



General Certificate of Education (A-level)
June 2011

Biology

BIOL2

(Specification 2410)

Unit 2: The Variety of Living Organisms

Report on the Examination

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General Comments

This unit test produced a relatively good spread of marks and there was no general misinterpretation of questions. A number of the longer questions proved to be very effective discriminators and often gave better candidates the opportunity to show their understanding of a topic. Overall, questions involving straightforward recall were well answered. As on previous papers, questions involving the interpretation of data presented graphically or in tables caused problems for many of the weaker candidates. These candidates often failed to gain credit because of the use of imprecise or inappropriate scientific terminology. However, there were also some very impressive responses with candidates expressing their ideas clearly and logically and demonstrating excellent analytical skills. These candidates often displayed an excellent understanding of the unit content covered on the examination paper.

Question 1

- (a) The vast majority of candidates obtained both marks, usually by naming the cell wall and chloroplast as structures that are present in plant cells but not in animal cells. Very few candidates scored zero.
- (b) Most candidates gained one mark for stating that starch is insoluble. However, less than half the candidates were then able to suggest an advantage of this in terms of osmosis or water potential. A common error was to suggest that starch would not move into or out of the cell by osmosis.
- (c) Most candidates scored two on this question and over a third of candidates gained all three marks. Generally there was a clear understanding of the roles of the chloroplast and eyespot. A smaller percentage of candidates was able to explain the role of the flagellum. A significant number incorrectly involved the starch store in their answer.

Question 2

- (a) Over seventy percent of candidates were able to explain what is meant by genetic diversity. Weaker candidates confused genetic diversity with species diversity. A significant number referred to fewer alleles rather than fewer different alleles.
- (b) Very few candidates did not refer to the environment as the other type of factor causing variation in a species.
- (c) Very few candidates scored zero and fifty percent gained both marks in this question. Most candidates realised that genetic diversity would be reduced and many could explain this in terms of a genetic bottleneck or reduction in the variety of alleles in the population.

Question 3

- (a)(i) Almost ninety percent of candidates were able to determine the maximum number of amino acids which could be coded for by the sequence of DNA bases provided.
- (a)(ii) There was almost an equal split here between candidates who correctly referred to introns or stop/start codons and those candidates who incorrectly provided an explanation in terms of the code being degenerate.
- (b) This question proved to be a very effective discriminator. Most candidates gained at least one mark, often by mentioning a change in the sequence of amino acids. However, a significant number of candidates incorrectly referred to 'different amino acids being formed'. Many candidates gained a second mark for explaining that the tertiary structure would be altered. Better candidates gained maximum marks either

by linking this to changes in hydrogen/ionic/disulfide bonds. Candidates were not penalised for references to 'active sites' even though the question did not indicate that the protein was an enzyme.

- (c) Rather surprisingly, only half of the candidates gained marks on this question. Those that did gain credit usually obtained both marks by realising that it was important to match the number of complementary base sequences between strand **A** and strand **B**.

Question 4

- (a)(i) It was clearly evident that the vast majority of candidates had a good understanding of what happens in metaphase with two thirds of candidates gaining both marks and only ten percent scoring zero. Most candidates gained credit for mentioning chromosomes moving to the equator of the cell. A number of candidates, however, referred to homologous chromosomes aligning in pairs and described metaphase I of meiosis.
- (a)(ii) Almost seventy five percent of candidates gained two marks often by stating that 'chromatids move to opposite poles'. Again, approximately ten percent of candidates scored zero.
- (b)(i) Although most candidates appreciated that the cells lining the human intestine needed to be replaced only half of the candidates conveyed the idea that this occurs quickly. A significant number of candidates simply stated that the cells needed to be repaired.
- (b)(ii) Almost half the candidates gained both marks for 774 minutes or 12 hours 54 minutes. A small number of candidates provided an incorrect answer but correctly indicated three cell cycles for one mark. Many of the remaining candidates used four cell cycles to obtain an incorrect answer of 1032 minutes.
- (c) There were some excellent detailed answers to this question which gained both marks. These were, however, in the minority. Most candidates gained at least one mark usually for stating that DNA replication would be inhibited. Generally, there was considerable confusion over the role of DNA polymerase, with many candidates believing it to be involved in breaking hydrogen bonds or in complementary base pairing.

