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Biology BIOL2

(Specification 2410)

Unit 2: The Variety of Living Organisms

Report on the Examination

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General Comments

Many of the candidates who entered were clearly retaking the Unit. Those who had prepared themselves fully showed a maturity of approach when it came to demonstrating the skills of analysis and application. They were also generally able to support this with a sound knowledge of the factual content of the specification.

The work of more modest candidates reflected a number of common failings. Among these candidates, knowledge was patchy and often recalled at the expense of genuine understanding. Not infrequently, technical terms were confused and used entirely out of context. Thus, in **Question 4**, the terms, gamete, chromosome and zygote appeared freely interchangeable; the concepts of species diversity and genetic diversity were confused in **Question 5** and the word species was used in a wide variety of inaccurate and inappropriate contexts. These candidates also appeared to have relied on rote learning of earlier mark schemes and, where they were asked to apply their knowledge to material presented in a novel context, it was not uncommon to read of inappropriate examples that had appeared in earlier questions, or to see answers that were much too general in their approach.

It is increasingly common to see answers written as bullet points. While the examiners are fully prepared to award credit for answers written in this way, less able candidates frequently offer too little information within any given bullet point to meet the requirements of the mark scheme.

Centres should encourage candidates to take into account the number of marks allocated to each question and write relevant answers of an appropriate length. Routinely extending answers to extra pages is unnecessary and can result in candidates falling short of time later in the unit test.

Question 1

(a) Although this question produced an even spread of marks across the entire ability range, the overall marks were disappointing for a question largely targeted at Grade E candidates. Many appeared uncertain as to the distribution of starch and glycogen, the identity of deoxyribose as a carbohydrate or of DNA helicase as an enzyme.

(b) Most candidates were able to gain some credit for recognising that condensation involved the elimination of a molecule of water, although there were some who apparently failed to appreciate that water molecules contained two hydrogen atoms and an oxygen atom, or that condensation involved linking the molecules shown. The better candidates selected the appropriate atoms and gained both of the available marks.

(c) In part (i), candidates were usually able to make an appropriate reference to the role of hydrogen bonds in strengthening either cellulose or the cell wall. Many, however, were uncertain as to the location of these bonds and produced answers referring to linking the β-glucose residues. Part (ii) was usually well answered and most candidates were able to discuss the compact shape of starch molecules. There were, however, some answers incorrectly based on the idea of a large surface area to volume ratio.

Question 2

(a) Although there were various interpretations of the diagram, most candidates correctly indicated the presence of more than one polypeptide chain.

(b) In part (i), many candidates correctly identified the number of amino acids coded by this piece of DNA as 141. Incorrect responses were usually centred on multiplying the number of bases either by two or by three. In part (ii), the single mark that was most frequently awarded was for a reference to introns. Many candidates, however, interpreted the question as asking about the nature of the genetic code. There were many responses centred on there being "more than one code for an amino acid".

(c) Despite the mark allocation shown for this question, there were some very extensive answers involving the DNA base sequence and protein structure. Many of these accounts also reflected much confusion between the terms base and amino acid. There were occasional unfortunate references to the environment causing the difference in haemoglobin structure.

(d) Better candidates were able to identify the principle involved here and suggested an explanation based on the ability of haemoglobin to load more oxygen at lower partial pressures. Where these candidates used the information from the graph and wrote of the partial pressure of oxygen and the percentage saturation of haemoglobin, they were usually able to gain full credit. There was, however, much imprecise wording and accounts were often marred by such phrases as there was "less air in mountains" and "the llama carries more oxygen". Less able candidates frequently twist the wording of questions round. This question, for example, was occasionally answered as requiring an explanation of the adaptations of horses to living at low altitudes. Such an interpretation failed to gain credit.

Question 3

(a) The majority of candidates gained full credit here, although it was not uncommon, to see references to genera and species. In spite of the example given some candidates suggested other organisms that might be considered as insects or attempted to identify the taxa concerned.

(b) Candidates who explained a phylogenetic relationship in terms of evolution gained credit for part (i). The answers to part (b) (ii) suggested that many candidates were able to interpret the diagram successfully.

(c) Much misunderstanding was in evidence in the answers to part (i). Only the better candidates appeared to understand the underlying principle. Using the same gene from each of the three species would mean that there would be a similarity between the base sequences which would allow the formation of hydrogen bonds. Most candidates appeared of the opinion that bases sequences would be identical. Part (ii) was answered rather better.

