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Specification A

BYA1 Molecules, Cells and Systems

Report on the Examination

2007 examination - January series

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General

Candidates entering for this unit test in January show varying degrees of preparation. The very best produce work of an exceptionally high standard, underpinning a secure knowledge of the factual content of the module with an excellent grasp of basic concepts and principles. In addition their work generally reflects mastery of the skills listed in the assessment objectives. Unfortunately, there are many candidates who are unable to demonstrate either the required knowledge or the necessary skills. Many of these candidates fail to gain further credit by not expressing their limited biological understanding in appropriate scientific language. Sometimes this is merely a matter of using inappropriate terminology as when, for example, describing glycerol as glycogen or in confusing heart valves. Of perhaps more concern are those scripts where the Quality of Written Communication is such that it proves impossible to award credit. There were many answers that fell into this category and, while it is not the wish of any examiner to withhold marks for other than biological misunderstanding, candidates must understand the importance of clear logical argument. In an attempt to identify those areas where marks have been withheld, examiners have been encouraged to use the letter “Q” on the script.

Question 1

(a) Although there were candidates who chose to test for lipids with an inappropriate reagent, most correctly identified the emulsion test. Subsequent detail was less convincing; incorrect reagents were added, the procedure often involved “boiling” and reference was seldom made to the importance of adding ethanol and then pouring the resulting solution into water. There were many correct references to the presence of an emulsion indicating a lipid, but there were a number of vague references to cloudiness. These failed to gain credit.

(b) The part of the molecule labelled Y was usually correctly given as glycerol and most candidates were able to identify at least one appropriate way in which phospholipids and triglycerides differ. Better candidates showed clearly the arrangements of carbon and hydrogen atoms in part **Z** but there was a variety of incorrect responses. Many of these were based on attempts to draw either carbohydrates or, less frequently, amino acids. The answers to part (iv) were particularly disappointing. The most frequent approach was to describe the arrangement of phospholipids in a plasma membrane. While most of these answers were fundamentally correct and gained some credit, they failed to address the question that had been asked. The examiners required an explanation of how part **Z**, in particular, contributed to the arrangement of the bilayer.

Question 2

(a) The responses revealed that few candidates understood the sequence of events that take place during inspiration. The best responses to this question did no more than the question required and described the initial fall in pressure and the subsequent increase as air enters the lungs. Errors crept in when candidates attempted to explain both inspiration and expiration, and much confusion then resulted. In contrast to this, answers to part (ii) were usually sound although there was some uncertainty over precisely what moved “up and out”, in some cases this movement being ascribed to either the lungs or the diaphragm.

(b) Better candidates were able to give an appropriate equation, but there were still many who began their answers with the statement “Fick's law =”, making no reference to the rate of diffusion. Another error, not infrequently encountered, was in expressing difference in concentration simply as concentration.

(c) Although most candidates displayed some understanding of Fick’s law, fewer were able to apply it. The most frequently encountered problem in part (i) was a failure to follow the instruction and base the answer on the observation relating to the alveolar wall. Answers to part (ii), however, contained much incorrect biology and revealed widespread misconceptions about the exchange of respiratory gases in the lungs. Most candidates attempted to relate the decrease in concentration of carbon dioxide to an increase in the oxygen concentration gradient. Very few appeared to appreciate that the rate of diffusion is only linked to the difference in the concentrations of the substance concerned.

Question 3

(a) Many candidates gained full credit although there was some confusion between active transport and facilitated diffusion, and between osmosis and simple diffusion.

(b) Part (i) was designed to test more able candidates and many of those in this group clearly appreciated that it would be likely that the concentration of potassium ions in the cell would, in all probability, be higher than the final concentration shown in the graph. Other candidates failed to analyse the data with sufficient care and considered the data as relating to concentrations in the solution and in the cell. Although there were some excellent answers to part (ii), there were many incorrect statements concerning plant respiration. Thus there were references to plants not “needing to respire”, “not needing oxygen” or “only using carbon dioxide for respiration”. Such candidates clearly regarded the question as involving something of a trick in concluding that a lack of oxygen would therefore have no effect. Poor expression not infrequently limited the credit that could be awarded with the examiners being left in considerable doubt as to how the final concentration of potassium ions was affected.

