Version 1.0: 0709

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Biology 1411

BIOL2 The Variety of Living Organisms

Report on the Examination

2009 examination - June series

Further copies of this Report are available to download from the AQA Website: www.aqa.org.uk

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334). Registered address: AQA, Devas Street, Manchester M15 6EX
Dr Michael Cresswell Director General.

General Comments

With a very large entry, it was not surprising that scripts reflected the complete ability range. There were candidates whose knowledge was very limited but there were also many who revealed an understanding and mastery of skills fully in keeping with the grade descriptions in the AS specification. It is very encouraging to be able to report that many of the topics that were new to the specification were clearly understood, although over-teaching in some areas led to confusion rather than clarification. The responses made to Question 9 reflected a genuine understanding of the principles associated with *How Science Works* and it was obvious that many centres had embraced this aspect of the new specification, devising successful strategies for its delivery.

The best candidates showed a comprehensive mastery of all assessment objectives. They revealed not only knowledge underpinned with sound understanding, but the ability to apply this successfully to material presented in a novel way. The work of more modest candidates reflected a number of common failings. Among these candidates, knowledge had obviously been gained at the expense of understanding. Not infrequently, technical terms appeared entirely out of context: elastic tissue in the lumen of veins contracting to force blood through the vessel; oxygen absorbed down a water potential gradient by osmosis; and bacterial chromosomes crossing over and dividing by mitosis. Although these candidates were often able to comment meaningfully over points concerned with *How Science Works*, they enjoyed less success when it came to describing and interpreting data. As with the legacy specifications, this remains a weakness.

Question 1

(a) Most candidates revealed a sound understanding of the direction of blood flow through the vessels shown in the diagram. Such errors that arose usually concerned the hepatic circulation.

(b) As was expected of a question targeted at grade E candidates, there were many correct answers to this part. There was, however, a failure to appreciate that blood always flows from a higher to a lower pressure and this led to a number of incorrect responses to part (b) (ii).

(c) In the many cases where vessels **C** and **E** were correctly identified as an artery and a vein, candidates were usually able to complete the table with two appropriate differences. There were, however, references to the vein having no muscular or elastic layer. Examiners expressed concern over the inability of some to complete the table unambiguously.

(d) Many candidates failed to address the question. Instead of explaining how the muscle in the wall of the blood vessel reduced blood flow, they offered general answers covering both vasoconstriction and vasodilation. The term ‘smooth muscle’ also appeared unfamiliar and there were numerous attempts to describe its function in terms of providing a friction-free surface or as being devoid of ribosomes.

(e) Although knowledge of the role of muscle contraction and the resulting vasoconstriction was sound, the same could not be said of the function of elastic tissue. Many of the problems that candidates experienced with this question came from poor use of terminology. The concepts of stretch and recoil were frequently confused with contraction and relaxation.

Question 2

(a) Most of the more able candidates recognised that the feature labelled **M** in the diagram represented the sugar-phosphate backbone of the molecule and identified phosphate and deoxyribose as the relevant components. Others enjoyed less success and offered such suggestions as base, nucleotide or, even, hydrogen bond.

(b) Although there were many candidates who identified the maximum number of amino acids coded by this piece of DNA as four, it was difficult to determine any pattern in the enormous range of incorrect responses. It was clear, however, that many candidates had little understanding of the concept of a triplet code.

(c) Part (c) (i) was answered correctly by most candidates, but a substantial number were unable to make use of their responses to determine the percentage of adenine bases in part (c) (ii). The incorrect answer 86% featured frequently.

(d) Better candidates were able to identify the principle involved here and suggest an explanation based on different base sequences coding for different proteins. This idea eluded many, however. Some clearly thought the question related to DNA hybridisation, while others attempted to derive answers from an uncertain understanding of ratios. A common problem arose from imprecise use of the term, genetic code. This should only be regarded as a base sequence coding for a specific amino acid. Answers that attempted to explain the observation described in the question in terms of changes in the genetic code of the bacteria were, therefore, clearly incorrect.

Question 3

(a) There were many excellent answers to this part of the question although, perhaps inevitably, some candidates confused prokaryotes and eukaryotes, and others referred to features other than the DNA.

(b) The answers to part (b) (i) suggested that horizontal gene transmission was very well understood by many candidates, and responses were often detailed and accurate. Candidates should, however, be encouraged to confine their answers to the question asked. There were some very lengthy accounts, extending on to extra sheets, that covered material ranging from mutation in Species **X** to the significance of antibiotic resistance. Answers to part (ii), however, were much less convincing. Many responses that might otherwise have gained significant credit were marred by links to mitosis or meiosis. The numerous references to dominant and recessive alleles suggested to the examiners that over-teaching of this area had resulted in much confusion.

