



General Certificate of Education

Biology 1411

BIOL1 Biology and Disease

Report on the Examination

2010 examination - January series

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General Comments

The paper generally seemed accessible to candidates and a wide range of marks was seen. There were some outstanding scripts at the top end of this range, which showed a thorough knowledge and understanding of the module content. These candidates were able to apply their knowledge to different contexts and express themselves clearly and logically, using correct scientific terminology. However, it was also apparent that some candidates were ill prepared for this examination. In such cases, answers were poorly expressed and some questions were misinterpreted. Even the straightforward recall questions caused problems for these candidates. Similarly, some candidates failed to gain marks because they failed to read carefully the information provided. The terms 'describe' and 'explain' were also sometimes confused. There were some common misconceptions, which have been described below in the appropriate questions.

Question 1

- (a) Most candidates gained at least one mark for stating that the water potential in the lumen of the intestine would decrease. Some were aware that a change in water potential occurred but did not indicate where. Surprisingly, relatively few candidates went on to mention osmosis, although many did describe the movement of water into the intestine. Weaker candidates often wrote in insufficient detail or gave answers out of context. Typically, these answers referred to water concentration and the lactose or milk having a lower water potential. A minority of candidates did not read the question stem carefully and instead explained how the cholera toxin causes diarrhoea.
- (b) (i) It was disappointing that only one third of candidates scored full marks on this question, given that it was targeted at grade E and involved straightforward recall. However, most candidates gained at least one mark for correctly naming water as the reactant or galactose as the product. A common incorrect response for the missing reactant was 'lactase', despite this being given in the stem of the question. There was a wide variety of suggestions for the missing product. These included water, fructose, maltose and sucrose.
- (b) (ii) Over 70% of candidates correctly named the reaction as hydrolysis. The most common incorrect responses seen were 'digestion' and 'condensation'.
- (c) There was widespread failure to read the stem of each question part, which resulted in only a minority of candidates gaining full credit. It was also clear that many candidates had failed to distinguish between the terms 'describe' and 'explain' for part (i) and (ii) respectively.
- (c) (i) There were numerous references to the Benedict's test for reducing sugars and, to a lesser extent, iodine solution and universal indicator. It was also clear from the colour changes given that many candidates were not familiar with basic food tests. Candidates who did refer to the biuret test often limited their answer to describing the method and naming the reagents involved. For those who did mention a purple colour, it was not often clear if they were referring to lactose or lactase.
- (c) (ii) Many candidates gave the answer to (c)(i) here but failed to explain why this result would be achieved.

Question 2

- (a) (i) Very few candidates gained two marks for this question. Only the most able used the correct scientific terminology to name the layers of the alveolus and capillary through which oxygen passes. A mark was often awarded for 'alveolar epithelium' or referring to the wall of both alveolus and capillary. However, a number of candidates who referred to the capillary simply stated that oxygen entered, without any reference to a layer. A number of weaker candidates referred to 'one cell thick membranes' or gave answers that focused solely on diffusion. Similarly, a minority of candidates referred to the passage of air through the 'bronchial tree', from trachea to alveoli.
- (a) (ii) This proved to be a good discriminator. Nearly 60% of candidates gained this mark for explaining that a thicker alveolar epithelium would increase the diffusion pathway or reduce the rate of diffusion. Candidates who failed to score usually referred to 'less diffusion', 'less surface area' or 'a longer pathway for gas exchange'.
- (b) (i) Approximately one third of candidates gained one mark for the idea that ventilation brings in air with a high concentration of oxygen. However very few then went on to mention the removal of air with a low concentration of oxygen. References to the removal of air almost always referred to carbon dioxide concentration. This was not credited. Similarly, many candidates did not read the stem of the question carefully and described the need for a concentration gradient between the alveolus and blood. This was usually expressed in terms of where the concentration of oxygen would be high and low. A minority of candidates described the roles of the ribcage, intercostals muscles and diaphragm in ventilation.
- (b) (ii) Many candidates gained the mark for the idea that the circulation of blood also helps to maintain the concentration gradient between the alveolus and capillary. However, some candidates did not attempt this question or gave answers that related to the properties of a gas exchange surface.
- (c) This was well answered and most candidates scored at least one mark. This was usually for the idea that miner's lung may be caused by other factors. Better candidates noticed fluctuations on the graph and made reference to a suitable year when the number of cases had dramatically increased. Weaker candidates often gave vague answers such as 'the number of cases gradually increased' without qualification or they suggested how coal dust may have affected the lungs over time.

Question 3

- (a) (i) Most candidates gained one mark for describing that the rate of reaction increased and then remained constant. Unfortunately, a minority of candidates disqualified this mark by stating that the plateau was where the reaction had stopped or the rate had decreased. Surprisingly, very few candidates correctly identified the substrate concentration at which the rate of reaction started to level off. Many simply referred to point **B** on the graph, or typically gave a value from 20-25. A minority of candidates gave an explanation for the shape of the curve.

