GCSE

Additional Science (Combined)

AS2FP

Report on the Examination

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Additional Science Paper 2 Tier F Examiners' Report June 2014

General

Inevitably there were some students who would have been better off taking the Higher tier paper as, on the evidence of their performance on this paper, they could well have achieved a higher grade.

Students should be reminded of the need to arrive at the examination properly equipped; a pen (preferably one which delivers dark black ink, rather than the greyish tones seen in many), a ruler and a calculator.

Question 1

(a)(i) Many students provided some information about fossils, either describing what they were or explaining the time scale involved or the material of which fossils are formed; however fewer than half gave both ideas from both marking points in their responses. It was commonly, incorrectly, believed that fossils are bones or shells rather than being imprints of these structures (in rock). Some students also failed to indicate the extent of the time scale, referring to 'the past' which could imply just a few years or even less, which the examiners did not accept.

(a)(ii) Many students realised that the skin is a soft tissue and as such does not fossilise, or gave the converse of this idea that only hard parts form fossils. Rather weaker responses were also accepted, as shown in the mark scheme, however the by no means uncommon response that the photographs taken of *Ichthyostega* were only in 'black and white' showed a poor understanding of either the time scale involved or the relatively recent evolution of man (and of the invention of photography).

(b)(i) A good majority of students realised that 'Tetrapods' have evolved from *Ichthyostega*.

(b)(ii) A low proportion of students secured this mark. Students should be familiar with evolutionary tree diagrams such as this and recognise that the divisions in the lines represent the time at which the organisms evolved. Thus *Ichthyostega* evolved approximately 395 million years ago. Many of those who did recognise where to take the reading then misread the scale, giving values slightly above 400 million years.

(b)(iii) This was well answered, with a large majority of students offering the correct answer '*Elpistostege*'.

Question 2

(a)(i) Relatively few students were aware that cell division provides more cells for 'growth', with many simply stating that cell division created 'more cells'.

(a)(ii) Although many students could identify the long strands of DNA as 'chromosomes', many others could not. 'Genes' was a not uncommon insufficient response, although many could not offer any suggestion.

(a)(iii) Given the choice of the three alternatives, more than half of the students correctly identified 'mitosis' as the process that the dividing cells were undergoing.

(b)(i) Acceptable definitions of 'variation' were frequently provided; these often included the term 'differences'. Weaker students often only gave answers such as 'a variety' which were not accepted.

(b)(ii) Around three-quarters of students gave three correct responses here and most of these went further, gaining all four marks available.

Question 3

(a)(i) Examiners were please that a high proportion of students recognised that the decline in starch concentration in the food showed that starch is digested in the small intestine. A few students chose to add further information about the stomach but this was ignored.

(a)(ii) Almost all students were aware that the ‘salivary glands’ produce the starch digesting enzyme found in the mouth.

(a)(iii) The majority of students knew that ‘sugar’ is produced in starch digestion. Relatively few gave the alternative ‘glucose’.

(b)(i) This area of the specification was not well known by students and only little more than a third gave the correct answer ‘isomerase’. This may be because both ‘lipase’ and ‘protease’ are more well-known and appear in the specification in both the industrial uses of enzymes and the digestive system.

(b)(ii) Two marks could be gained by describing the data shown in Table 1, that the ‘energy content (per gram) is the same’ in fructose and glucose and that fructose is ‘sweeter’ than glucose. Most students gave one of these and well over half gave both. A third mark required some analysis of this information in terms of the advantage of using fructose, rather than glucose in slimming foods. References to ‘less being needed’ to provide the same overall sweetness, so that food would contain ‘less energy’ were needed here. A small number of students gave both these ideas, showing clear understanding, but a reasonable number gave one of them.

Question 4

(a) Most students gained at least one mark here, usually through recalling that ammonia is alkaline. The least frequently correctly answered part was the use of ammonium nitrate in fertilisers.

(b)(i) Most students were able to analyse the graph to obtain the temperature decrease mark. Just under half then went on to describe the temperature as remaining constant. However few gave responses relating to the temperature decrease being at a decreasing rate. Those who didn’t match marking points often just quoted figures from the graph without adding any value.

