GCSE
Additional Science (Route 2)

AS1FP
Report on the Examination

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General comments

Examiners continue to be concerned about a number of features that would enhance the marks students achieve but which would require very little additional effort on their part. These include avoiding leaving answer spaces blank and using rulers and calculators in appropriate places.

Students should also be reminded that simply copying out the information in the question is unlikely to gain marks and that they must 'add value' to what is given. In some questions this may involve as little as making comparisons, using terms such as 'greater' or 'less than'.

Examiners also noted the number of students whose writing was so poor that it was difficult to interpret. Simply, if the writing cannot be read, despite the best attempts of several examiners, then no marks can be awarded. Schools are reminded that it is possible to apply for a range of access arrangements for students, such as scribes or the use of a word processor.

It was evident that some students had started the examination well but, as the questions became more demanding, had lost impetus.

In this paper, large numbers of additional pages were used. Students should be reminded that they should answer in the spaces provided and that these spaces are considered more than enough to accommodate an answer, even if half of it is crossed out and replaced. However, should more space be needed, students should use additional pages and not continue answers into the margins.

Question 1

(a)(i) The vast majority of students correctly identified 'A' as the salivary glands.

(a)(ii) Slightly more students identified that 'E', the small intestine, was one site where digestion happens, than identified 'B', the stomach. Approximately two-thirds of the students gave at least one of these responses, with 'D', the large intestine, being a common error.

(a)(iii) Knowledge of the site of production of bile was less secure, with less than half of the students identifying 'F', the liver. The most common error here was 'C'; examiners suspecting that many of these students were unsure what organ C was and were similarly unsure what bile was, so logically put the two together.

(a)(iv) The examiners were pleased that most students recognised organ D, (the latter part of) the large intestine, as the site of production of faeces.

(b)(i) Almost all students were aware that movement would be due to a difference in concentrations of 'food' between the small intestine and the blood, thus very few selected the third alternative. Well over half of the students realised that there would need to be a higher concentration in the intestine than in the blood for movement to occur out of the intestine.

(b)(ii) 'Digestion' proved to be a powerful distracter here, with almost as many students selecting this as those who chose the correct 'diffusion'. This was disappointing, as the examiners might have hoped that most students would realise that food is not absorbed by digestion, or that digestion is a break-down process occurring within the small intestine; however, the examiners also realise that few students would use ‘diffusion’ in an everyday context. However, relatively few opted for ‘dilution’, which is perhaps a more well-known term in other situations.

Question 2

(a) A good proportion of students referred to either ‘respiration’ or ‘energy’, or to the idea that sperm cells need to ‘move’. Disappointingly, relatively few put these two ideas together. The examiners were not looking specifically for the importance of there being ‘many’ mitochondria; only for how the role of mitochondria was specifically useful in the function of sperm cells. A number of alternative expressions for ‘movement / swimming’ were acceptable, provided these conveyed the correct idea; thus ‘so the sperm can reach the egg’ was awarded the mark.

(b) The role of the cell membrane, either for ‘retaining the cell contents’ or to ‘control what can enter / exit the cell’ was not well known. Many students opted for the weaker ‘protection’ but this was not accepted unless there was some further qualification in terms of what it might protect from. A relatively small proportion of students confused the roles of cell membrane and cell wall.

(c)(i) A high proportion of students were able to correctly substitute the values into the equation provided and most of these had their calculators with them to arrive at the correct answer, ‘0.05’. The most common error was to reverse the values in the equation, whilst less successful students sometimes arrived at wholly unlikely figures, up to several hundred metres! Students should be advised that in all questions involving calculations, they should look at the result they achieve to decide whether it is feasible, as if not, they should then check their calculations.

(c)(ii) Students might have arrived at the correct answer to this question by one of two routes: either from their biological knowledge, or by comparison of their calculated figure in part (c)(i) with that given in the question. Consequently, examiners were willing to accept answers which were consistent with incorrect calculations. It was evident that most students had used their biological knowledge in this question as, even if they had made wildly incorrect calculations, they had still circled ‘smaller than’ here and despite the lack of consistency this response was also awarded the mark.