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- (a) (ii) Most candidates were aware that substrate concentration was limiting the rate of reaction. Many then went on to explain correctly how this could be determined from the graph. A minority of candidates did not read the question stem carefully and referred to the curve **after** point **B**. References to temperature as the limiting factor were not credited as this could not be determined from the graph.
- (a) (iii) This proved to be a good discriminator. Just less than half of candidates gained this mark for explaining that all active sites were occupied or that enzyme concentration was a limiting factor. Weaker candidates were often let down by poor expression or a lack of detail e.g. 'enzymes working flat out', 'all enzymes are active', 'enzymes are at saturation point' and 'maximum number of collisions'. As was the case for (a)(i), a minority of candidates thought that the reaction had stopped between points **C** and **D**. Other incorrect explanations seen included reference to enzyme denaturation and the presence of an inhibitor.
- (b) Almost half of candidates scored one mark. Many candidates who failed to score were aware that the initial rate of reaction would be lower. However, they usually confused the two types of enzyme inhibitor and drew the plateau below that of the original curve.
- (c) (i) Most candidates gained at least one mark for stating that the drug would bind to the active site. Weaker candidates sometimes missed out on this mark through a lack of detail e.g. 'the drug binds to the enzyme'. Better candidates usually went on to score full marks for the idea that less enzyme-substrate complexes would form. References to the drug having a similar shape to the substrate were less frequent. However, some candidates disqualified this for stating that the drug was the same shape as the substrate or active site.
- (c) (ii) Just less than half of candidates gained the mark for explaining that the drug could only fit the active site of folate reductase. This was expressed in a variety of ways but typically in terms of the complementary shapes of drug and active site. Very few candidates gained the mark for explaining that the drug was a similar shape to only one substrate. Weaker candidates often wrote in general terms about enzyme specificity, without reference to the drug. Similarly, as in (c)(i), poor expression prevented some candidates from scoring. This was usually for referring to the enzyme rather than active site or for stating that the drug was the same shape as the active site.

Question 4

- (a) (i) Over 90% of candidates correctly identified organelle **Y** as a mitochondrion.
- (a) (ii) This question proved to be a good discriminator. Most candidates gained at least one mark for the function of mitochondria in terms of respiration, energy release or ATP production. Better candidates usually went on to link this to active transport. Unfortunately, some candidates disqualified the first mark through poor expression e.g. 'energy produced' and 'produces ATP for respiration'. Similarly, some answers referred to facilitated diffusion and linked this to a requirement for ATP. A minority of candidates incorrectly referred to structure **Y** as either 'microvilli' or 'ribosome'. This resulted in incorrect answers relating to surface area and protein synthesis respectively.

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- (b) Most candidates gained one mark for the principle of dividing the measured length by the magnification. However, only the best candidates were able to convert the measured length to micrometres. Candidates who failed to score often divided the magnification by the measured length.
- (c) Most candidates scored one mark for mentioning a reduced surface area. The more able usually went on to link this to reduced absorption for full marks. However, some candidates disqualified this mark by referring to less protein being absorbed. Relatively few candidates referred to the cell membrane or membrane proteins.

Question 5

- (a) (i) Almost three quarters of candidates gave the correct answer of 1.08. However, some answers showed an excessive number of decimal places. Similarly, some candidates subtracted the final mass from the starting mass to give an answer of 1.8.
- (a) (ii) Most candidates were aware that a ratio enabled a comparison to be made between different sets of data. Unfortunately, some gave this in the wrong context by referring to a comparison of the start and final mass of the same disc. Similarly, it was usually only the better candidates who wrote that the discs had different starting masses. Some candidates narrowly missed out on this mark through a lack of detail e.g. 'different sizes' and 'different masses'. The table showed the start and final masses of each disc. It therefore had to be clear which of these was being referred to. As was the case last year, weaker candidates had difficulty in understanding the concept of a ratio. Their answers usually made reference to a ratio allowing 'a better graph to be plotted' or 'it being easier to draw conclusions'.
- (a) (iii) Many candidates gained one mark for the idea that anomalies could be identified. However, some mistakenly thought that additional readings prevented anomalies from occurring or being recorded. These were not credited. Relatively few candidates mentioned that a mean could be calculated. There was also widespread failure by weaker candidates to read the stem of the question. This usually resulted in descriptions of methods that could be used to take additional readings.
- (b) (i) This question was asked in the first paper of the series and it is encouraging to note that candidates did much better this time. Most candidates scored one mark for describing the correct graph to be plotted. There were, however, some suggestions to plot sodium chloride concentration against water potential. The second mark proved to be a good discriminator. It was usually only the better candidates who appreciated the concept of using a ratio of 1. Some candidates clearly remembered doing this practical but were let down by a lack of detail e.g. 'read off where line crosses x-axis', with no mention of a ratio. Once again, the concept of a ratio was too much for weaker candidates. Similarly, a minority of candidates were aware that there would be no change in mass but then disqualified this mark by using a ratio of 0.
- (b) (ii) Only the most able candidates scored one mark on this question. This was either for mentioning a more reliable line of best fit or that error bars could be plotted. However, there was widespread failure by most candidates to

