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Report on the Examination

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General comments

The overall performance of students on this paper was slightly disappointing. Although the first series of examination papers for a new specification often cause difficulties for students, it was evident that a significant number of students had not adequately prepared for this exam. A relatively demanding mark scheme and questions on new subject content did contribute to students gaining fewer marks. However, many students also underperformed in questions on well-established topics, common to the previous specification. Nevertheless, there were some very impressive answers with students displaying an excellent understanding of the assessed content on the paper. Some of the relatively simple calculations proved more challenging than expected as did questions involving interpretation of data presented graphically. There was a wide range of performance on questions related to the required practicals. Poor use of scientific terminology and limited powers of expression often prevented many students gaining credit. However, it was also clear that some answers were based on a lack of thorough revision.

Question 1

1.1 Approximately 50% of students correctly identified the type of enzyme as a dipeptidase. The most common incorrect response was protease.

1.2 Only one in five students obtained both marks in this question. Students who obtained one mark usually correctly identified the role of either endopeptidases or exopeptidases. However, there were many students who confused the roles of these enzymes or suggested that endopeptidases work outside cells and endopeptidases inside cells.

1.3 In marking this question, particular care was taken to ensure that no students were disadvantaged due to the error on **Figure 1**. Consequently, any references to ATP producing ATP and Pi were not penalised. Most students obtained the mark for stating that the respiratory inhibitor would prevent the production of ATP. Students who did not gain this mark usually referred to the inhibitor blocking or changing the shape of the carrier protein involved in moving the amino acid rather than mentioning ATP or active transport. Over 40% of students obtained a second mark for describing that the movement of sodium ions would be affected. Many other students simply referred to amino acids no longer being absorbed without any reference to sodium ions. Answers obtaining maximum marks clearly explained that a diffusion/concentration gradient for the movement of sodium ions would not be maintained. Again, incomplete explanations simply referred to the movement of amino acids without any reference to sodium ions. Overall on the paper, this question proved to be the most effective discriminator.

Question 2

2.1 Most students were unable to provide appropriate units to compare the distribution of stomata on leaves. The units used varied from nanometres to metres and these were often measurements of length or volume rather than area. A significant number of students were under the mistaken impression that ‘per’ can be represented by a solidus.

2.2 Most students were able to obtain one mark in this question usually for explaining that light would be able to pass through a thin piece of tissue. Very few students obtained both marks by further explaining that a single/few layer(s) of cells was required for this to occur. Many students did not gain a second mark due to the use of imprecise terminology, others

were clearly confused with references being made to 'diffusion distance', 'water loss' and 'electrons'.

2.3 Almost 80% of students were able to obtain at least one of the two marks available. Both mark points were seen in relatively equal numbers. A common error was to refer to variation in the number of stomata on different leaves rather than in parts of the same leaf. There were also frequent references to anomalies, not always in the correct context.

2.4 The quality of the answers for this question was very disappointing. Consequently, 75% of students scored zero. Some students had not carefully read the question and described a range of xerophytic features of plants rather than those specifically related to leaves. Other students simply described two xerophytic features of leaves but did not provide explanations. However, most students did suggest two xerophytic features of leaves and gave explanations but these explanations lacked detail. Students often referred to 'hairs trapping water' rather than 'water vapour' and omitted any reference to water potential gradients. Another common response was 'a waxy cuticle to reduce water loss' which again lacks sufficient detail to gain credit. A common misconception was that small leaves reduce surface area to volume ratios rather than referring to needles or spines.

2.5 This question was problematic for many students, with only a third gaining any marks. The most frequently awarded mark point related to the use of water in photosynthesis. However, almost the same number of students suggested that water was produced in photosynthesis. Slightly fewer students mentioned the use of water to provide support/turgidity. There were far fewer references to the production of water during respiration or its use in hydrolysis. Again, weaker answers suggested that water is used in respiration or provided vague references to water being used for growth. A significant number of students referred to leakage of water from a potometer evidently having misinterpreted the context of the question.

Question 3

3.1 The vast majority of students correctly identified the process as diffusion. The most common incorrect responses were osmosis and facilitated diffusion.

3.2 Almost two thirds of students gained at least one mark for this question. Often this was achieved by explaining that the small/thin body of a tubifex worm would provide a short diffusion distance. A significant number of students named specific features of the body of a tubifex worm but did not explain how they allowed efficient gas exchange. Conversely, some students referred to a large surface area to volume ratio without relating this to a specific body feature.

3.3 Less than 5% of students gained both marks for this question. The vast majority of students did not refer to the percentage saturation of haemoglobin in relation to the partial pressure of oxygen. Most students simply stated that the haemoglobin had a high affinity for oxygen at low partial pressures of oxygen. Approximately, a third of students gained one mark, invariably for referring to the use of oxygen for respiration.

