APPLIED GENERAL L3
APPLIED SCIENCE

ASC1 Key Concepts in Science
Report on the Examination

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General

In this report, the performance of students in this series is summarised in a way that is as helpful as possible to teachers preparing future cohorts.

This paper gave students the opportunity to apply their knowledge and understanding across a wide range of topics across the unit. It was clear, as with last series' exam, that the best students had managed to prepare well in the circumstances for this examination and were able to attain high marks. However, there were many aspects of the paper which proved to be very challenging for the majority of students. For example, the key concepts of the light-dependent and light-independent reactions in photosynthesis, applying Newton's Laws in the Dynamics topic as well as the behaviour of semiconductors in the Electricity and circuits topic need to be better understood by students to raise achievement in future series. The term molecule has a specific meaning and if used to mean any type of particle a student may not gain credit.

Presentation was generally good with handwriting being legible and it was clear that the space provided for answering questions was sufficient for the vast majority of students (there were very few additional pages to mark). It was also clear that students had sufficient time to complete the paper. All questions were attempted by the vast majority of students.

The fact that students are prompted in questions to 'Use the Formulae Sheet' has helped students in questions that require an equation. Calculations were answered better in this examination than in previous series. It should be remembered that, in their answers, students should be encouraged to always write the formula down and then substitute in the required data, setting their work out clearly. For some students, a better understanding of unit conversion is needed.

Students should also be aware that if they give several answers when only one is requested, they will gain no credit.

Biology

Question 1

1.1 Approximately two thirds of all students gained credit for identifying the left ventricle in the diagram. All other options were seen in students answers and the most common incorrect answer was for identifying the left atrium instead of the ventricle.

1.2 Slightly under half of all students gained the mark for identifying the bicuspid valve in this multiple-choice question. A slightly higher number of students identified the right semi-lunar valve.

1.3 This question saw the highest percentage of students not attempting an answer and over a third did not gain credit. Most students who gained credit did so for explaining arrhythmias as an irregular heart rate.

1.4 Approximate one fifth of all students gained some credit for describing how an artificial pacemaker works. Of these, less than 4% gained 2 or 3 marks. Answers that did not gain

credit were often vague in their descriptions, such as describing information or pulses being sent across the heart without making clear that the nature of these are electrical. There was also some confusion seen between the SAN and the AVN.

1.5 A quarter of all students gained full or partial credit in this question. Of those gaining credit, most correctly identified the baroreceptors. There were a significant minority who listed baroreceptors and chemoreceptors as a 50:50 choice and this was not credited.

Question 2

2.1 Over two thirds of all students gained credit for stating one feature that would be found in eukaryotic cells and not prokaryotic. The most common correct answers seen were nucleus, and chloroplasts, although all other correct answers were given. Common, but incorrect answers included cell wall and ribosomes.

2.2 Over two thirds of all students gained some credit in this calculation question, with a quarter gaining full marks. A tolerance was allowed for the measuring aspect of the question but this on its own did not gain credit. The student's measurement needed to be correctly converted to gain the first marking point but do note if they conducted the correct calculation with an unconverted value and then correctly converted it at the end, they still gained credit for this.

Most students who only gained 1 mark did so because their conversion was incorrect and therefore there were errors of magnitude.

2.3 Just over a quarter of all students gained one mark in this question, often for identifying the cytoplasm as the site where glycolysis takes place. A further 30% gained both marks for glycolysis and the electron transfer chain. A small, but significant, number of students gave several locations for each process and therefore did not gain credit due to the list principle.

Question 3

3.1 Less than one fifth of all students gained credit for naming the raw **materials** for photosynthesis. Some students wrote the full equation which does not demonstrate their knowledge of reactants and products, and some also included light and / or chlorophyll which is not a material.

3.2 Just over one third of all students gained full or partial credit in this question, of which less than 2% gained full marks. To gain full credit, students needed to make clear that it was the breakdown of water that produced the oxygen not just the overall process of photosynthesis and this was the idea many students did not articulate. However, most that gained credit recognised the oxygen production as the key part of the process that then caused the leaf to float.

3.3 One fifth of students gained credit in this question. Some students wrote the equation for photosynthesis, but this was insufficient to explain that it is the hydrogen that combines with carbon dioxide to produce glucose.

Chemistry

Question 1

1.1 A large proportion of candidates answered either giant covalent or ionic. Students must be able to recall all types of structures and bonding.

1.2 Roughly a quarter of students discussed the sharing of electrons. Only around 10% mentioned that a covalent bond is an electron **pair**. Many others did not mention electrons, or incorrectly discussed a covalent bond as an intermolecular force.

1.3 Only a small number of correct answers were seen.

1.4 Less than 10% of students were able to recall this definition. Students should be encouraged to learn definitions for standard enthalpy changes.

1.5 Only a small number of answers included a Hess's Law cycle with carbon dioxide and water at the bottom. A good proportion of students were able to score on the calculation, but many only scored one or two marks in total because of their incorrect Hess's Law cycle.

Question 2

2.1 Most students recognised the need to give sub-shells in the electron configuration. Approximately half of all students seemed unaware of the order in which these sub-shells were filled and what the maximum capacity of each sub-shell is. A minority of students gave an electron configuration with simply principal energy levels as is required at GCSE.

