GCSE
Additional Science (combined)

AS2HP

Report on the Examination

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General

There is general concern amongst examiners that students who are unprepared for a Higher tier examination continue to be entered inappropriately. Many students scored below 15 marks for the paper and must have left the examination room low on confidence for their other examinations, be they science or otherwise. Students working close to but below grade C are more likely to perform better if they gain confidence by completing more straightforward questions in the early part of a Foundation tier paper.
Students should be reminded of the need to bring correct equipment to the examination. A black pen that delivers a dark ink is likely to give examiners more chance of reading their answers from a scanned image, and a calculator, as some of the questions, particularly in the Physics part of the paper, will require calculations to be carried out.
The quality of writing appears to be getting worse and Centres are reminded that scribes may be used where writing quality might compromise the ability of students to express their ideas legibly. Thus students will be assessed on their scientific ability and not on the examiners ability to decipher their answers.
Students should also be reminded that the space provided for answers is far more than is necessary to give a very full response and there should be no need to continue onto additional pages, except in exceptional circumstances.

Question 1 – Standard Demand

(a) The majority of students correctly identified ‘amino acids’ as the product of protein digestion. The most common incorrect suggestion was ‘glucose’ or ‘sugar’. A high number of students were unable to offer an answer to this question.

(b)(i) Many students realised that keeping the two tubes separately in the water bath would allow them to ‘reach the same temperature’. Weaker students, though, thought that this would allow the enzyme to reach ‘its optimum temperature’ or ‘allow a fast reaction’ when they were mixed. Very few students opted for the alternative idea that this would prevent them reacting at the wrong temperature.

(b)(ii) It should have been a fairly straightforward task to read the volume of solid egg white from the scale on the measuring cylinder in the two diagrams and complete the subtraction.

(c)(i) Most students recognised that the volume of egg white that had been digested increased with increasing temperature; however relatively few went beyond this to describe the ‘doubling for each 10 ^{o}C rise’. Some did get close by referring to ‘doubling each time’ although examiners considered that ‘each time’ did not clearly identify the idea of a 10 ^{o}C rise. A considerable number of students went beyond the requirements of the question and described the effect at 50 ^{o}C, which examiners ignored.

(c)(ii) Students tended to go down one of two routes, either suggesting that the whole investigation should be repeated, which was incorrect or suggesting that a greater number of temperature values should be investigated. In the case of the latter, those who suggested increasing the range of values had misunderstood what was needed to improve accuracy. Those students who realised what was needed, referred to reducing the interval within the temperature range studied and usually picked up one mark, with phrases such ‘change the temperature by 5 ^{o}C instead of 10 ^{o}C’. A second mark was awarded to those students who had studied the data and realised that the

optimum temperature must lie between 30 ^{o}C and 50 ^{o}C, so answers such as 'do the investigation at 45 ^{o}C' gained both marks.

(c)(iii) The examiners ignored the subheadings within this section which were given to help students organise their answers. Thus, many students gained both marks within the first section by stating 'enzymes are not killed, they are denatured'. Although the term 'denatured' is not on the specification, the vast majority of students used this term, rather than 'changed shape' which they are expected to know. Those students who did not recognise the inaccuracy of the term 'killed' often suggested that the temperature 50 ^{o}C was incorrect as 'it might be killed at 45 ^{o}C'.

Question 2 – Standard Demand

(a) Most students gave the correct response with by far the most common incorrect response being 'alkali'.

(b) The state symbols were well known but few students were able to successfully allocate the correct state symbol to the substance required.
Magnesium oxide (s) and water (l) were the best known but even with the (aq) already assigned to sulfuric acid few were able to give the correct symbol for magnesium sulfate solution.