(c) A few of the better candidates did appreciate that water uptake would affect calcium concentration, but most sought refuge in uncertain chemistry and improbable biology.

Question 4

(a) Although there were some who incorrectly identified the relevant chamber of the heart, part (i) was, in general, answered well. Credit was occasionally withheld from the responses to part (ii) because of superficial answers that only referred to "pushing" the blood further, and there were those who responded in terms of "needing to withstand" high pressure rather than generating it.

(b) Although valve terminology defeated some of the less able candidates, answers to part (i) were usually correct and reflected an understanding that blood was leaving the ventricle at time **X**. Examiners were of the opinion that most candidates understood the information in the graph but frequently commented on the fact that ideas were poorly expressed. Candidates should call on their biological knowledge in describing trends and patterns rather than rely solely on expressions such as that there would be more curves, or that curves would be smaller or shorter. Most candidates were able to identify cardiac output as the product of heart rate and stroke volume, although there were those who introduced lung volume and breathing rate into the equation. Relatively few, however, were able to determine the duration of one heart beat and successfully calculate heart rate from this. As a result, although better candidates were able to gain full credit, many gained no more than a single mark.

Question 5

(a) Although most candidates identified the relevant features of a leaf cell, few appeared to appreciate that red blood cells do not contain chromosomes. There was also widespread acceptance that bacterial cells contained mitochondria. The instructions made it quite clear that candidates were expected to insert a tick if the feature were present or a cross if it were absent. In view of this, it is disappointing to note that many candidates opted to leave boxes blank or to produce hybrids between ticks and crosses. Neither of these approaches gained credit.

(b) There were many comprehensive answers although a common error was to refer to the wavelength of the microscope rather than of light in expressions such as "the resolution is not powerful enough due to the long wavelength of the microscope".

(c) Many of the better candidates clearly appreciated that material must be sectioned in order to view it with an electron microscope. They frequently continued to explain that the section concerned may not pass through the branch. Less able candidates often devoted much space to discussing two dimensional and three dimensional images, missing the essential argument entirely. Others attempted to relate the observation to the inability of electron microscopes to produce coloured images or to be used with living material.

Question 6

(a) The problem most frequently encountered was confusion of the concepts of activation energy and kinetic energy. A substantial number of less able candidates elected to base their answers on increased kinetic energy and explained the role of a catalyst in these terms. Poor expression marred many accounts and confusion of catalase with catalyse did little to help.

(b) Answers to part (i) were almost universally disappointing. Very few candidates understood what is meant by a control and were able to explain its importance in demonstrating that the sand alone did not bring about the breakdown of the hydrogen peroxide. Incorrect answers were usually based on describing ways in which the investigation could be made a fair test and there were many references to factors such as temperature, pH and even substrate concentration that should be kept constant. Those who had some idea that the effect of sand alone should be tested often had little understanding of the reason for this and suggested such possibilities as to find out whether the sand “contained enzymes” or “could act as a substrate”. Part (ii) was usually answered correctly, although some candidates were of the opinion that low temperatures denature enzymes.

Question 7

(a) The examiners were instructed to be generous in what they accepted as a flow chart but, even so, some candidates attempted to construct graphs. They were unable to gain credit, but most of the rest gained at least one of the two available marks. The steps in the reaction were usually identified correctly, although there was an occasional failure to mention dextrins. Glucose isomerase was the enzyme most frequently omitted.

(b) Candidates gained marks for referring to isomers or for describing the different arrangement of the constituent atoms in glucose and fructose. Those who failed to gain credit fell largely into one of three groups. Candidates who referred loosely to the molecules being in a different arrangement; candidates who failed to note that both glucose and fructose are monosaccharides, and candidates who confused the terms isomer and isotope.

