledge and ensuring integrity;*
- ***c.*** *appreciate the ways in which society uses science to inform decision-making*

c was addressed in Q3(c).

Appendix D in the specification outlines the Mathematical Requirements for the course. In addition to any specific mathematical processes or applications stated in the Learning Outcomes, candidates may be asked to apply these mathematical requirements to data or principles and should be prepared to do so. The greater experience that candidates have of

manipulation of data and calculations in the context of various learning outcomes, the better prepared they will be.

A key feature of these papers will be that candidates will be asked to deal with unfamiliar material in unfamiliar contexts, based on an understanding of the specification. This might include suggesting explanations for qualitative observations or patterns of data which may not, at first sight, appear to be related to a Learning Outcome but will use the knowledge and skill that have been acquired in the study of the specification. It is sometimes difficult for candidates to recognise the areas of the specification upon which they should draw when answering these questions and so, once again, candidates would benefit from as much experience as possible in dealing with material in this way.

One important way in which candidates can optimise performance in the examination is that of tailoring the response to the particular question. In particular, there is a tendency for candidates to launch into lengthy accounts that are disproportionate to the space available for the answer, the mark allocation and the scope of the question. Such responses only serve to waste the candidate's time and effort, when a much more succinct response would just as easily access the available marks. Candidates should be encouraged to look critically at the phrasing of the question, the space available and the mark allocation. The answer should get to the point as soon as possible. When setting a paper, every effort is made to allow the space of a suitable number of lines to answer a particular question and it is anticipated that most candidates will find the space sufficient for the answer. If a response continues elsewhere, either further down the page or on a separate sheet, it is important that this is indicated somewhere in the space allocated for that particular response. This will reduce the chance of potentially correct information being missed by the examiner.

F211 Cells, Exchange and Transport

This is the first examination of the new Biology specification. There has been much debate about whether candidates should enter in January of the first year of a two-year course and some centres took the decision not to enter their candidates so early. Despite this, we had a very a strong entry and examiners were pleased to see a good proportion of the candidates achieving very high scores.

In general, candidates were very well prepared and Centres have obviously studied the new specification carefully. All areas tested were attempted by the majority of candidates and there was no evidence that candidates, generally, ran short of time. The examination has discriminated well achieving a wide spread of marks from the 25 500 candidates entered.

A general point that should be noted for candidates who write long answers is that they should be encouraged to use the space provided for their responses. If they need extra space, they should use an extra sheet rather than filling space around the edge of the page. Also, these candidates should be encouraged to indicate that their response continues elsewhere – perhaps by writing an asterisk or similar.

Question 1

In question 1 (a)(i), candidates were asked to identify cell organelles from a diagram. Most candidates scored at least two marks and many achieved all four. The most common errors were to name structure **B** (the nuclear envelope) as rough endoplasmic reticulum and structure **D** (the nucleolus) as the nucleus. Poor spelling was an issue with some candidates but this did not usually mean that credit was lost. "endoplastic…" was not uncommon, and "endoplastic rectum" provided some light relief!

It was rare for candidates to achieve two marks in question 1 (a)(ii). The most common response was to refer to the mitochondria being cut at different angles or being viewed from different angles. The idea of **E** being at a younger stage of development was also suggested regularly, however, some candidates did not effectively compare **E** and **C**, merely suggesting that **E** was young, leaving the examiner to decide whether the statement went far enough. Only a few candidates suggested that the difference could be an artefact or could be caused by the preparation of the sample. A few candidates demonstrated poor understanding of what goes on in mitochondria by suggesting that all the ATP had been "released from E" or that one mitochondrion was much more active then the other.

Calculating sizes and magnifications has always been a problem for candidates under examination conditions. The correct response to part (iii) (3.75) was seen regularly amongst a wide variety of other speculative responses. It was very rare to see suitable clear working although a good many candidates did attempt to make use of the IMA triangle. It was clear that many candidates did not make use of a calculator and centres are reminded that candidates should be told to bring a calculator into the examination. Answers ranged from measurements less than the size of an atom to those greater than an elephant. It is important, in questions such as this, that candidates think about their answers and decide whether they are reasonable.

In part (b), there were a lot of very good responses which gained full credit. However, it was clear that many candidates did not read the question carefully and started their answer in the nucleus with DNA and transcription. The question asked for an outline of the events following production of the protein – so the response should really start with proteins leaving the ribosomes. Candidates should remember that secretion from the cell involves passing through the 'cell surface membrane' or 'plasma membrane' rather than just 'cell membrane'.