(c) The question asked students to describe how they would prepare crystals of magnesium sulfate. Examples of equipment that could be used were given in addition to indications as to what was required in their response.
Six marks were only awarded if the method would produce magnesium sulfate crystals rather than magnesium powder at the end.
Students who gave labelled diagrams could gain credit for the diagrams but 6 marks would not be awarded to a student who just included the diagram, it is expected that some prose would also be seen.
There was clear evidence that many students had not experienced this practical work. The spatula was often used to pick up the crystals or add solution. Students often thought the filter paper was to filter out the magnesium sulfate crystals.
Some students gave good descriptions of the mixing process, but few went on to add excess magnesium oxide, though the absence of this was not penalised.
The filtration process was usually described but sometimes 'sieves' were used which was not credited. A significant number did not read the question and thought that the crystals would be in the residue rather than the solution that was the filtrate.
To obtain crystals from the filtrate, students often stated that they would evaporate all the water. As this would produce powder rather than crystals a maximum of 5 marks could be obtained in this case.
Colours given in the response were ignored as students are likely to have prepared copper sulfate from copper oxide and sulfuric acid which is a very similar reaction and students are not expected to know the colours of magnesium sulfate solution and crystals.

Question 3 – Standard Demand

(a)(i) The majority of responses correctly identified the live wire.

(a)(ii) Some students referred to 'double insulation' although most who gained the mark did so for reference to wood not conducting. Many students wrote that the (earth) wire just wasn't needed or that only a two core cable was used and several referred to the plug case, 'it is plastic', rather than

the lamp. There was a marked lack of understanding about the purpose of fuses and neutral wires with only a quarter of the students gaining a mark.

(a)(iii) This was generally well answered but with more responses of 'doesn't conduct' than 'insulator'. A large proportion of students thought that plastic is a conductor. Some responses were on the right lines but were too vague and lacked correct terms, for example referring to plastic as a 'poor conductor' suggests that it does conduct to some extent.

(a)(iv) About half gained a mark here usually the second one on the mark scheme. Some merely amplified 3A to '3 amps/amperes' or thought this was the current required rather than the maximum. Creditworthy responses used the term 'blow' more often than 'melt' to describe the effect on the fuse. The level of understanding of fuses and how they work is very poor. Many students suggested that the fuse supplies the current. Phrases such as '3 amps of voltage' were common.

(b) Only a minority of students gained both marks. Some incorrect attempts at defining a.c. included altering, alternate, accelerating or alternative current'. Several were distracted by the power rating of the bulb. Overall, there was a poor understanding that Hz refers to frequency.

(c) This was well answered with a large proportion of students achieving both marks. Only a few students divided rather than multiplied. However, it is a matter of concern that some students stated that they did not have access to a calculator. Some students produced complex grids to achieve the multiplication in the absence of a calculator with varying degrees of success.

(d) Most selected 'A' although a few failed to get the mark as they did not complete the comparison of input to output. A minority used the term 'efficiency' successfully.

Question 4 – High Demand

(a) Most students could suggest at least one difference between the two forms of respiration, most commonly 'it does not use oxygen'. In answers such as this the word 'it' should be used carefully by students; in this case the subject of the question is 'anaerobic respiration', therefore 'it' is appropriate; however some students reversed the answer 'it uses oxygen' and could not be credited, even if it seemed likely that they were referring to aerobic respiration. Students should be advised to avoid the use of 'it' (or similar terms) wherever possible in the examination. A second difference eluded many students, although they were being asked little more than to recall the equation for aerobic respiration, so 'not producing water' or 'not producing carbon dioxide' would have gained the marks. Relatively few students referred to energy release; of these some suggested, incorrectly, that 'no energy is released' anaerobically or disqualified their answers by referring to energy 'production / creation' rather than 'release'.

(b)(i) This question tended to be answered well only by more able students who knew that glycogen stores are converted into glucose. No details regarding glucagon were required as this is not on this part of the specification; however a few students did refer to glucagon and were credited, although in almost all cases they would have gained the three marks without the reference. Less able students often referred to glycogen but were unsure where it might be found or how it overcame the problem of providing glucose for the runner. Many students referred to 'starch' being stored in the body, only one mark being available in this case for the description of all the other marking points.

(b)(ii) Students struggled with describing what an oxygen debt is. Many were able to explain how an oxygen debt might be built up, 'inability to supply sufficient oxygen to muscles', and others how it might be removed, 'by breathing deeply after the exercise'. Thus only good students gained the mark, referring to 'the amount of oxygen needed to break down the lactic acid' and were able to secure the mark.