Question 3

(a)(i) It seemed evident to examiners that some students had not used quadrats as a means of sampling populations. Even those who seemed to have done often struggled to express their ideas coherently. With seven possible marking points for the four marks available, examiners had hoped for a better response. Many students did refer to ‘randomness’ and often explained how this would be achieved, a wide variety of methods being accepted for this. The need to ‘repeat’ was also often seen. However, having all three of these fairly straightforward ideas in a single answer was by no means common. Examiners were disappointed that relatively few students referred to the need to carry out quadrating in the two areas or even the need to count plants within the quadrat. Even basic descriptions of how the total number of plants could be determined from the samples were uncommon.

(a)(ii) An understanding of why values were only estimates was reasonably well known, with most of those who gained the mark doing so by explaining that not all areas had been sampled or not all plants counted. Less common was the idea that it is relatively easy to miscount or misidentify plants.

(b)(i) Some students confused the information in the graph, describing the plants themselves as being walked on or not. Thus neither 'plantain is more walked on than not walked on', nor 'dandelions are more not walked on' gained marks. Students were required to identify the differences in fairly simple, but comparative, terms, such as 'the walked on area has more plantain' or 'there are more dandelions in the not walked on area'. Some students included descriptions of the distribution of daisies in their answers, clearly having misread the question; however, these were ignored. Having said that, overall a good proportion of students gained at least one of the marks available.

(b)(ii) This was poorly answered. Students were asked to suggest reasons for the difference in distribution of different species. Very few referred to the effect of walking / trampling. Those students who did gain this mark often referred to physical factors such as differences in light, although students should be aware that 'sun' is not an acceptable term at this level.

Question 4

(a)(i) This question was very poorly answered, with the correct response, 'giant structure' being the least commonly selected of the three alternatives. The most commonly selected distracter was 'covalent structure', but even the suggestion that silver is a simple molecule was much more often chosen than the correct answer.

(a)(ii) A large proportion of students referred to the diagram of atoms in silver metal to help them in their response, but then only gave a description of the structure, such as 'same size atoms' or being 'tightly packed', rather than using the diagram in an explanation, as was required. Others gave a general account of properties such as being 'malleable' or 'dense'. Some students tried to explain in terms of electrical conduction and described a 'delocalised' structure. The relatively few students who gained credit obtained marks either by referring to 'layers' or the 'atoms sliding over each other'.

(b)(i) Most students were able to interpret the data given in the question to name silver as the best conductor.

(b)(ii) This was well answered, with students being able to interpret the data given in the question to give comparative answers. In the second part, it was recognised that aluminium was not as good a conductor as the other metals, although the suggestion that aluminium does *not* conduct electricity was not accepted. In the first part, the reason why silver was not used in electrical wiring was slightly less well answered, with incorrect responses usually replying in terms of reactivity. However, comments such as 'silver is too good a conductor', or 'might be dangerous' as a consequence of this, were by no means uncommon.

Question 5

(a)(i) Although the majority of students identified methane as 'a compound', considerably fewer were able to describe methane as a 'simple' molecule. The most common error was to describe methane as a 'polymer' and as 'an element'.

(a)(ii) Those students who did not obtain the correct formula for methane either invented a symbol such as 'Me', gave responses such as 'C + H', or did not write the subscript correctly, giving answers such as 'CH4', rather than CH_4. It should be noted that 'H_4C' was also accepted, as, although unconventional, this showed the correct understanding. A number of students used lower case letters for the symbols and these were not accepted. A significant number of students failed to make any attempt at this question.

(a)(iii) A little less than half of the students correctly identified the particle represented by the symbols as an 'electron'. A wide range of other suggestions was given, notably 'proton' and 'neutron', but a considerable number offered responses that were not sub-atomic particles, such as 'oxygen' or other elements, along with 'molecules' and 'atoms'. Again, a significant proportion of the students could not offer any suggestions.

(b)(i) Although the majority of students correctly identified 'covalent' as the bond holding the atoms in methane together, ionic proved to be a very attractive distracter.