2.2 Just over 10% of students were able to discuss the arrangement of positive ions and delocalised electrons correctly. Approximately 5% discussed the electrostatic attraction between the ions and electrons. Many students incorrectly referred to molecules and intermolecular forces. Many others discussed ionic bonding.

2.3 Approximately a fifth of students were able to answer this question correctly. Incorrect answers included water, carbon dioxide and nitrogen.

2.4 Very few correct answers seen. Most students did not realise that a calcium ion has a 2+ charge.

2.5 Approximately one fifth of students answered this question correctly, despite the question showing an equation that included state symbols.

2.6 More than half of students did not score on this question. A large percentage of students did not convert kg into g and a significant proportion who attempted the unit conversion did so incorrectly. A significant proportion of students calculated the relative formula mass of calcium carbonate only and so incorrectly calculated the number of moles in 200kg of calcium carbonate.

A large number of students attempted to calculate the number of moles of calcium hydroxide by dividing 200 000g by the sum of all the relative formula masses of **all** the reactants and

products. Some students used the atomic numbers rather than the relative atomic masses of each element in their calculation of relative formula mass.

Physics

Question 1

1.1 Nearly 60 % of students were able to select the correct answer, recognising that the best insulator would have the lowest U-value.

1.2 Just over a fifth of students were able to describe how the data showed the type of glass used for double-glazing made more difference than the gap size on reducing heat transfer. Students were expected to recognise that there was a bigger difference in U-values for the different glass types compared to the U-values for the different gap sizes. Many students lost the mark here because they only described how the U-value changed for either the glass type or gap size. Students should be encouraged to write about **both** when comparing two sets of data.

1.3 About half of students were able to state that the U-value would decrease for thicker glass as this would be a better insulator.

1.4 The formula $U = \frac{Q}{A\,t\,\Delta T}$ is given on the formulae sheet. In this question, it was given in its rearranged form $Q = UAt\Delta T$. Despite this, less than 40% of students were able to insert the data given in the question to attain the correct answer. It is clear that the majority of students were unfamiliar with this equation. Students should be given more examples of using this formula to better prepare them for future examinations.

1.5 Around an eighth of students were able to give two benefits of fitting double-glazed windows and about half were able to provide one example. Marks were not gained here because students did not expand on their answers. For example, instead of writing ‘less likely to smash’ (which was not given a mark), they should write ‘less likely to smash compared to single-glazed windows’ which would gain credit. They ‘save money’ should be made clearer by writing ‘they save money on heating bills.’

Question 2

2.1 Nearly 60% of students were able to select the correct equation to calculate the momentum of the load in the question. Just over 10% of students, however, knew the correct unit for momentum (kg ms^{-1} or kg m/s). There are often questions with at least one mark per Physics paper for the correct units, so it is important that students are aware of those involved in the specification. There is still a minority of students who wrongly covert kg to grams and teachers should address this in lessons.

2.2 More than three quarters of students were able to select the correct equation for power from the formulae sheets to obtain the correct answer. The mark was generally not gained here by students who converted 176 000 J to kilojoules or tried to use the equation P = IV.

2.3 This question stated that the load moved at **constant** velocity. Students should recall that Newton's First Law of Motion applies here so the forces must be balanced (i.e., there is no resultant force). Only a quarter of students realised that the two forces involved must be the same size. More than 8% of students did not attempt this question which shows that more time should be spent on this key concept in lessons.

2.4 This question was asking students to apply their knowledge of Newton's Second Law of Motions. This proved to be the second most challenging question on the paper with less than 2% of students gaining full marks. Just over 10% of students were able to state the load would accelerate (upwards) but were unable to compare the two forces involved or resultant force to explain why. Over 85% of students gained zero marks here with many of those thinking that the cable would break.

Question 3

3.1 About half of students were able to draw a curved line of best fit on the graph. Half of students drew a straight line which did not gain credit. Students should be taught that lines of best fit can be a curve or a straight line (or both!) and must be given practice at identifying which type of line is required.

3.2 Over 85% of students were able to give the correct description of the relationship between temperature and resistance for the thermistor in the question.

3.3 The specification states that 'Learners will develop their knowledge and understanding of free electrons and the electrical behaviour of semiconductors'. It was clear from the answers seen that students were unaware of why the resistance decreases when a thermistor is heated. About 6% of students knew that the resistance decreases as a result of electrons becoming delocalised/free. However, no students were able to describe that the atoms gain energy as the thermistor is heated which results in the electrons becoming delocalised. Most students confused this concept with the increase in resistance of a lamp as it gets hot. Many answers incorrectly referred to electrons colliding with atoms/ions. This was the most demanding question on the paper.

3.4 About a quarter of students recognised that this was a series circuit so the total resistance of the circuit could be calculated using the formula $R_{total} = R_1 + R_2$ (which is given on the formulae sheet).

3.5 Around a fifth of students were able to state the current in the circuit increased which made the lamp brighter. However, less than 1% of students said this was because the total resistance of the circuit had decreased. Many students restated that the resistance of the thermistor decreased, and this gained no credit as this information was given in the question.

3.6 Just over one third of all students were able to give a use for a circuit containing a thermistor. Students should be taught uses for potential divider circuits, and this should include circuits including a thermistor and light-dependent resistors.

Mark Ranges and Award of Grades

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