3.4 Most students gained one mark for correctly stating that seawater would have a lower water potential than the tubifex worm. Almost a third of students then gained the second mark by explaining that the worm would lose water by osmosis. However, many students did not gain this second mark as they either attempted to relate water potential to oxygen uptake or

failed to refer to osmosis. A significant number of students suggested that the tubifex worm would 'burst' in seawater despite correctly identifying the water potential gradient.

Question 4

4.1 70% of students correctly gave 14 as the answer. Some students used **Figure 5** rather than **Figure 4** or provided a definition of species richness.

4.2 Surprisingly, less than 50% of students obtained this mark. Many students suggested that the additional information required was the total number of all dung beetles rather than the number of individuals in each species.

4.3 Almost two thirds of students failed to obtain a mark on this question. It was evident that many students did not fully understand what was meant by standard deviations. Also a large number of students used the results in **Figure 4** rather than **Figure 5**. Most students who did refer to no overlap in standard deviations were able to relate this to there being a significant difference in mean total to obtain both mark points.

4.4 Three out of every four students correctly explained that choosing sites at random would prevent bias. Responses failing to gain credit often referred to 'controlling variables' or 'a fair test'.

4.5 Most students obtained at least one mark usually by referring to the removal of a habitat for the birds. A significant number of these students then gained a second mark by referring to a decrease in food sources. Very few students obtained maximum marks as they did not relate the removal of hedges to the loss of plant/insect species. Often students showed understanding but did not gain credit due to the use of imprecise terminology and/or poor quality of communication. Common examples of this included, 'less food', 'less homes' and 'less shelters'. A small minority of students misinterpreted this question and discussed reduction in genetic diversity.

Question 5

5.1 The vast majority of students correctly named the type of reaction as hydrolysis. Common errors were 'condensation' and 'phosphorylation'.

5.2 Approximately 50% of students gained a mark in this question. The most common scoring points referred to phosphate being required for the formation of ATP, DNA, RNA or phospholipids in cell membranes. Many students stated that phosphate was used as a 'nutrient', 'for energy' or to 'form protein'.

5.3 Approximately 40% of students were able to calculate a correct ratio. A significant number of students did not gain the mark as they provided the ratio the wrong way round or they simply transcribed their readings from the graph as a ratio, most commonly, 4.1:1.1.

5.4 This question proved difficult for most students with almost 60% scoring zero. The most common misconception was that the chilling requirement of seeds would enable plants to grow during the winter so that they would be fully grown by spring and could outcompete other plants. Some students also referred to plants carry out photosynthesis and reproducing during the winter. A significant number of students misinterpreted the question and answered it in terms of natural selection for plants with a chilling requirement. Students who did gain credit often referred to growth of the seed/embryo during the winter followed

by photosynthesis in the spring/summer. Very few students referred to seed production in the spring or summer.

Question 6

6.1 Most students who gained both marks for this question, often referred to a large sample size and to selecting individuals at random. The idea of selecting healthy individuals and the 'same sex/gender' were also often credited. Fewer students mentioned taking repeat readings for each individual. Students failing to gain a mark often stated that smokers, non-smokers and individuals of similar body size should be selected.

6.2 This question provided a similar mark distribution to 6.1 with approximately 70% of students gaining at least one mark. This mark was most often awarded for explaining that a mean FEV1 value could be used to provide a 'comparison' or 'benchmark'. Students gaining the second mark usually referred to determining the effect of smoking or ageing on the FEV1 value. Incorrect responses often described the benefits of twenty five year olds being selected in terms of their health or lung function.

6.3 One in four students obtained this mark by referring to the reduced elasticity of lung tissue or the weakening of the internal intercostal muscles. Incorrect responses often involved vague descriptions of reduced lung efficiency or reference to incorrect muscles.

6.4 Almost 60% of students gained at least two of the three marks available for this question. These marks were usually awarded for explaining that a reduced FEV1 would reduce the uptake of oxygen into the blood and consequently lead to reduced rate of respiration or of ATP production. Some students provided further details on increased anaerobic respiration and lactic acid production. Although many students appreciated that less air would be removed from the lungs, relatively few students linked this to less carbon dioxide being removed. Students scoring zero often provided superficial descriptions of breathing being affected with no references to gas exchange or respiration.

Question 7

7.1 It was disappointing that less than 50% of students obtained two or more marks out of the four available on this question. Although the context of the question was novel the knowledge and understanding required have been regularly assessed on previous AS Biology papers with students achieving better outcomes. The fact that a mutation involves a change in the DNA base/nucleotide sequence was only appreciated by a minority of students, often the 5% of students who obtained maximum marks. Although most students appreciated that a different amino acid sequence would be coded for, a number of students incorrectly stated that different amino acids would be formed. Better answers did gain credit for references to changes in hydrogen, ionic or disulfide bonds. However, many students failed to gain a mark for a change in the tertiary structure as they incorrectly suggested that this changed 'the active site' of a receptor. 30% of students obtained no marks. These students often provided detailed accounts of translation or outlined the consequence of having a non-functional receptor which was required in the following question.