(b)(ii) Most students gained a mark through the realisation that their leg would feel cold, occasionally with varying descriptions of this such as numbness. Few though followed the instructions to write in terms of ‘energy change’ for the explanation with many referring to the temperature changes seen on the graph. Others who did write in terms of energy often thought that the energy went from the pack to the leg or that the bag produced ‘cold energy’. Some who tried to give more detail often gave an amalgamation of exothermic and endothermic reactions in their explanation, for example by saying that it was a ‘endothermic reaction’ because the bag ‘gave out energy’.

Question 5

(a) Just over half of the students knew that ‘(aq)’ represented a solution, although ‘(s)’ was a very commonly selected distractor.

(b) Just under half of the students were able to correctly work out which line would be obtained with a greater concentration of hydrochloric acid, although many gave the distractor which not only increased the speed of the reaction but also produced a higher volume of gas with the students not appreciating that the acid was in excess.

(c) The mark was usually gained by reference to the volume of acid or number of tablets. Incorrect or incomplete answers often referred to the volume of gas collected or made reference to the water in the trough or very commonly to the time taken. Others were unclear in that they referred to the ‘same tablets’ or ‘same solution’ giving the impression that the same tablets were used throughout the investigation.

(d) Just over a quarter of students gained both marks recognising that the tablets had to be chewed for faster relief so that they were in smaller pieces and have a larger surface area. The most common distractor was that the tablets would have more energy.

Question 6

(a) Most students correctly answered that the rate of reaction would increase if the pressure increased though a few thought that this would lead to an explosion.

(b) Just over half of the students gained both marks. Nearly all knew that catalysts are used to increase the rate of reactions, although the use in industrial processes to reduce costs was less well known. Many of the incorrect responses were that catalysts are used to make more reactants displaying a lack of scientific understanding of chemical processes.

(c) Students found it easier to gain the advantage mark through the idea of a faster reaction. The students found the disadvantage mark harder to obtain in that they were often able to select a disadvantage in that the catalyst was poisoned or lasted two years but then either did not compare or did not add value to the information provided, just giving a bald statement such as ‘platinum lasts 2 years, vanadium oxide lasts 5’; whereas the addition of ‘only’ in a suitable place would have allowed the mark to be gained.

Question 7

(a)(i) Just over two thirds of the students correctly identified that silver nitrate is used in solution so that the ions are free to move. The most common distractor was that the silver ions were solid particles.

(a)(ii) Generally this was well done with all the mark point answers seen. Some students thought it was the silver electrode which was attracted.

(a)(iii) Just over half of the students knew that silver ions gain electrons at the negative electrode, with losing electrons being the most common distractor.

(b) A common incorrect answer was ‘48’g with students following the pattern shown at the positive electrode of a loss in mass rather than appreciating that the silver lost from the positive electrode would transfer to the negative electrode.

Question 8

(a)(i) The vast majority scored at least one mark by recognising the first row referred to the proton. Over half of the students were awarded full marks for also getting neutrons and electrons in the right order.

(a)(ii) A very high number of students scored one of the two marks for correctly giving the number of protons as ‘11’. However, the second mark eluded many, perhaps thinking there shouldn’t be two answers of the same value, quite a few put ‘12’ which would have been the number of neutrons.

(b) This question was answered very well. Incorrect answers were either ‘proton’ or ‘electron’.

Question 9

It is worth reminding students that parts of questions tend to follow on from each other and information given in one part can help them in a later section. This question gave a story about an experiment culminating in the identification of the type of nuclear radiation under test. Unfortunately the majority of students failed to realise the connections.

(a)(i) Just over half of the students were awarded this mark. The most frequently chosen distractor was that the temperature in the room changed the background count. This may have been due to the number being similar to room temperature values.

(a)(ii) A very high proportion of students calculated the mean value correctly. The main errors made were due to incorrect use of the calculator e.g. 16+18+20/3 = 40.7. There was no mark for working in this question.

(b)(i) This question was answered quite well with students knowing the correct safety precautions. 'wear safety goggles' was the most popular distractor and seems to be the fall back safety procedure in every experiment in science! There were a few who only ticked one box despite being instructed to tick two.

