



General Certificate of Education

Biology 2410

BIOL5 Control in cells and in organisms

Report on the Examination

2010 examination - June series

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Set and published by the Assessment and Qualifications Alliance.

General Comments

The mean mark for this paper confirmed the impression gained by the examiners that many candidates had prepared themselves well for this unit. Better candidates demonstrated sound knowledge of many of the topics tested and linked this with an excellent understanding of underlying principles. They were also able to assimilate information presented in a novel context and interpret it with considerable success. Those who were less successful revealed fundamental gaps in their knowledge and a failure to apply basic examination technique. Many of these candidates appeared to have taken little note of the material provided in the question, responding to key terms with what appeared to have been prepared answers, correct in detail but irrelevant in context.

Forty of the marks available for this unit are synoptic and, in this context, the poor standard of many of the essays must receive comment. Sound biological knowledge was frequently interspersed with basic misunderstanding, thus respiration was confused with photosynthesis, carbon dioxide was widely considered to impact on the ozone layer, and amino acids were freely confused with nucleotide bases. It was clearly apparent that many candidates failed to prepare themselves with sufficient care for this part of the unit test. The essay also demonstrated that Quality of Written Communication proved a problem for some and it was not uncommon to encounter poor or non-existent use of technical language or to encounter arguments that lacked all coherence.

Question 1

- (a) Although many candidates correctly identified the behaviour shown as a taxis, there were other responses including both kinesis and tropism. Those candidates who identified the type of behaviour correctly were generally able to provide the necessary evidence in part (ii). Those who failed to gain credit usually offered a general reason for their choice rather than select the specific evidence required from the information provided.
- (b) Poor examination technique often limited the marks that could be awarded. Many candidates ignored the responses of the termites in group **A** while others answered generally and offered a largely irrelevant interpretation of the responses of all three groups. Many of those who gained credit correctly recognised the importance of gravity as the stimulus. Few, however, linked detection of this stimulus to the antennae.
- (c) Although less able candidates failed to link the behaviour to the habitat of the termites, many were able to gain full credit for the idea that the winged insects would, thus, be able to leave the soil and found new colonies.

Question 2

- (a) This part of the question was often poorly answered. While errors in the first column were perhaps predictable, those not infrequently given in the second column suggested confusion between polynucleotide strands and bases or even chromosomes.
- (b) This question was marked in such a way that a candidate who made a single error was still able to gain some credit. The answers to both parts were generally sound although there were occasional errors involving giving the base sequence on the complementary DNA strand, or resulting from uncertainty over splicing.

Question 3

- (a) The high standard of the answers to this part of the question indicated that many candidates had an excellent understanding of the role of sodium ions in creating an action potential. Such errors that arose were generally over the direction of ion movement, or concerned the perceived role of active transport in this process. Regrettably, marks were missed through poor Quality of Written Communication as the phrase, "sodium ions enter the membrane" could refer to ions going into or coming out of the axon.
- (b) Candidates were also handicapped by their written expression in this part of the question. Here the common error was to write of an influx of ions out the axon. Clearly a contradictory statement of this nature cannot be awarded credit. There were, however, many sound answers that gained significant credit.
- (c) Most candidates recognised the importance of ATP in active transport but some either failed to refer to the ions involved or were confused over the directions of their movement.

Question 4

- (a) The higher marks in this part of the question went to those candidates who identified the story that they were required to tell and were able to maintain their focus. These candidates generally gained most of the credit available. Others attempted lengthy but vague descriptions of the fluctuations shown on the graph or referred imprecisely to increases and decreases as "changes".
- (b) Many candidates did not have the understanding that, following ovulation, the corpus luteum secreted progesterone and this accounted for the rise in March. Many answers were phrased in unfortunate terms and emphasised the "need" for a high progesterone concentration.
- (c) Although most candidates identified changes in oestrogen and LH, only the more able linked these to ovulation and gained full credit. A significant number of candidates ignored the instruction given in the question and discussed the change in progesterone.