Question 5 – High Demand

(a) The tabular format of this question allowed students to synthesise their ideas more easily than if they had been asked to write a prose response. Inevitably some students mixed the two processes and reversed the numbers. Many were also unsure of the number of divisions or the number of cells produced in one complete division cycle and the most commonly correct answer was for the number of chromosomes in each daughter cell.

(b) A significant number of students did not know which chromosomes are to be found in males and females, often referring to males as 'YY', reversing male and female or appeared to believe that males have a single sex chromosome called XY. Those who stated that males are XY and identified the origin of the X chromosome gained both marks in a question that required little more than an understanding of how sex is inherited.

Question 6 – High Demand

(a) Students are expected to know the different ways in which fossils may be formed. Many students were able to give some details, such as the 'slow decay of bones' (which would have gained two marks) or the 'unavailability of the oxygen' in specific circumstances and thus gained marks. There were few succinct responses and examiners needed to read through a considerable amount of irrelevant or repeated information in order to locate the marks. Although it is debatable whether organisms trapped in peat, ice, amber or tar pits are actually fossilised, rather than being preserved, this idea was accepted and many students gained a mark for this.

(b)(i) The examiners recognised that the concept of rate of change of percentage of radioactive material remaining is a difficult concept and only the most able students approached the question in this way. However, the much less demanding approach, that more recent fossils will have 'a greater percentage / amount of radioactive carbon (than older fossils)' was given by many more students.

(b)(ii) Students needed to use the graph to determine that a time equivalent to 1.8 half-lives of radioactive carbon would have passed since the human died and then use the information that one half-life for this radioactive carbon is equivalent to 5730 years. The subsequent straightforward calculation resulting in '10 314' would have yielded two marks. A number of students misread the graph as 1.9 half-lives and were not credited. However as the question required an 'estimate', those students who used '2 half-lives' could gain one mark for completing the calculation correctly based on this value.
The great majority of students gained the very straightforward final mark for identifying the unit, 'years'.

(b)(iii) Students are expected to know that the earliest forms of life were 'soft bodied' or had 'no hard parts'. Only students who had a secure understanding of the appearance of the earliest organisms and the fact that they would probably have completely decayed, gained both marks. The as yet failure to find fossils of these early life forms was not considered to be sufficient as the question referred to there actually being very few fossils of them.

Question 7 – High Demand

(a) Writing this equation was better done than symbol equations in previous years, although this time the students were given O_2. Approximately half the students who wrote the correct symbols and formulae managed to then correctly balance the equation.
A few gave $H_2O_2 \rightarrow H_2 + O_2$ or reversed the equation so that the product was hydrogen peroxide.
An arrow had to be given; an equals or reversible sign was not credited.
A significant number of students who did not score any marks added additional items into the equation such as silver or energy.

(b) Some good answers were seen and just under half of the students gained at least two marks. Many students just made reference to 'more collisions' rather than an increased rate or likelihood of collisions. There was some confusion with activation energy and others tried to link smaller beads to an increase in concentration and explain the change in rate in terms of concentration.

(c) The idea of control variables is still poorly understood by students. Commonly seen were the 'temperature of water', 'volume of water', 'same time intervals' or 'size of apparatus'. It is evident that students still do not read the question carefully, as a significant number suggested the 'volume of hydrogen peroxide' even though this was given in the question.

(d)(i) Most students obtained the first marking point, usually by reference to a 'steeper gradient', 'faster reaction' or gas being 'collected faster'. However those who stated that 'more gas is produced', were not credited with a mark as there had to be some indication that the gas was being produced more quickly.
Fewer obtained the second mark, not realising the significance of reaching $100cm^3$ first. Other misconceptions were that lead (IV) oxide itself produced the gas.

(d)(ii) Although, essentially, a definition of a catalyst, many students failed to recognise this and answers were frequently vague and showed poor understanding. Just over a quarter gained one mark but very few were able to explain their answer to obtain the second mark.
Many students repeated the question or gave descriptions of end of reaction. Others suggested a link to controlling catalysts, limiting factors or using the same amount of catalyst.

Question 8 – High Demand

(a) Few realised the requirement for a large amount of electricity. Many students thought the aluminium was used in the power station. Others talked about carbon dioxide emissions or pollution whilst others mentioned high temperatures but did not link this to electricity.