(b)(ii) This question appeared to confuse a very large proportion of students, with the correct answer of '-161^{o}C' being selected by fewer than twenty per cent of students. The majority selected the boiling point of water, presumably through their over-reliance on casual descriptions such as '100^{o}C is boiling point', rather than the addition '… of water'. Those who selected either of the distracters apparently had little concept of the consequence of boiling on the physical nature of materials.

(c) Students again found this question very demanding and the majority merely repeated the information they had been given: that 'methane is a gas', that 'gases do not conduct electricity', or that 'methane is not a metal'. The examiners were looking for something beyond this, in terms of the lack of charge, having 'no ions' or 'no delocalised electrons'. Those few who did gain the mark usually did so by referring to the last of these.

Question 6

(a) A variety of incorrect approaches was seen. One common mistake was to add the relative atomic masses of nitrogen and oxygen, to obtain 30, before then correctly using the supplied equation to divide the total by 44. Others were unable to substitute correctly or obtained an answer of '275' by inverting the formula provided. Those students who at least used the correct method but made one mathematical (rather than scientific) error or omission were awarded one mark. Students should be reminded to clearly show their working for all calculations. Examiners are able to award some of the marks for correct methods with incorrect answers, but can only do this if they can see the method.

(b) The majority of students correctly circled '44g' here, both distracters being equally attractive.

Question 7

Examiners became aware that this area of the specification had not been well revised by many students.

(a) The correct answer, 'tangled', was selected by only one in seven students, with the great majority opting for 'cross-linked'. Indeed 'rigid' was selected by almost as many students as those who gave the correct response.

(b) Only just under a quarter of students suggested (thermo)'setting', with a considerable range of other suggestions, along with a significant proportion who could make no suggestions.

(c) To examiners marking this question it appeared that many students were simply selecting their answers from the list provided at random, although marginally over half the students did manage to select the two correct answers.

Question 8

(a) Well over half the students matched all the components with the correct circuit symbols. The components that caused problems for some were the diode and the fuse, where they usually chose the symbols the wrong way round. The cell symbol was selected only a small number of times for the diode and fuse.

(b)(i) This was poorly answered with a high proportion of students failing to gain marks, believing that an increased resistance will increase the ammeter reading and increase the brightness of the bulb. Other popular combinations were that there would be a 'decrease in the ammeter reading' and an 'increase in the brightness', or vice versa.

(b)(ii) This question was missed out by a third of students, presumably because there were no answer lines to guide them to the question. It is good practice to encourage students to always check the marks allocated for each question. A high number of those who did offer an answer circled the correct point at '0.6V'. A few circled the origin or the point at 1V.

(b)(iii) Many students gave an answer which indicated a misreading of some sort, although there were many ways in which they articulated this. A few mentioned the idea that the circuit could have been faulty in some way. Those who did not gain the mark usually had misunderstood the question and attempted to suggest how they knew it was an anomaly, for example, 'it doesn't fit the pattern'. Others tried to describe something that could have affected the experiment like the 'amount of resistance' or the 'number of volts'.

(c) Despite these graphs coming directly from the specification, the examiners were really disappointed with the very large percentage of students who did not attempt an answer and of those who failed to correctly identify the components. Some, unfortunately, had 'resistor' for component 2 instead of 1. 'Bulb' was quite a popular incorrect component. There were many answers that were not component names, perhaps because these students had not fully grasped the meaning of the term 'component'.

Question 9

(a) Around half of the students knew that the resultant force on the rocket before take-off was 'zero'. The most common distracter was that the resultant force was 'large', probably due to thinking a rocket needs a large force to take-off and not knowing the meaning of 'resultant'.

(b) This question was well answered with a good number of students obtaining full marks. Those who did lose a mark did so because they selected the incorrect unit. The most common unit chosen was m/s. It was certainly evident that the majority of students had calculators, but a few did enter the wrong number of zeros. However, they still attained one mark for the correct substitution of values into the equation. A few used the incorrect format for the equation of $F = ma$ and then simply multiplied the two numbers they were given in the question.

(c) Disappointingly, only half the students knew that frictional forces increase when the speed of the rocket increases. 'Decreases' was a popular distracter.