distinguish between the terms 'accurate' and 'reliable'. Taking additional readings does not necessarily allow results to be closer to the true value. Hence, references to 'accuracy' were not credited. The term 'precise' was rarely used. However, credit was given if this term was used in the correct context as highly precise and highly reliable results both have very little spread about the mean value.

Question 6

- (a) Over 90% of candidates gained this mark, usually for 'virus'. Relatively few referred to 'fungi'. The few candidates who failed to score usually repeated 'bacteria' from the stem of the question or gave a specific example of a bacterium or virus.
- (b) Many candidates gained full marks for this question, although a minority misread the stem of the question and gave ways in which a pathogen could gain entry into the body. The most common mark awarded was for the production of toxins. Unfortunately, some candidates failed to gain the second mark through a lack of detail e.g. 'damages the body' and 'infects cells'.
- (c) (i) This question was poorly answered by most candidates. Only the most able were aware that monoclonal antibodies were produced by the same B cell or B cell clone. There was evidence of widespread poor expression and responses usually fell into one of two discrete camps. Candidates who focused on the 'mono' aspect of 'monoclonal' frequently referred to these antibodies 'only binding to one antigen' or 'being produced from a single antibody'. Candidates who focused on the 'clonal' aspect usually gave responses that were out of context, such as 'these antibodies are cloned' and 'they are genetically identical antibodies'. Disappointingly, very few candidates mentioned B cells.
- (c) (ii) This question proved to be a good discriminator. The most common mark awarded was for 'tertiary structure'. Weaker candidates usually went straight into an explanation of why monoclonal antibodies are specific in terms of binding, shape or fit. However, a number of these answers lacked detail regarding what these antibodies bind to. Relatively few of these candidates used the term 'antigen'. In such cases, the terms 'bacteria' or 'pathogen' were typically used. A number of candidates also confused antibodies with enzymes, with references to 'active sites' and 'antibodies being complementary to the substrate'. There were, however, some highly impressive answers given by the more able candidates. These usually gained full marks and often gave more detail than that shown on the mark scheme.
- (d) Most candidates gained at least one mark for the idea of reducing the spread of disease. The more able qualified this by explaining that rapid identification allowed infected cattle to be isolated and treated. Relatively few wrote about infected dairy products not being sold. Weaker candidates often gave vague arguments that related to animal rights and economics. These usually involved less distress being caused to the animals, not having to transport the animals or money being saved due to the samples not having to be sent to a laboratory. Such responses were not credited. Similarly, a minority of candidates incorrectly thought that the monoclonal antibodies were being used to treat infected cattle, rather than as a diagnostic tool.

Question 7

There were many excellent answers to parts (a) and (b), with many candidates scoring at least three marks. Both questions proved to be good discriminators.

- (a) Most candidates understood the role of the SAN in initiating the heartbeat and generating electrical impulses, which cause contraction of the atria. Similarly, there were numerous references to the passage of impulses along the Bundle of His or Purkyne fibres and the subsequent contraction of the ventricles. However, there were some inventive spellings of 'Purkyne'. It was encouraging to see only a small number of candidates referring to electrical impulses as 'signals', 'messages' or 'electronic pulses'. It was usually only the most able candidates, who correctly referred to the delay at the AVN and described its significance. A number of candidates described the delay in the wrong context. This was usually in terms of a delay in impulses reaching the AVN or the non-conducting tissue of the heart causing the delay. Weaker candidates often gave a muddled sequence of events or gave a description of the cardiac cycle in terms of blood flow, valves and pressure changes.
- (b) Most candidates were aware that atheroma involved the build up of fatty tissue. However, a number of weaker candidates incorrectly referred to fatty acids. The location of atheroma proved to be a good discriminator. Weaker candidates often placed it in the artery, lumen, endothelium or on the wall of blood vessels. Thrombosis formation was generally well understood, although a minority thought that atheroma and thrombosis were identical. Consequently, there were some references to the transport of atheroma in the blood. Answers that gained full credit usually referred to the blocking of coronary arteries, reducing the supply of oxygen to heart muscle and the effect of this on respiration or ATP production. Weaker candidates often gave answers that lacked detail or context. These answers typically referred to blood vessels being blocked, less blood reaching the heart or the heart dying. Similarly, a minority of candidates referred to 'cardiac arteries' instead of 'coronary arteries'.