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Report on the Examination

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General Introduction to the November Series

This has been an unusual exam series in many ways. Entry patterns have been very different from those normally seen in the summer, and students had a very different experience in preparation for these exams. It is therefore more difficult to make meaningful comparisons between the range of student responses seen in this series and those seen in a normal summer series. The smaller entry also means that there is less evidence available for examiners to comment on.

In this report, senior examiners summarise the performance of students in this series in a way that is as helpful as possible to teachers preparing future cohorts while taking into account the unusual circumstances and limited evidence available.

Overview of Entry

The size of entry for those who took this paper is less than 3% of the cohort who took the 2019 paper. The mean score achieved by students and the size of the standard deviation of marks compare well with similar statistics calculated in 2019. Although a much smaller proportion of the entry in 2020 achieved marks above 50 out of 75 marks compared with 2019, there was a smaller proportion achieving fewer than 10 marks. The distribution of marks appears to be skewed towards marks below the mean mark, in a manner not observed in 2019.

Comments on Individual Questions

01.1 This question tested an understanding of the principles involved in designing an investigation. The requirement to use a large sample was demonstrated frequently, however selecting animals at random was less common and often confused with selecting sites rather than randomly selecting individual animals.

01.2 Just over one third of students successfully named the statistical values that summarise the distribution of data.

01.3 Most students accurately identified the taxa as genus and species.

01.4 Most answers achieved at least 1 mark and usually because they contained a good definition of ‘null hypothesis’. This question discriminated well.

02.1 Most students demonstrated their good knowledge of phosphodiester bond formation, by successfully describing a condensation reaction between a phosphate ion and deoxyribose molecule. A small number made valid reference to DNA polymerase, but incorrectly referred to its role as forming hydrogen bonds or joining together complementary bases.

02.2 In approximately half of all answers, students demonstrated a sound understanding of how to successfully rearrange the subject of an equation, but many failed to gain a mark by failing to appreciate that the code for a polypeptide chain is a single strand of polynucleotide bases so they frequently gave the incorrect answer as140 amino acids. In addition, many who successfully applied the relevant mathematical skills, to give 420 as the total number of bases in the DNA did not show they had an awareness of the triplet-code principle by dividing this figure by a value of 3.

02.3 Over 80% of answers successfully identified histone proteins. Incorrect answers made reference to centromere, DNA polymerase, ligase and ATP.

02.4 In a majority of answers, students correctly identified DNA helicase and explained that it broke hydrogen bonds between base pairs and many of the answers demonstrated a sound appreciation of the complementary relationship between bases. Occasionally, students failed to gain marks by failing to use DNA in the name of the enzyme, or by referring to hydrolysis as the mechanism of breaking hydrogen bonds.

03.1 Very few students demonstrated a secure understanding of the structure and function of arterioles. The role of muscle contraction in arteriole walls was not known by most students. Common misconceptions included the presence of valves and explanations in which the dilation of blood vessels caused reduced blood flow.

03.2 This question discriminated well, with approximately 20% of answers demonstrating a sound understanding of the cause of blood movement through the heart along with an appreciation for the role of heart valves. Many successfully applied this understanding to the context given in the figure and produced well-written explanations. The answers that focused on differences in valve sizes, rather than on whether the valves are open or closed, tended to achieve no marks or gained only one mark for the idea that valves prevent blood backflow.

03.3 Approximately 30% of answers achieved the mark by identifying the blood vessel with lowest blood pressure as the vena cava. 50% of answers gave the capillaries as the blood vessel with lowest blood pressure, which demonstrates there is a common misconception in understanding the principle of pressure changes in the circulatory system.

03.4 The mathematical skills tested in this question proved to be accessible to over 90% of students, but only 25% of the entry achieved full marks. In over half of the answers, students failed to use 2 significant figures and so failed to gain one of the available marks.

04.1 Most answers successfully suggested it was a method to measure and monitor the temperature of the solutions over time. However, almost all then assumed that the temperature of the waterbath would not change during the investigation and made no mention of a suitable corrective measure.

04.2 This question discriminated well because it gave credit to those who described an aspect of cylinder size, such as measuring the surface area, mass or volume. Descriptions in which the dependent variable or the independent variable was given as a control variable was a common misconception.

04.3 Approximately 20% of answers identified the correct uncertainty (±1), with many giving a figure of 2 (a correct scale reading, but the value was not halved) or 0.5 (an incorrect scale reading which was halved). Many students suggested using a valid type of graduated scale to reduce the uncertainty of measurement, although suggestions referring to increased resolution or better reading of the meniscus gained no mark.

04.4 This question produced answers covering the full range of marks with a mean of 2 marks. Many students successfully described the different levels of pigment release from the shading given in the figure. Those who focussed on the damage caused to cell-surface

membranes achieved more marks, but many referred to cell walls rather than cell-surface membranes or made vague references to 'the damage caused to cells' in general.

05.1 Approximately a quarter of students gained no marks because they presented a graph instead of a results table, or the independent variable did not feature in the first column or the headings lacked detail. Many failed to gain a mark by describing 'Time' rather than 'Time for hydrolysis or Time for digestion' and for putting the independent variable in the first row rather than in the first column.

05.2 Approximately 50% of answers gave the correct answer. References to differences in the rate of reaction or to the effect of changes in the concentration of amylase gained no mark.

05.3 Many answers contained detailed explanations of how competitive inhibitors affect enzyme action with good use made of relevant terminology. Some failed to gain marks by incorrectly referring to inhibitors and substates having identical shapes, or by describing the action of non-competitive inhibitors. In many, otherwise nicely explained answers, students did not compare the structure of the substrate with the inhibitor, and some failed to gain the mark by suggesting that the inhibitor has the same shape as the enzyme's active site.