(c) Responses to this part of the question were usually sound but again, in some cases, poor use of terminology restricted the marks that could be awarded. At this level, candidates should be able to distinguish between resistance and immunity.

Question 4

(a) The first column in the table was intended to test the basic idea that chromosome number is unchanged in mitosis but is halved during meiosis. Many candidates attempted to halve the chromosome number in mitosis and then halve this number again to produce the number of chromosomes in a sperm cell. Unfortunately they failed to recognise the impossibility of an answer involving half a chromosome.

Completing the second column correctly proved more challenging but better candidates clearly understood the principles involved.

(b) There were some excellent answers to this part of the question that were not only factually correct but expressed the essential points clearly and logically. Others were limited by poor use of technical language, the most common failing being to describe the protein rather than the gene as mutating. Once again, there was considerable evidence of over-teaching leading to confusion. Almost invariably candidates who introduced the topics of Hayflick limit, oncogenes and tumour suppressor genes lost sight of the underlying theme. They frequently produced contradictory answers that gained little credit.

(c) Both parts of this question were usually answered correctly.

Question 5

(a) In defining a tissue, care needs to be taken to produce a definition that excludes organs and other levels of organisation. Thus, it is essential to refer to the cells involved being similar or with a common origin. To say that a tissue consists of cells that carry out a particular function lacks the necessary precision.

(b) In part (a)(i), most candidates appeared to appreciate that iodine solution could be used to locate starch but often failed to note the specific requirement of the question. There was a tendency to describe the test concerned without heeding the need to find out where in the cells the starch was present. On occasions, candidates failed to note that this question was directed towards what a student should do, and there were a number of inappropriate answers involving electron microscopes and ultracentrifugation. Most of the answers to part (b) (ii) identified the need to produce a section through which light could pass but seldom developed the arguments further to embrace the points made in the mark scheme. Some of the less able candidates confused optical and electron microscopes.

(c) Although most candidates produced sound answers to part (c), some occasionally went far beyond the two differences required in the question. They should be aware that this approach is not without its drawbacks. Examiners cannot be expected to select correct answers from a mixture of correct and incorrect responses. In order to be fair to all, once the required number of responses has been exceeded, correct answers are disqualified by those that are clearly wrong. ***Guidance for Teachers Marking ISAs*** on the AQA Website has useful information about the application and interpretation of mark schemes.

Question 6

(a) Most candidates correctly identified a taxonomic group to which all seals belonged, although some failed to understand the meaning of the phrase ‘taxonomic group’ and suggested mammals or animals.

(b) In spite of the many correct answers to part (i), there was much less certainty over the identity of a genus. The correct answer of six was seen relatively rarely and, while there was a certain logic to some of the alternatives suggested, it was difficult to understand the reasoning underlying many of the others. Although part (ii) was answered rather better, some of the responses to part (iii) suggested a lack of understanding of the diagram. The references to grandparents and to brothers and sisters suggested

confusion of the taxonomic representation here with a family tree. Some candidates also experienced difficulty with the idea of a common ancestor, and clearly interpreted common as meaning found in large numbers. Of those who did appreciate what was required, only the better candidates answered appropriately.

(c) The concept of genetic diversity is new to this specification and it was encouraging to note that many candidates clearly understood the meaning of the term.

(d) The separation of the stem from the requirement for part (i) may have led some candidates to answer this question in general terms rather than relate their often clear understanding of the concept of a genetic bottleneck to the circumstances described in the question. There were many, however, who were clearly writing about elephant seals but suggested that the decline in numbers was due to factors such as volcanic eruptions rather than the hunting specified in the stem of the question. Although knowledge of genetic bottlenecks was generally sound, relatively few candidates were able to explain how the founder effect might have influenced the genetic diversity of seals after 1910. Answers to part (ii) frequently involved a rewrite of the response to part (i).

Question 7

(a) Most candidates correctly identified the length of a single song as either 2 or 1.75 seconds but some experienced obvious difficulties in managing the scale bar. Conversion of the answer to part (i) into a rate proved challenging for many, however.

(b) Less able candidates often failed to maintain focus here and, instead of discussing the species-specific nature of mole cricket song, digressed from this theme to review the advantages of courtship behaviour in general. Better candidates produced more directed answers, and often also noted the advantages of song in a species that was nocturnal and lived underground.