Question 5

- (a) The answers to this question and to Question 6 (b) suggested that many candidates were uncertain as to the roles of various enzymes used in gene technology.
- (b) Although the majority of candidates clearly understood the basic idea of transcription, they tended to gain limited credit for part (i) of this question. This was largely because they failed to make effective use of the material with which they had been provided. There were few references either to binding to the promoter or to stimulation of the enzyme. In part (ii), most candidates recognised the specificity of the receptors but were not always able to address the question of why oestrogen does not affect other cells. There was much discussion of oestrogen binding to receptors, but relatively little about receptors being confined to the cells of target organs.
- (c) Most candidates recognised the molecular structures as being either complementary or similar and used this information to construct sensible suggestions about reduction in

growth of breast tumours. The terminology used by many, however, suggested confusion with enzyme action.

Question 6

- (a) While most candidates recognised that stem cells are undifferentiated, many failed to point out that they were capable of replacing themselves. A reference to totipotency ensured this first mark, but a second could not be awarded for simply explaining what the term meant. The examiners were of the opinion that many candidates had encountered the word but had very little understanding of its meaning.
- (c) In part (i), only the better candidates recognised and were able to describe the relationship between the altered sequence of nucleotide bases and the consequent change in the sequence of amino acids affecting the tertiary structure of the protein. There were many general answers that offered little more information than that the “gene was disrupted” or that a “different amino acid was made.” Many candidates found part (ii) challenging and, although they were able to gain credit for a general statement relating to the uncontrolled division of cancer cells, they attributed this to insertion of the gene in the base sequence of either the tumour suppressor gene or into a proto-oncogene, thereby converting it into an oncogene.
- (d) Many candidates had clearly given careful thought to their answers and made effective use of the data provided. They usually came to the conclusion that 25% was either an unacceptably high cancer risk or that 75% of children were unaffected by cancer. Many took the view that, as the cancer could be treated, whereas SCID was likely to prove fatal, this was an acceptable trial. Answers that adopted a more general approach, describing the trial as unethical, accusing the scientists concerned of “playing God” or commenting on children being unable to make informed judgement did not gain credit.

Question 7

- (a) Many candidates produced sound answers to part (i), successfully linking succinate dehydrogenase concentration to aerobic respiration and hence to slow twitch fibres. Although most responses to part (ii) referred to the peripheral distribution of the enzyme, they often failed to provide a satisfactory explanation of the importance of this distribution. Comments about the diffusion of ATP into and out of cells were frequent.
- (b) There were many poor answers to part (i) in spite of the fact that estimating the size of objects viewed with a microscope is a specification requirement. Candidates who had the necessary practical experience tended to offer appropriate responses, illustrating the importance of practical work in this specification. Others persisted in quoting impracticable approaches based on the equation relating magnification to observed and actual size. Although, in part (ii), many candidates suggested that random sampling would avoid bias, few offered the suggestion that the sample should be large enough to be representative. There were many instances of candidates failing to appreciate that they had been provided with a prepared slide and therefore that answers such as taking muscle from different areas of the body were inappropriate. Many weaker candidates opted for an approach based on safety. The numerous comments about “not cutting yourself” were judged inappropriate.

Question 8

- (a) In part (i), the simple statement that the girl may have eaten a meal rich in carbohydrate gained marks for many; others were able to relate high blood glucose concentration to insulin concentration. Given the scatter of points on the graph, it was perhaps unsurprising that relatively few candidates, in answering part (ii), commented on the positive correlation between the results of the two tests. Many, however, referred to the wide range of glucose concentrations corresponding to individual urine measurements. Candidates should be aware that when required to evaluate it is only fair that the information provided genuinely allows candidates to judge the worth of a particular data set or conclusion. As such, they should consider both how the argument is supported and how it fails to be supported.
- (b) Quality of Written Communication proved a challenge in the final part of this question. The more able candidates gained credit with succinct answers referring to glycogenolysis and gluconeogenesis. Others used the terms but were clearly confused by their meanings, or suggested rather predictably that glucagon could be converted into glucose.