(c) Most candidates had a sound understanding of the principles tested in this part of the question and were able to identify the concepts of shape and fit needed to explain enzyme specificity. Failure to gain credit here was often linked to incorrectly identifying the active site as part of the substrate.

(d) Although there were many correct answers to both parts of the question, condensation was frequently offered as a response to part (i). It is disturbing to note that many candidates have little idea of what is meant by a chemical element and, as a result, there was a wide variety of inappropriate answers given to part (ii).

(e) This question confirmed once again that many AS candidates lack the ability to carry out simple calculations. Part (i) combined a requirement to calculate percentages with the need to extract relevant information from a simple passage. The combination of the two skills regrettably proved too much for the many who carried out a single step in the necessary calculation. The responses to part (ii) were particularly disappointing in that the application of a little common sense would have enabled far more candidates to have gained credit. Confronted with whether to multiply or divide by 180 to find the amount of aspartame necessary to replace 10 g of sucrose, it was surprising that so few

appreciated that substitution of the 10 g of sucrose necessary to sweeten a mug of coffee with 1.8 kg of sweetener was not the most likely of scenarios.

(f) This question offered good candidates the opportunity to demonstrate some basic knowledge. Many availed themselves of this opportunity and gained maximum credit. At the other end of the spectrum were those candidates who were clearly uncertain as to the nature of starch and variously described the structure of cellulose, protein and, in some cases, particular cell organelles. It was noticeable that candidates from some centres were inclined to produce what appeared to be pre-planned answers. Unfortunately some of these concentrated on structure while others dealt solely with function. The resulting omissions meant that neither group gained full credit. Although many candidates appreciated the link between structure and storage capacity, only the better candidates were able to associate the branched molecules of amylopectin with rapid hydrolysis. Most contented themselves with references to “easy breakdown”. A mnemonic used by some, LICE, with the letter E representing “easy”, proved less than helpful here.

Question 8

(a) Most candidates clearly understood that blood flows from high pressure to low pressure. Where credit was withheld, it was usually because of poor expression.

(b) Part (i) required calculation and again created problems for many. Some were, rather surprisingly; content to measure the length of the capillary on the diagram as a straight line extending from the arteriole to the venule, conveniently ignoring the bends. Calculations were often out by a factor of ten suggesting unfamiliarity with the relationship between centimetres, millimetres and micrometres. Candidates would be well advised to set out their working in questions requiring calculation as clearly as possible. Examiners are usually willing to award the approach adopted but can only do so where they can follow what has been done. The rate calculation in part (ii) was seldom correct, the main errors being the frequent multiplication of length by time or division of time by length. Those candidates who did more than merely reiterate information given in the question, generally gained the mark awarded in part (iii).

(c) Many of those candidates who attempted to describe the curve on the graph rather than explain it went no further than to note the decrease in pressure with distance along the capillary. Despite the very basic nature of the skill involved, very few candidates, and not always the better ones, noted the changing gradient. There were two approaches to part (ii) seen on the scripts of more able candidates, explanations based on friction between the wall and the blood, and those involving loss of fluid during tissue formation. Both were able to gain credit. There were many who, having more or less successfully answered part (i), continued to offer the same information again. By far the most common answers, however, were those which simply referred to capillaries being at a considerable distance from the heart, or those which offered an explanation in terms of preventing the capillaries from bursting.

(d) It is encouraging to be able to report that almost all examiners commented on the excellent answers seen from many candidates in response to this part of the question. These answers reflected a genuine understanding of how tissue fluid was formed and reabsorbed. There were still candidates, however, who demonstrated very little knowledge of the processes involved. These candidates frequently offered all the appropriate terms but had very little understanding of how they fitted together. There was also much discussion of “blood pressure” and “osmosis” but often in the context of movement along blood vessels or exchange between tissue fluid and cells.

Mark Ranges and Award of Grades
Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA Website.