Question 4

(a) Most candidates correctly identified the number of chromosomes in a male gamete in part (i) and appreciated in part (ii) that a chromosome number of 33 could not lead to viable gametes. Not all were certain as to the reason for this, however. One frequent misconception was that it is not possible to have a gamete with an odd number of chromosomes. Weaker candidates often attempted to explain why the gametes that would be produced were unable to form a zygote. Their answers were often further marred by poor use of technical language. There was much confusion between the terms chromosome, gamete and zygote.

(b) There were some excellent answers to both parts of this question. Both parts again required candidates to use the data in the table and it was clear that some failed to

take sufficient care with this. The breaking strength of the leaf, for example, was not uncommonly expressed as the strength of the plant or even the breaking strength of the banana fruit. Candidates should be advised to use the wording provided in table headings and graph labels wherever possible.

(c) It was clear that some candidate's knowledge of cell division failed to extend to the use of such terms as mitosis and meiosis. The quality of many answers was also influenced by poor understanding of technical terms. Thus different varieties of bananas were not infrequently referred to as species and genetic diversity was equated with species diversity. Consequently what should have been a simple answer linking mitosis to genetically identical offspring not often involved irrelevant accounts of competition and speciation.

Question 5

(a) Those candidates who could explain with sufficient clarity that it was necessary to determine the number of each species present were able to gain credit. A surprising number of candidates knew that an equation was involved and could quote it with some degree of accuracy. Many revealed, however, little knowledge of what the various terms represented.

(b) Part (a) should have indicated to candidates that the thrust of this question was species diversity. Unfortunately the term diversity triggered many candidates to respond in terms of selection, genetic bottlenecks or the founder effect. The approach to this question was further influenced by a poor understanding of the concept of a species with many candidates apparently of the impression that all insects are members of the same species. Better candidates however approached the question in an appropriate way, and although they did not always appear to appreciate that clearing forest and planting crops would lower the plant diversity and hence the variety of available food, they were able to make worthwhile comments.

(c) In part (i), many candidates showed an unfamiliarity with the idea that joining points on a graph with straight lines indicated uncertainty over the reliability of intermediate points. Answers to part (ii) were rather better with most candidates clearly understanding the nature of controls even if they enjoyed less success in explaining why a control would be necessary in the investigation described.

(d) The best candidates understood the requirements of a question requiring evaluation and were able to link the changes in breeding birds shown on the graph with species diversity. They also indicated that the data referred to total number of birds and not diversity and point out the shortcomings at arriving at conclusions based on limited data. Those who did not gain significant credit, not infrequently failed to read the axes with sufficient care or did not appreciate why the points had been joined with straight lines. *Evaluate* was occasionally regarded as having the same meaning as *Explain*. Explanations gained little if any credit.

Question 6

(a) The knowledge required to answer this question was familiar to most although there was occasional confusion between horizontal and vertical transmission.

(b) Better candidates accessed the full mark range and there were some excellent logical accounts based on the information provided. Less able candidates were generally able to recognise that they were expected to draw on their knowledge of enzymes. They experienced considerable difficulties, however, in identifying the enzyme and its substrate in the context of this question. Thus the enzyme was often

incorrectly given as the penicillin molecule or equated with the gene encoding it. The substrate on the other hand was identified as either an antigen or an antibody or, more commonly, as a bacterium. Elsewhere, there were a number of answers which offered convincing detail of enzyme action but were totally unrelated to the situation presented in the question.

(c) Although part (i) revealed a general understanding that the addition of antibiotics would result in fewer cows becoming ill, candidates did not always link this to bacterial infection or could indicate with sufficient clarity how famers would benefit financially. In part (ii), the concept of selection proved to be very poorly understood by all but the best candidates. Where the concept was invoked, there was a widespread failure to appreciate that, in the context of this question, selection referred to antibiotic resistance in bacteria, not in cattle. Other candidates resorted to ethical considerations, many of which implied a total lack of consideration of animal welfare by farmers.

Question 7

(a) Candidates who answered this question well followed the instructions and referred either to interphase in part (i) or to telophase or cytokinesis in part (ii). A significant number of others confined themselves to general descriptions, often related to the concentration of DNA rather than to the number of cells as required.

(b) In order to gain full credit here, candidates were simply required to recognise that the curves repeated themselves at 3 hourly intervals and to explain how they arrived at their answer. It was not uncommon to see a reasonable explanation but this was all too often incorrectly related to a 4 hour cycle. Some candidates had annotated the graph on the opposite page. This practice should be discouraged as such answers may not be picked up.