Question 9

- (a) Most candidates had some understanding of the function of restriction endonuclease but were not always sure of its role in the investigation described. Thus, there were numerous references to the enzyme “cutting out” particular sections of DNA, these pieces ranging from haplotypes, to genes and even chromosomes. Most candidates correctly suggested that electrophoresis would be involved in separating the DNA fragments, although some were clearly of the opinion that it was the chains of DNA that were separated.
- (b) Candidates were generally able to describe the complementary base sequence present on the probe but seldom progressed to explain how it could be used to show that the haplotypes concerned were the same.
- (c) The relatively few candidates who understood the concepts of genetic bottleneck and founder effect answered this question well. However, there was much confusion between the two ideas. Less able candidates not infrequently sought an explanation based on selection and the evolution of new species of wolf.
- (d) The majority of candidates linked the Y-chromosome to male inheritance in part (i) although a significant number suggested that the Y-chromosome was inherited from the female. Part (ii) was targeted at stronger candidates, but very few could suggest that mitochondria could only be passed to the offspring in the cytoplasm of the egg.
- (e) The responses to part (i) suggested that while many candidates were aware that giving the units per unit area enabled comparison, they were uncertain as to what was being compared. The most frequent suggestion was that it allowed wolves to be compared with prey numbers. Others wrote about the territorial behaviour of wolves or suggested that the mobility of the animals made counting over a larger area too difficult. In part (ii), better candidates appreciated that wolves ate only part of their prey and that the amount eaten differed with different species of prey.
- (f) Although the positive correlation between prey index and wolf numbers was usually recognised, few progressed to state that this suggested that food must be limiting

population size. Unfortunately, the few who pointed out that other factors might possibly be involved rarely linked this conclusion to the spread of data on the graph.

Question 10

There were occasional essays that were a pleasure to read. They had accurate and detailed content and presented the underlying argument lucidly and coherently. Many of the essays seen, however, were of poor quality. The following comments could often be applied to these essays.

- There was no evidence of planning. This inevitably led to much repetition and to the liberal use of footnotes and asterisks which detracted from overall coherence and allowed only limited marks to be awarded for skill **Q**.
- They were frequently based on content that was superficial and rarely reflected the detail expected at the end of an A-level course.
- There were many fundamental errors and misconceptions. Such phrases as ‘plants respire by photosynthesis’, ‘carbon dioxide creates the diffusion gradient for oxygen’ and ‘carbon dioxide makes a hole in the O₃-zone layer’ were frequent.
- Much of the content was clearly irrelevant. Examiners were left with the impression that once candidates had identified a topic that they considered to be of some relevance, they were determined to extend it far beyond any link with the essay title. There was the occasional suspicion that some candidates were attempting to recall essays that they had written earlier. Thus the effects of carbon dioxide not infrequently became the importance of carbon-containing compounds or even the importance of oxygen while the causes of disease became the immune response or DNA and mutation. While examiners are fully prepared to give credit to any relevant biology that relates, even, distantly to the title, irrelevance inevitably results in withholding marks, not only for skill **R** but also for scientific content.

(a) ***Carbon dioxide may affect organisms directly or indirectly. Describe and explain these effects.***

Most of the candidates who attempted this essay, introduced the topic with a reference to the light-independent reaction of photosynthesis. Where they progressed beyond a general equation, their knowledge of biochemical detail was often sound, even though there was often a disturbing degree of confusion between respiration and photosynthesis. The physiological role of carbon dioxide in regulating heart beat and the Bohr shift usually received mention but accounts were often spoiled by confusion between haemoglobin and red blood cells or between carbon dioxide and carbon monoxide. From this point, detail usually fell away. References to the carbon cycle were often followed by superficial and long-winded accounts of climate change. Given the relevance of this topic to the future lives of these students and the emphasis that is placed on it in Unit 4, it was indeed depressing to see that so few could progress beyond the melting of ice caps and the demise of polar bears. Such phrases as “insects would have to migrate to find new niches” raised concerns about fundamental understanding of ecological concepts.

(b) ***The causes of disease in humans***

Most of the candidates who attempted this essay were able to write about pathogens, lifestyle diseases and genetic disease. The section on pathogens was usually based on

the diseases considered in Unit 1 and marks awarded were closely linked to the accuracy with which candidates recalled basic facts. Fundamental errors were numerous. The terms virus and bacterium appeared freely interchangeable and while understanding of the part played by the cholera toxin was sound, knowledge of tuberculosis was less convincing. Many, indeed, attempted to link tuberculosis with smoking or even with a high fat diet. Many candidates introduced material that was clearly irrelevant at this stage and digressed at great length on the topic of immunology. Better candidates considered genetic disease in considerable detail linking it to cystic fibrosis and sickle-cell anaemia. Others were inclined to produce a lengthy account of DNA structure and mutation finally ending with a phrase along the lines that, if “this goes wrong then you will get a disease.” The section on lifestyle disease, was by far the most poorly answered. Generalisation and inaccuracy were frequently compounded by poor expression such as tar “clogging up” lungs or fats similarly “clogging up veins.”