(d) The examiners were pleased with the fact that three quarters of the students gained full marks for this calculation. A few substituted correctly but then missed a zero from one of the values when they evaluated the answer using their calculator. Surprisingly, there were quite a few who did not attempt this question despite having the Physics Equations Sheet to hand.

(e) The majority of students gave at least one sensible suggestion as to why the rocket needs to have zero velocity when connecting to ISS, often expressing their answer in terms of ‘crashing’ or ‘damage’. However, there were quite a few who confused the scenario with the rocket taking off or landing.

(f) A high number of the students believed that the cost of the ISS was justified in terms of ‘scientific research’ or ‘new discoveries’. Those who thought it was not a justified cost did not answer as well and gave vague suggestions, such as ‘because it costs too much’. A few misunderstood the question and said the cost wasn’t justified ‘because it shouldn’t cost that much’ or ‘because it costs a lot to maintain’.

Question 10

(a) A high percentage of students were able to correctly identify a control variable in this investigation. Most of these elected to offer ideas referring to the alginate beads and there were very few references to factors that might affect the rate of photosynthesis in general, such as ‘temperature’. The most common error was to indicate that ‘light (intensity)’ would be a suitable control variable, possibly as a result of poor reading of the information which showed clearly that light intensity was the independent variable.

(b) ‘Oxygen’ was correctly circled by the majority of students. As might have been expected, ‘carbon dioxide’ was the more favoured of the two distracters, with relatively few selecting ‘nitrogen’.

(c)(i) Students did not find this such a straightforward question. Many simply described the effect of increasing light intensity on time, rather than linking this to the rate of photosynthesis and oxygen production, hence usually limiting them to just one mark. It should be noted that an incorrectly named gas in part (b) was accepted here to avoid a double penalty. Of those students who did describe the relationship between light intensity and the rate of photosynthesis correctly, only the most successful students went on to explain that more oxygen would be produced as a result of the increase in rate. Examiners were surprised at the number of students who believed that the graph showed an increase in light intensity, causing a decrease in the rate of photosynthesis. As previously, students should consider what they are planning to write before they commit pen to paper, or at least read through answers once written, to check whether they do indeed make sense.

(c)(ii) In this question examiners were looking for some understanding of the idea of limiting factors. Responses were very varied but, except in a very small number of cases, incorrect. Students were expected to recognise that beyond a certain light intensity, the rate of photosynthesis did not increase, and to suggest a reason for this. Unfortunately, most students suggested that at this point photosynthesis ‘had stopped’ or, slightly better, ‘could not go any faster’.

(d)(i) In terms of advantages, most of the students who made sensible suggestions went along the route of *Chlorella* being ‘easy’ or ‘quick’ to grow, with very few making any of the alternative points shown in the mark scheme.

As disadvantages, many referred to the possibility that Chlorella might lack specific nutrients, such as vitamins / minerals, or provide insufficient energy.

In both of these parts the examiners were willing to accept fairly vague references to the correct ideas, as students had been asked to speculate on possible advantages and disadvantages.

(d)(ii) Despite being told not to include food in answers, many students ignored this instruction, thus eliminating any possibility of a mark being awarded. Even so, a reasonable proportion of students suggested either 'oxygen production' or 'use in research' of various kinds.

Question 11

(a)(i) Few students were able to fully interpret the chromatogram, although a significant number gained one mark for ideas relating to differences in the spots. Here the most common correct response was to describe differences in 'colour' or 'shade', whilst some gained a mark for describing differences in 'position' on the chromatogram. Relatively few realised that red food colouring, B, had 3 dots. Many students realised that there were differences but then linked their response to different size or shape of the spots, which were ignored as irrelevant in terms of chemical analysis of the food colourings.

(a)(ii) Interpretation of the chromatogram was weak, with few realising that B *contained* Allura Red, many suggesting that B was entirely Allura Red, although this was accepted. Those who did obtain the mark often answered in terms of possible 'allergies' or 'harm'. The most common incorrect responses were that the unsuitable food colouring contained 'too many e-numbers', featured an 'unknown chemical' or had 'different colours and therefore high sugar / acid levels', rather than using the information provided at the start of the question.