(b) About a quarter of students gained one mark usually for a 'less energy required' type response.
Of those that did not obtain a mark, many students suggested that cryolite 'lowers the melting point of the aluminium oxide' rather than the correct idea that the 'mixture has a lower melting point' than the aluminium oxide alone. There were some very confused answers making reference to the electrodes or enabling the electrons to be free to move.

(c)(i) The correct answer was the one least often selected. Students did not recognise the need to balance the numbers of oxygen atoms or the charge values when selecting incorrect answers.

(c)(ii) Students who were able to link oxygen production to a reaction with the carbon electrode usually gave a good response. However there were many confused answers showing a complete lack of understanding of the process at the positive electrode and the wearing away of the electrode was often linked to the high temperature and large current involved.

(d) A very small minority of students gave excellent answers here but most found descriptions of this process difficult and there were many confused and muddled answers with technical terms such as losing / gaining, oxidation / reduction just being used in what almost seems to be random distribution. Some talked about aluminium being positive and a lack of understanding of how electrons move was evident.
A student who produced the equation, '$Al^{3+} + 3e^{-} \rightarrow Al$', could gain all 3 marks as all the marking points shown are within the equation. However a written answer would take precedence over the equation if there were contradictions.

Question 9 – High Demand

(a)(i) There was some confusion about the term 'nucleus' with some responses referring to DNA and chromosomes. About half the students identified a difference in the number of neutrons; a few gave numbers incorrectly, others lost the mark by including numerical references to protons as well. There was a number of responses referring to numbers of electrons.

(a)(ii) Some responses appeared to be related to what may have been given in (a)(i) eg referring the number of neutrons or 'genetic' in nature. There was a number of responses about electrons/atoms instead of referring to the subject of the question, 'the nucleus'.

(b)(i) This was poorly answered with only about a fifth gaining marks. There was little understanding demonstrated of standard form: many thought that about half the sun's mass was converted each year (10^{16} compared to 10^{30}). Other responses were about the hydrogen-helium conversion.

(b)(ii) Generally well answered although some 'red dwarf' responses were noted. Most students correctly identified 'black hole'.

(b)(iii) This part was very poorly answered. Some thought Earth was itself following a star's life cycle; others that 'red giant' were the stage involved, with the 'supernova' featuring rarely. When it did, this was not always carried through to the second mark.

Question 10 – High Demand

10(a) Half of the students gained marks here. The calculation was usually written out rather than in standard form. Some responses were incorrect due to errors in use of the standard form in which the question was phrased. Some inversions were evident as was the use of the 'triangle' to decide how to carry out the task.

10(b) Many students thought the metal strap conducted something electrical (voltage / charge / electricity / power) rather than recognising the heating effect.

10(c) This part was quite well done with most mark-worthy responses referring to reliability. There were some vague responses about safety with 'dangerous' a frequent response.

Question 11 – High Demand

(a) About a quarter of the students gave a mark-worthy response; this was often phrased as 'a helium nucleus'; some just stated that an alpha particle is the 'first type of radiation' or drew the alpha symbol.

(b) This part was not well done, with many non-numerical and vague answers; some numerical answers did not have units. The values given varied from those shown in the mark scheme to several miles. Others misinterpreted what was required and described what would stop the radiation rather than answering the question.

(c)(i) Most gained a mark relating to mutations or cancers. Despite the information in the stem of the question, there were responses about beta and gamma radiation and also a variety of ways that radon could get into the body including skin absorption or through the water supply as students did not recognise the information describing radon as a gas which would be inhaled.

(c)(ii) Although the majority of students scored a mark here, either for the second marking point (different levels in different rooms) or for producing an average, responses clearly indicated the lack of understanding of this topic. Very few recognised that radiation is random and few understood the implications of this in terms of marking points 3 and 4. Many were discursive on the accuracy of the data and the issues connected with one of the detectors being faulty. Many students suggested all the words they could think of related to investigations such as 'valid', 'accurate' or 'reliable'.

Mark Ranges and Award of Grades

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

Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.

UMS conversion calculator