Question 5

- (a) This was a straightforward question with over ninety percent of candidates gaining both marks and very few scoring zero.
- (b) A third of the candidates gained this mark for clearly indicating that measuring water loss in milligrams would improve precision or accuracy. Incorrect responses often mentioned reliability, anomalous results, or calculating a mean.
- (c) Some answers were limited to descriptions of the graph and scored zero, or referred in general terms to transpiration for one mark. Candidates scoring three marks often provided a clear, detailed explanation of the results including reference to changing water potential gradients and the opening and closing of stomata. A significant number of candidates also realised that water was not replaced in the leaves as they were detached.
- (d) Most candidates gained one mark for indicating that there would be less transpiration or evaporation. Far fewer candidates, however, suggested that the grease had

covered the stomata or had increased the diffusion pathway. Many candidates failed to get this mark as they simply stated that the grease provided a waterproof layer.

Question 6

- (a) Most candidates obtained at least one mark for stating that the haemoglobin of a lugworm has a higher affinity for oxygen than has human haemoglobin. It was pleasing to note that compared with previous years many candidates referred to low partial pressure of oxygen rather than low oxygen concentration. This enabled them to access the second mark.
- (b) There were some very impressive responses to this part of the question with almost a third of candidates obtaining maximum marks. Candidates obtaining a single mark often did so by referring to the role of the lymphatic system in returning tissue fluid to the circulatory system. A significant number of candidates wasted time by explaining the formation of tissue fluid at the arteriole end of the capillary. There was some confusion by weaker candidates about the effect of protein on the water potential inside blood capillaries. Many candidates did refer to osmosis but not always in the correct context.

Question 7

- (a) Most candidates obtained at least one mark for indicating that the calls made by cranes are species specific. Many candidates, however, then proceeded to discuss courtship or simply to state that biologists could compare the calls. Relatively few candidates suggested that the greater the similarity in calls, the closer the relationship between different species is likely to be.
- (b)(i) Almost eighty percent of candidates obtained both marks. They identified *G. americana* and *G. monachus* as being the most closely related because the percentage of DNA hybridisation between these species was highest. A significant minority of candidates suggested that *G. rubicanda* and *G. americana* are most closely related because these species having the highest intraspecific percentage DNA hybridisation.
- (b)(ii) Most candidates obtained one mark by linking the requirement of a higher temperature with a higher percentage of DNA hybridisation. Approximately fifty percent of candidates obtained a second mark for a correct reference to hydrogen bonds. A common error by weaker candidates was to refer to hydrogen bonds between amino acids.
- (c) Very few candidates obtained both marks and over fifty percent scored zero. Answers were often expressed poorly with many candidates interchanging the terms amino acids and DNA bases. The omission of the word 'sequence' often prevented candidates gaining credit. A small number of candidates approached this question via immunological comparisons. These candidates often obtained a single mark for suggesting that 'more precipitate' would be formed in closely related species.

Question 8

- (a) This proved to be a very effective discriminator with almost equal numbers of candidates scoring two, one or zero marks. A significant number of candidates referred to 'more food' rather than a greater variety of foods. Vague terms such as 'more shelter' were not accepted as an alternative to more habitats.
- (b) Very few candidates obtained both marks in this question. However, almost half the candidates gained one mark for indicating that the index of diversity measures the number of species and the number of individuals. Better candidates used this

information to explain that an index of diversity would be more useful where some species were only present in low or high numbers.

- (c)(i) This proved a very demanding question with two thirds of candidates scoring zero. Despite the cue that 'these eggs are small' relatively few candidates correctly linked this to a large surface area to volume ratio. Only a small percentage of these candidates then referred to diffusion. It was very disappointing to see responses describing pesticides moving by osmosis.
- (c)(ii) The majority of candidates appreciated that evaporation of water would increase the concentration of the pesticide.