Question 2
Responses to part (a) were usually correct, although a number of candidates reversed the two animal cells.

Part (b) was also well answered by many candidates and examiners are pleased to see that teaching and understanding of this part of the specification has improved. It was notable that more candidates are being taught to use the terms 'more negative' and 'less negative' when referring to water potentials. Examiners were pleased to see few candidates referring to 'water concentrations'. However, there was still some confusion as evidenced by this response: 'by osmosis the water potential in the plant cell has moved down a water potential gradient causing the cell to become turgid, causing the cell to undergo plasmolysis and become haemolysed '. Simply throwing terms at an answer like this is not likely to achieve many marks.

In part (c), examiners were hoping that candidates would relate the mechanism of transport to the size of the molecule or substance being transported. The best candidates did this very well and described diffusion of small non-polar substances, use of carrier proteins and endocytosis for large substances and channel proteins for polar substances. However, many candidates were unable to see the link between size of particles and mechanism. The weakest candidates wrote very little and some simply listed all the mechanisms of transport for each substance. Credit was also given for appropriate use of 'active transport' and 'facilitated diffusion'; however, it was notable that many candidates seem to believe that facilitated diffusion requires ATP.

Question 3
Most candidates could define 'stem cell' in (a)(i), most commonly describing it as an undifferentiated cell that had the ability to differentiate or specialise, although some candidates only got half way to this definition. References to the capacity of stem cells to divide or undergo mitosis were not very common. Weak candidates gave incredibly vague responses such as 'a cell that has no job to do but can do one later'.

Part (a)(ii) was not as well answered. It was evident that some candidates confused the term 'stem cell', with a plant's stem, often suggesting "stem" or "xylem" or "phloem". These responses often conflicted with the definition the candidate had given in part (i). Examiners were willing to accept 'meristem' or 'cambium'. Examiners were also prepared to allow 'plants do not have stem cells' as this statement does appear in some text books – however, this was not seen in any scripts.

In part (b), those candidates who did not attempt to add detail to their responses were more likely to get all three marks. For example, "repair" and 'growth' were acceptable responses, however, some candidates attempted to provide more detail by stating 'repair of cells' or 'growth of cells' – neither of these are achieved by mitosis. Asexual reproduction was also commonly suggested.
In part (c)(i), some candidates simply repeated the stem of the question: 'umbilical cord stem cells are more effective' – this was not sufficient to gain a mark. Candidates were expected to state that umbilical cord stem cells provided a greater probability of remaining leukaemia free for five years. This was stated in a variety of ways and examiners were pleased to see that most candidates were using the figures to back up their answers.

Many candidates achieved one mark in part (c)(ii) by referring to the idea that umbilical cord stem cells are easier to harvest or obtain than bone marrow stem cells. However, this was often repeated in a different way as their second suggestion. Many candidates suggested that umbilical cord stem cells would be younger or that umbilical cords are thrown away. This sort of suggestion failed to gain credit if candidates did not clearly allude to any advantages of using umbilical cord stem cells.

Question 4

Part (a) was well answered by some candidates, however, a surprisingly high proportion failed to use the term 'surface area to volume ratio' despite the instruction in the stem of the question. Many candidates referred to a large organism having a large SA/Vol ratio or needing a large SA/Vol ratio. A significant number of candidates described what a specialised surface could achieve without explaining why this was needed; i.e. they explained how a gaseous exchange surface provides a large surface area but failed to identify that larger organisms have a small SA/Vol ratio. Candidates frequently referred to diffusion not happening in large organisms, rather than it taking too long or the distance being too great.

In part (b), examiners were looking for explanations rather than descriptions. Many candidates had clearly learned how the various components of the breathing system are adapted for gaseous exchange, but were unable to write down clear and concise explanations. There were many weak and unfocussed responses, only the best candidates achieved full marks. Many weaker responses included the idea of diffusion being 'easier' or 'quicker', without any attempt to explain why. Few candidates clearly understood the role of the capillaries in supplying plenty of carbon dioxide and removing the oxygen from the lung surface in order to maintain a high diffusion gradient. Also, many candidates described the diaphragm and intercostal muscles as protecting the lungs rather than enabling ventilation. Better candidates did refer to maintenance of diffusion gradients and scored well.