05.4 Over 50% of answers achieved at least one mark, usually for showing an understanding that the effect of retrograded starch on amylase activity will cause either less absorption or more egestion. Occasionally, answers correctly included mention of hydrolysis rather than general terms such as digestion or breakdown, but few answers gave maltose as the product of amylase action

06.1 Accurate identification of the numerical information taken from a graph and its use to successfully calculate a rate of change were skills demonstrated in over 75% of answers. In addition, almost all of these answers accurately substituted the calculated value into the equation, $y = mx + c$ to successfully predict fish mass.

06.2 This question baffled all but a very small percentage of students, with only 40% of answers achieving at least one mark. Very few answers demonstrated an understanding that the mass of DNA has doubled during interphase, and then is halved to achieve the haploid state. The constancy of chromosome number per cell in mitosis was better understood, but judging by these answers, the skill to apply this understanding carefully to a novel context was not possessed by the majority of students.

06.3 Approximately 40% of answers achieved the mark, with random segregation and crossing over appearing equally frequently. Descriptions of meiosis, as two divisions producing haploid gametes, gained no mark because they did not identify why the gametes are genetically different.

06.4 Approximately 50% of answers achieved the mark.

06.5 Students found it challenging to link their understanding of meiosis to the production of gametes in an organism with more than two sets of chromosomes. Some focussed correctly on the idea of too many chromosomes, but then did not go on to suggest how meiosis is adversely affected.

07.1 Many students demonstrated a sound understanding of the principles involved in the immune response, with over 30% achieving at least 2 marks and very few scoring no

marks. The progression of an HIV infection, in reducing the production of antibodies, was known by the majority of students and many could explain how the action of the virus produces this effect.

07.2 This question discriminated well, with students achieving the full range of marks. Over 90% of students demonstrated their ability to read information from the graph and explain what it meant in terms of drug effectiveness. The best answers showed a logical sequence of thought and made careful use of values taken from the graph. Some students noted the significance of the low, relatively constant HIV level and linked this expertly to low drug effectiveness. A small number of answers examined broader issues associated with the design of this drug-test programme, gaining marks for noticing the involvement of only one person along with the limitations of using only 16 months for the test.

08.1 Over 60% of answers achieved both marks, showing that there was a good understanding of the mathematical skills required to calculate a mean, to determine the range of data and to substitute values into an equation. Some failed to gain a mark by not halving the value for the range, as directed in the question and, occasionally, because they inaccurately calculated the mean value.

08.2 Only 25% of answers achieved at least one mark, which demonstrated there was limited awareness in students of the mass flow hypothesis. Very few answers identified sucrose as the carbohydrate that is loaded into phloem tubes, although active transport as the mechanism for loading was better known. More than occasionally, students demonstrated a misconception in which they suggested the water potential increased when a solute is added to a solution. Explanations frequently included terminology relevant to the cohesion-tension hypothesis, not to the mass flow hypothesis, which added to a sense that this topic is not well known.

08.3 Recognising and describing an inversely proportional relationship from the information presented in a graph was a skill demonstrated successfully in more than 85% of answers.

08.4 Over 60% of answers achieved at least one mark, but very few achieved all three. Most students correctly explained the effect of high temperature on water loss by evaporation and many went further to include the role of stomata in the loss of water from leaves. Only very occasionally did students make a link between the movement of water in xylem vessels and the pressure inside phloem tubes.

09.1 Knowledge of the mechanism for lipid absorption was not well known because students achieved one or more marks in only 30% of answers. Very few described the structure of micelles, or the role of micelles in lipid absorption. Many answers described transport processes such as facilitated diffusion, co-transport, active transport and osmosis in the context of lipid absorption and achieved no marks. The reformation of triglycerides inside ileum cells followed by their transport to cell membranes by vesicle movement (and exocytosis) are ideas that achieved most of the marks observed in these answers.

09.2 This question differentiated well. Although, approximately 25% of answers achieved no marks, most answers demonstrated an understanding of a protein's primary structure and also that the position of amino acids within this structure determines the location of interactions which affect the protein structure in general. Many wrote at length about nucleotide sequences determining the primary structure and achieved no marks for doing this and some completely confused DNA structure with protein structure. Some otherwise

good answers made reference to ‘certain’ amino acids in the sequence determining protein structure, without making clear it is the relative position of these monomers that is important.

Concluding Remarks

The students who took this paper demonstrated sound knowledge of topics such as DNA structure and DNA replication, protein structure and how HIV affects the immune response. They showed limited or no knowledge of lipid absorption, arteriole structure and function, maltose as the product of amylase activity and the mass flow hypothesis in translocation. Consequently, the overall impression is one in which student knowledge is patchy.

What is far more secure is the students’ ability to take information from a graphical form and to use mathematical skills accurately, such as rearranging equations or selecting the correct statistic to use when summarising data. However, many did not take careful note of all the information given in the mathematics questions, so they did not perform all of the required steps in their calculations.

Answers where students are required to interpret and evaluate information, including their ability to draw valid conclusions from the data collected in practical settings, are skills many demonstrated successfully. Consequently, success gained in answering these questions, to some extent, made up for any limitations they had with the level of their knowledge.

There are few examples where valid knowledge is applied successfully to answer the questions that are set in a novel context. Evidence from reading scripts suggested that limitations caused by a lack of subject knowledge, along with a perceived inability by students to correctly link ideas together, resulted in low attainment on the questions which have a focus on learning objective AO2.

Mark Ranges and Award of Grades

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