Question 9

- (a) This was well answered with almost eighty percent of candidates obtaining both marks for explaining that EPO would increase the number of red blood cells and consequently the concentration of haemoglobin. Less than five percent of candidates scored zero.
- (b) Most candidates gained at least one mark by stating that the control group would be treated in exactly the same way as the experimental group apart from being given EPO. Approximately a third of candidates gained the second mark by indicating that the control group would be injected only with salt solution. Many candidates simply referred to a placebo without mentioning the salt solution.
- (c) This proved quite challenging with over forty percent of candidates scoring zero. Many of these candidates limited their response to the idea that the investigators would be able to see if EPO was effective. The idea of allowing a 'comparison' was the most common marking point awarded. Relatively few candidates considered the different masses of the volunteers or the different weeks of treatment.
- (d) Over half the candidates failed to gain any marks on this question because they limited their answers to descriptions of the data in the table. Better candidates realised that the information provided would enable the investigators to determine the most effective dose and length of treatment.
- (e) This question was well answered with over seventy five percent of candidates gaining three or more of the four marks available. Candidates realised that EPO would increase the amount of oxygen being transported to the respiring tissues because of an increase in the number of red blood cells. This was often linked to an increase in the energy released. Better candidates had often gained maximum marks before mentioning that this energy would be available for muscle contraction or that anaerobic respiration could be delayed.
- (f) This question proved more demanding than expected. Most candidates did gain at least one of the two marks available but a significant number of responses lacked detail. These answers often suggested testing one or two athletes or one athlete and a non-athlete. The most common scoring marking points related to random sampling, determining a mean value and testing a large sample of individuals. It was pleasing to see some high quality answers which included the use of standard deviation when establishing the normal concentration of EPO.
- (g) Most candidates failed to gain this mark as they simply referred to 'more blood' being present. Better candidates often suggested that an increase in blood pressure would be due to an increase in the volume of the blood or 'thicker' or 'denser' blood.

Question 10

- (a)(i) This caused little difficulty for most candidates with the vast majority gaining at least one mark for suggesting that *C. difficile* is resistant to antibiotics. Although many candidates realised that the other bacterial species would be killed, they failed to gain a second mark by not stating that there would be an increase in the number of *C. difficile*.
- (a)(ii) Most candidates gained this mark by suggesting that the immune system would be less effective. There were several answers linked to older people taking lots of antibiotics. These responses were not credited.
- (b) Although the majority of candidates obtained at least one of the two marks available, there was still some confusion, particularly with weaker candidates, about the precise role of methicillin. Most candidates realised it was a competitive inhibitor but a significant number referred to it possessing an active site. Approximately forty percent of candidates provided a clear accurate explanation of competitive inhibition by methicillin.
- (c)(i) The majority of candidates had little difficulty explaining that some of these patients were already ill and this illness could be the cause of death.
- (c)(ii) The vast majority of candidates gained this mark by describing the increase in the number of deaths up to 2006 followed by a decrease.
- (c)(iii) Less than a third of candidates could correctly calculate the percentage increase in the number of deaths caused by MRSA in Wales from 1996 to 2006. A small percentage of candidates obtained a single mark for reading figures from the graph but almost sixty percent scored zero.
- (d) This question proved an excellent discriminator. The majority of candidates obtained at least two marks for referring to vertical and horizontal gene transmission, although a small number of candidates confused the two terms. Many also mentioned an antibiotic resistant gene but it was not uncommon to see this mark negated because of the term resistance being linked to immunity. Horizontal gene transmission was generally well described with a good proportion of candidates including the terms plasmid and conjugation in their descriptions. Better candidates often stated that horizontal transmission can occur between different species. Vertical transmission was generally well understood but weaker candidates often referred to mitosis and there were some references to antibodies rather than antibiotics. There were also some excellent answers to this question which covered every mark point, including the increase in frequency of the resistant allele in future bacterial generations.

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