7.2 Approximately half the students obtained at least one of the two marks available for this question. Usually this mark was awarded for appreciating that HIV would not be able to attach to the protein receptor and therefore could not enter the cell. Many other students omitted the latter part of this description. Again, many students referred to an active site on

the receptor. Approximately 10% of students gained both marks by further explaining that HIV would not be replicated or that the T cells would not be destroyed.

7.3 As expected, this question proved very difficult for the vast majority of students with less than 5% obtaining both marks. The most frequent correct response related to the low number of HIV infections in Europe compared with other parts of the world. A number of students did gain credit for outlining that HIV has only been present in humans for a relatively short time period. The other mark points were rarely awarded. A significant number of students appreciated that natural selection often occurs over a long time period but did not relate this information to the context of the question.

Question 8

8.1 Approximately two thirds of students correctly explained that the clear zone was due to the disinfectant killing the bacteria. Answers which only referred to the growth of bacteria being prevented were not credited as the stem of the question outlined that a culture of bacteria had already been grown on the agar.

8.2 Slightly over half the students gained this mark. Most referred to the clear zones being too large or merging. A significant minority did refer to all the bacteria being killed. Students failing to gain credit often provided vague responses relating to the clear zones, concentrations of disinfectants, enzyme denaturation or safety concerns.

8.3 Almost 90% of students obtained at least one mark, usually related to controlling the size of the paper disc. Approximately 40% of students gained the second mark for outlining that the discs should be soaked in each disinfectant for the same time period. A common response was to suggest that the same volume of each disinfectant should be used but as the information stated that the discs were soaked, this was not credited.

8.4 30% of students obtained both marks for his question. A similar percentage obtained a single mark for an incorrect answer but a valid method of calculating how many times more effective disinfectant D was than disinfectant B. Most students did this by dividing the diameters or the radii of the clear zones.

Question 9

9.1 Approximately half the students correctly calculated the heart rate as 66.7 beats per minute.

9.2 40% of students correctly determined the stroke volume as 70 cm^3. There was a vast range of incorrect answers indicating that many students had little idea of how to use the information provided to determine the stroke volume.

9.3 Almost two thirds of students failed to obtain a mark in this question. Many of these students provided descriptions of how tissue fluid is formed rather than explaining why the tissue fluid actually builds up. Most answers which were credited only gained one mark for mentioning more fluid being forced out of the capillaries, or less being reabsorbed due to the high pressure. Very few students mentioned both points for 2 marks. A few students mentioned limiting drainage via the lymphatic system. A frequent misconception was that a higher ventricular pressure forces out ‘more tissue fluid’ rather than more fluid.

9.4 Generally this was well answered with almost 90% of students gaining at least one mark. Most students understood that widening of blood vessels would provide a larger lumen or volume through which blood could flow. Many students linked this to a reduced blood pressure within the blood vessels to gain the second mark. Very few students referred to reduced friction or resistance due to widening of the blood vessel.

Question 10

10.1 There was a considerable range in the quality of answers for this question. Some students provided detailed explanations of how the structures of starch and cellulose are related to their functions. At the other end of the spectrum, students referred to these molecules as polypeptides and provided details on protein structure. 10% of students gained full marks and almost 15% gained zero. Although many students appreciated the importance of starch being compact they did not always relate this to its helical/spiral structure. Most students stated that starch did not affect the water potential of cells due to its insolubility. Fewer students related the branching of starch to the faster release of glucose for respiration or discussed its inability to leave a cell. Generally, more students gained marks when describing the structure and function of cellulose. Most appreciated the strength of cellulose but a common error was to relate this to 'strong hydrogen bonds'. However, a significant number of students gained credit for describing (micro/macro) fibrils.

10.2 As in question 10.1, 10% of students obtained maximum marks. However, almost 30% of students scored zero in this question. The responses from students obtaining low marks included a number of factual errors; sugars being produced by sinks, phloem consisting of dead cells, the transport of sugars in the xylem, transport of glucose rather than sucrose, and transport of sugars using cohesion tension. Conversely, there were also some superb answers which included detailed explanations that went beyond the requirements of the mark scheme. This was particularly evident in the details provided on the loading of sugars from the source into the phloem via companion cells. Better answers contained extensive explanations of how co-transport is involved in this process. A significant number of students gained credit for explaining how the pressure gradient between the source and sink was established including the osmotic movement of water into the phloem. Surprisingly, few students obtained the mark for referring to the mass flow of sugars towards sinks. However, most students did describe the unloading of sugars at sinks.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA website.