(b) Approximately half the students gained at least one mark, usually for reference to being 'more accurate' or 'quicker'. Responses that weren't creditworthy included being 'more reliable' or giving 'clearer / better results'. Once more, a relatively high number of students offered no suggestions and it might have been worthwhile for these students to consider why anyone might choose one method over another in any situation; many of these could have speculated that being 'quicker' would be a reasonable suggestion.

Question 12

(a) Achievement on this question was equally spread across the range of marks. The use of the key in the periodic table on the Chemistry Data Sheet would have helped many students to determine the proton number for the two isotopes. Similarly, the mass number could have been determined by reference to the data sheet, although this would require students to recognise that mass number and relative atomic mass are the same. Had students done this, then they should have been able to derive the number of neutrons in the isotopes. It appeared that relatively few students made use of the data sheet here. Determination of mass number for the two isotopes could have been achieved by two routes, both of which were accepted by examiners. Either the values '59' and '60', derived from the symbols, or the addition of the (incorrect) proton and neutron numbers the students had given in the table. Thus students were not penalised for making a logical deduction albeit from flawed answers.

(b) Many students realised that the use of a symbol informed customers that cobalt-60 had been used in the preparation of foodstuffs. However, a large proportion believed that the use of radiation from the isotope meant that the 'food would be radioactive', thus the label was telling customers 'not to eat it'! Others thought that the radiation in the food would interfere with radiation treatments for diseases such as cancer. Thus relatively few students gained the second mark for the idea that knowing the food had been irradiated allowed customers to make their own choice whether to eat / buy it or not.

Question 13

(a)(i) The examiners were disappointed on the whole with the answers given to this question. The students were required to answer in terms of 'distance', but the majority answered in terms of 'time'. Students need to use the specification in order to learn the definitions of certain terms, which are made clear there. Some students answered the thinking distance in terms of time, but then managed to secure a mark by answering the braking distance in terms of distance. There were a few that tried to answer in terms of distance, but were too vague, for example, 'braking distance is the distance needed to stop' without further qualification.

(a)(ii) Although this presented a graph that the students would not have seen before, the question was answered well by a large number of them. If they did get the thinking distance incorrect, there was still an error carried forward mark available if they made sure that their value for thinking and braking distance added up to the total stopping distance of '110'.

(b) Many students knew a range of factors that affected either thinking distance or braking distance. The majority of students were able to name the factors and their effects on stopping distance, or name factors and an attempt at an explanation. This meant that there were a good number of students who achieved at least a Level two response. However, what prevented most from moving from Level two to Level three was that they struggled to articulate how each factor affected the stopping distance and then give a coherent explanation. For some, if they did know the connections between factor, effect and explanation, they then limited their total maximum mark to four by talking about 'time' throughout, instead of 'distance'. Question (a)(i) was intended to help clue them to this, but unfortunately that question was answered incorrectly by the majority of the students. If students only achieved a Level one response, this was mainly because they knew the factors but were too vague about their effects on stopping distance, for example, 'alcohol will affect thinking distance'. A few students had not read the question properly and described the meaning of braking and thinking distance.

The majority of students gave alcohol, drugs, fatigue and distractions as the factors that affect the thinking distance. It was interesting to see the number who wrote about 'children in the back of the car' being a distraction, or 'talking on the phone'. Few students recognised that these factors increase reaction time. Many wrote that they 'slow down reaction time' which was not worth credit; however, others wrote 'slows responses / reactions' which was creditworthy.

A few students incorrectly thought that visibility (fog / rain / glasses) had an effect on thinking distance.

Condition of tyres and brakes, ice and rain on the road, and speed of the car were the main factors mentioned with reference to the braking distance. Many discussed the effects of rain / ice on the road in terms of 'skidding' or 'not being able to stop', but did not go into any detail in terms of friction between the tyres and the road, or say that the braking distance would increase.

The majority of the students failed to organise their answers into a clear, logical order and this is certainly an area for practice for future papers. Common misspelt terms were tyres, brakes and alcohol.

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 www.aqa.org.uk/umsconversion