Question 8

(a) Many candidates appeared to understand the principles that were being tested in the two parts of this question but explanations often fell short of the required standard. In part (i) a reference was required to the dispersal of water vapour and the consequences of this on the diffusion or water potential gradient. Many less able candidates offered explanations in terms of moving air forcing water out of the leaf or involving water moving out of the leaf by osmosis. Those who appreciated, in part (ii), that an increase in temperature increased kinetic energy usually progressed to refer to an increase in the rate of movement of water molecules. Others, perhaps inevitably, attempted to link temperature with enzyme activity

(b) Most candidates followed the instruction in part (i) and described the relationship with sufficient precision to gain the mark. They were also able to link movement through the xylem to increased light intensity and stomatal opening with some success. However, by far the most popular response to part (ii) was to suggest that there would be an increase in the rate of photosynthesis and therefore more water would be needed by the plant. The terms cohesion and tension were frequently used in such a way as to suggest little real understanding. It was not uncommon to read about water molecules being pulled through the xylem because “they stick to each other by cohesion-tension”. The idea conveyed in part (iii) appeared to be unfamiliar to all but the best candidates. The structure of the question should have lead candidates to realise that it was testing the same basic principle. The question was worded in such a way as to encourage candidates to explain the lower diameter at 12.00. Many opted however to explain the converse of this and based their answers on suggestions involving storage of water in the xylem.

(c) Responses to this question were very disappointing as evidenced by the large number of candidates who were unable to gain credit. Many answers were very general and did little more than suggest, often at great length, that "strong" walls meant that blood vessels did not burst under pressure. Such answers often established this point for arteries, then repeated it for arterioles. Only the very best candidates appeared aware of the presence of muscle and elastic tissue within the walls and could describe the roles of these particular tissues. There was also much emphasis on valves. They were correctly described as not being present in arteries and arterioles but then discussed in terms of what they would have done if they had been present. Those candidates who referred to the endothelium were generally able to point out its functions in reducing friction. There were others, however, who considered the lumen to be a fundamental component of the wall.

Question 9

(a) Although a considerable number of candidates gained credit for their answers to this part of the question, others offered inappropriate suggestions. Many of these were yet again centred on the converse and attempted to explain why they did not measure the minimum diameter.

(b) There was evidence from the answers to part (i) that many candidates still fail to absorb material presented in the stem of a question or look critically at data in tables and graphs. Thus, although most appreciated that shrimps that lived in caves had smaller eyes and longer antennae than those that lived in the open, they were unable to point out either that the antennae were responsible for detecting touch or that these data only referred to shrimps. More limited candidates often suggested that shrimps either had eyes or sense organs. Those candidates who avoided explaining standard deviation in terms of range, generally gained at least one mark for part (ii). Better candidates were also aware that overlap in the values of standard deviation was important in indicating whether differences were attributable to chance or were significant.

(c) In part (i), most candidates made an appropriate qualitative statement about the body lengths of the shrimps concerned but few supported this with data from the graph. Some appeared distracted by antennal length and failed to identify the thrust of the question. Part (ii) was generally well answered.

(d) Most candidates appeared to have understood the information in the graph but could not always explain this with sufficient clarity to gain credit. Thus, although an answer relating to cave shrimps and ocean shrimps (interpreted as shrimps living in <u>open</u> streams) could be awarded credit, one that merely referred to shrimps in streams could not. There were also many sweeping statements such as that "the percentage of shrimps was higher in the open for all alleles". This was clearly not correct. More credit might have been awarded had candidates based their wording more carefully on that supplied in the column headings in the table.

(e) One of the key phrases in this question was "Use your knowledge of the founder effect". This should have indicated that candidates were required to apply this concept to the example provided in the question. A significant number failed to do this and opted instead to discuss the difference in percentages in terms of either natural selection or genetic bottlenecks. Such approaches rarely gained credit. Others offered extremely general explanations that made no reference either to shrimps or to allele L. These accounts often incorporated volcanic eruptions and hunting to extinction. Answers were further marred by imprecise language with the term "species" used in a variety of ways that had an adverse effect on the sense of

the argument presented. Some candidates again turned the question round and attempted unsuccessfully to use their knowledge of the founder effect to explain the percentage of shrimps with the allele L in the open.

(f) Candidates who answered this question successfully either suggested breeding cave shrimps with those living in the open to see if fertile offspring were produced, or looking at whether courtship behaviour led to successful mating. Although both of these approaches were acceptable, those based on DNA hybridisation and protein analysis were not. Those candidates who chose to discuss crossing shrimps often suggested procedures that would not have guaranteed the relevant parentage. Attempts were made to add detail and there were some valid comments about repeats and carrying out reciprocal crosses. However, there was much discussion about the ethics of experimental work and the perceived cruelty of such experiments that could not be given credit.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results statistics page of the AQA Website.