(c) Many candidates gained both marks for recognising that the song of the hybrid would not attract a female. Others adopted a different, but acceptable, approach and based their answers on the likelihood that hybrids would be sterile. Such answers, however, tended to labour this point. As a result, they usually failed to gain full credit.

Question 8

(a) Candidates showed a good understanding of the adaptations of gills for efficient gas exchange. Although there were some who wrote in very general terms about ‘gills’, most candidates linked surface area to the possession of gill filaments or lamellae and to diffusion. The principle of counter-current flow was frequently mentioned and it was clear that most candidates had an excellent understanding of this concept. Some illustrated their answers with diagrams and these were occasionally very helpful. Candidates should be aware, however, that marks can only be awarded for diagrams that are properly labelled. There were numerous sketches on which were written figures that might have represented anything. Some points were made less frequently or less convincingly. There was relatively little mention of the roles of ventilation and circulation in maintaining the concentration gradient and many struggled to describe the short diffusion path in sufficient detail to gain credit. There were also a number of frequent misconceptions. These included references to air passing over the gills; to diffusion only being able to take place in water, and to the presence of carbon dioxide being essential for the diffusion of oxygen.

(b) Successful responses to this part of the question usually referred to photosynthesis or to the diffusion of oxygen from the higher concentration in the air. There were many answers, however, that involved fanciful ideas about generation of oxygen at depth and this bubbling to the surface, or incorporated the concept of need, such as that there was less oxygen at depth because the toadfish did not need it.

(c) This answer illustrated a common failing among less able candidates in answering questions that involve application of knowledge. They were often inclined to rely on recall and, while most were able to indicate that the toadfish environment was low in oxygen, they not infrequently related this to high altitude. There was also a tendency to give answers that were too brief, omitting reference to the context of low partial pressure when describing the high affinity of toadfish haemoglobin for oxygen.

(d) Answers to part (i) tended to fall into two categories. Either candidates gave very good answers that made the points in the mark scheme succinctly, or they wrote at length about the three organisms without ever quite answering the question. However, it was encouraging to see many excellent answers to a question set in a context which is new to the specification. Part (ii) discriminated effectively across the full mark range. Where a single mark was obtained, it usually came from the correct identification of the hybrid DNA from the chimpanzee and the orang-utan separating at the lowest temperature. Some candidates then unfortunately suggested that weaker rather than fewer hydrogen bonds were formed. It was only in the best answers that differences in amino acid sequence were successfully linked to differences in base sequence.

Question 9

(a) Most candidates gained credit for their answers to this part of the question.

(b) There were many incorrect responses to this straightforward calculation. The answers to this part, and to others within this question, suggested a very limited understanding of the concept of percentages.

(c) Most candidates correctly recognised the positive correlation between the percentage of frogs with deformed legs and the mean number of parasitic worms per frog but some, despite the length of their answers, were unable to progress beyond this point. Many, however, pointed out that correlation does not necessarily mean causation and supported their answers with references to the involvement of other factors, or to the fact that there were frogs with deformed legs in ponds where there were no parasitic worms.

(d) Most responses to part (i) recognised that very few ponds meant that the sample was small but then went no further than to rewrite the question and explain that this meant that the scientists involved could not draw reliable conclusions. Answers to part (ii) were generally better, and most were able to suggest that there would be factors that might apply specifically to mountainous areas. Only the better candidates pointed out the need to compare like with like before valid conclusions could be drawn. Among less able candidates there was concern about the risk to biologists working in mountainous regions and much philosophical discussion over whether a pond that was studied by a biologist could be said to be free of human influence.

(e) One of the purposes of this question was to help candidates to understand the complex table. Very few were able to describe the information in the shaded box in terms of the column and row headings. There were two particularly disconcerting approaches. Many candidates saw the figure as representing an anomaly, even going

as far as to suggest that the scientists shaded the box to show that the figure was anomalous. Many of the candidates who approached the question in the right way failed to note that this figure was a percentage and referred to 27 frogs having deformed limbs.

(f) This question was targeted at the more able candidates and, in view of this, it was extremely encouraging to note that many of those whose ability was more limited were able to make a number of pertinent observations for which they gained credit. The weakest candidates, however, made little progress, usually because they failed to note that this was a properly designed investigation. They resorted to a stock answer that would have been more appropriate in answering part 9 (c). There was, however, widespread recognition that the parasites caused deformities and most candidates were able to support this with appropriate evidence. Better candidates also recognised the role of run-off in increasing this problem. Candidates were awarded credit for supporting their statements with calculations based on the data provided. It was disturbing to note the number who treated percentages in a totally inappropriate way, totalling the figures or calculating means.