There was considerable confusion regarding the roles of the two types of muscle in part (c). Although good candidates had a clear understanding, weaker ones often referred to the "diaphragm making the intercostal muscles rise", to 'muscles detracting' or 'muscles pushing'. Amongst the very weakest there was also much confusion regarding the simple physics involved e.g. pressures rising as volumes increased and even vacuums being produced. Centres are advised that candidates do not find this topic easy and it is an area where more detailed teaching may be needed.

In part (d), an erratum notice was sent to all Centres as there was an error in the printing of the examination paper. The unit on the horizontal axis of the graph was incorrect. However, Centres should understand that this misprint had no direct effect upon the questions or the potential responses given. Therefore it should not have affected the performance of any candidates. In part (d)(i), many candidates placed their **X** at the peaks or troughs of the waves showing a lack of logical thought – they should have realised that during inhalation the trace must be moving up or down, rather than being stationary at the peak or trough. Poor mathematical or graph reading skills let down some candidates in part (ii), as the calculations showed they had taken the wrong values from the graph or could not subtract 0.55 from 3.55. Some candidates failed to include the unit.

Teaching tip:
Use a spirometer in teaching – ensure that students have seen one in operation and understand that the lid moves up and down. The lid moves up when the subject breathes out and down when the subject breathes in. This is an excellent place to bring a little ICT into Biology teaching as it is straightforward to attach a spirometer to a data logger – then it is easy for the subject to keep a print out of their own breathing movements which they can annotate.

Question 5

In part (a), most candidates knew what was meant by a single circulatory system but sometimes failed to describe this clearly. Many descriptions fell short of what was required. Weaker candidates simply stated 'blood passes through the heart once' which suggested ideas about the circulation that predated Harvey's demonstrations of circulation. Others stated that 'blood passes once through the heart on each cycle' which left the examiners wondering if the candidate was referring to a circuit of the body or to the cardiac cycle. Some candidates failed to read the question and went on to describe a double circulatory system rather than a closed

circulatory system. Those who had read the question accurately described a closed system as one in which the blood remains in vessels.

Poor spelling was again evident in part (b)(i). Good candidates knew the correct responses but weaker candidates came up with a wide range of answers that demonstrated a poor understanding of heart structure and coordination.

Most candidates were able to give a good account in part (b)(ii) and demonstrated a good understanding of how the action of the heart is coordinated. Some candidates misunderstood the focus of the question and gave rambling descriptions of the circulation of blood through the heart.

Teaching Tip.
Test the spelling of technical terms. Many candidates seem to have trouble with spelling e.g. 'sinoarterial node', which suggests a node between the sinus and the artery, which is inaccurate. In a question where credit is given for use of terms encourage students to use the full terms and not abbreviations.

Question 6
In general, drawings in part (a) were inaccurate. Candidates need to be taught to make more detailed observations of tissue plans and to record these accurately in diagrams. Many candidates knew that the phloem occurs in discreet patches near the centre of the root – however, the majority of drawings exceeded the generous tolerance on the width of the phloem. Many candidates drew in both xylem and phloem and some failed to label either.

In part (b), most candidates achieved at least one mark. "E" was the most common incorrect answer, with only around a third of candidates scoring both marks.

In part (c), the terms 'source' and 'sink' were not well known by many candidates. Those who had some idea of the meaning of these terms often referred to 'substances' or 'materials', rather than specifically to sucrose or assimilates. Some candidates referred to the 'sink' as simply 'where these substances are needed' rather than providing detail.

Most candidates achieved a mark in part (d) for the idea that the assimilates collect above the cut. However, few candidates were able to offer any detail that would gain them a second mark. A very few referred to the decrease in water potential or increased cell division.

Teaching tip:
Use slides and microscopes to view a range of plant and animal tissues. If microscopes are not available then use websites to access photographs of tissues – the Science Photo Library has a wide range, as do other sites. Get the students to draw what they see accurately – tissue plans as viewed at low power and cell detail as viewed at high power. Mark work for accuracy of detail, proportions, relative sizes etc.

Grade Thresholds

Advanced Subsidiary GCE Biology H021 H421
January 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
F211	Raw	60	46	41	36	31	26	0
	UMS	90	72	63	54	45	36	0

Specification Aggregation Results

The first AS aggregation for this specification will be in June 2009.

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums_results.html

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