(b)(ii) Very few spotted that the anomalous point was about twice the height of the other readings around this point meaning the teacher had not reset the counter to zero. The majority of students believed the G-M tube had moved during the experiment.

(b)(iii) This was not answered particularly well as the students seem to struggle to understand the graph. A high proportion gave an answer of '10cm' as this is where the graph ended. Others quoted figures from the number of counts rather than the distance. The students calculated the average background count in part (a)(ii) so the examiners were hoping this would also help them realise when the graph reached 18 and then stayed constant.

(c) The students had quite a bit of work to do to answer this question, they needed to apply their knowledge of the properties of radiation to the data they were given. They had to identify the nuclear radiation was 'alpha' as it was stopped by both paper and aluminium. However, if they incorrectly identified the radiation but interpreted the data correctly then they were given the reason mark, essentially to award those students that mis-named the radiation but understood the data. Despite calculating background radiation earlier in the question many did not realise that the counts remaining after the material were due to background radiation and this led many to believe it was gamma as it was neither stopped by paper nor aluminium. The examiners thought this was worthy of one mark in total given their interpretation of the data and knowledge of gamma, however their reason had to match the data so vague answers like 'gamma can penetrate all materials' was not creditworthy. Those that did write alpha tended to have no reason or the correct reason of being stopped by paper. Those that put beta usually scored zero as they said that beta was not stopped by aluminium.

Question 10

(a)(i) The specification statement for what happens to the fuse wire is 'melts' and many gave this as their answer. 'Blows' is typical term people use in an everyday way to describe what happens when a fuse wire melts and the examiners accepted this, at this level. However, a few students thought the wire would 'explode' or 'set on fire' which were not accepted. Some did not read the question in that their answers said what happens to the circuit i.e. 'disconnects' rather than what happens to the fuse wire. These answers were not worth credit.

(a)(ii) To gain credit here students had to identify that the 'circuit breaks' or the 'current stops flowing' or that the 'circuit is incomplete'. This was answered quite well.

(a)(iii) Students had three ways to get the mark for this question, but only just under half of the managed to score. Generally students gave answers of 'no electricity to the heater' or the 'circuit is broken'. However, there were a number who suggested that the earth wire takes the current from the casing, which though it is technically correct the answer is about after the fuse has melted.

(b)(i) The vast majority of students identified that the aluminium toaster needed an earth wire and a high number also correctly chose the steel washing machine. The other two appliances proved to be attractive distractors to a number of students.
(b)(ii) Just over two-thirds knew that double insulated appliances don't have an earth wire. Each of the distractors proved equally attractive.
(c) This question was not answered particularly well. There were many answers of 'doesn't need to be replaced' which the examiners thought was not worth credit as this does not give an 'advantage of using an RCCB'.

Question 11
(a) The majority of students gave at least one of the correct responses, 'water' or 'carbon dioxide', more often the latter. Some of the incorrect answers simply repeated the reactants. A number of students made no attempt to answer this question.
(b)(i) Having been provided with the required equation, most students were able to complete the calculation, arriving at '2400'. Answers were accepted either on the line provided or in the table, with the former taking precedence if different answers were given in the two places. Again, too many students made no attempt at this, perhaps having not read the information and seen the equation, or maybe not having brought a calculator to the examination.
(b)(ii) Many students used their answer to part (b)(i) to calculate the volume of blood flowing to the muscles, arriving at the correct answer '1392'. Those students who had given the wrong answer in part (b)(i) could still gain both marks here, provided they used their answer to part (b)(i) in the correct way.
(b)(iii) This part proved to be more demanding; however there were many possible ways to gain the four marks. Many students appeared to believe that free-divers could breathe under water and that their training had allowed them to do this. Examiners expected that a repetition of Figure 22 would be recognised by students as giving some guidance as to how to gain some of the marks. Simply stating the changes in blood flow from rest to during the free-dive would provide two of the marks, i.e. that there is 'increased blood flow to muscles' and 'decreased blood flow to other organs'. Some students suggested that there would be decreased blood flow to all organs, which is incorrect. The question also reminded students to refer to respiration but students, having been given the equation for anaerobic respiration, often failed to compare this with aerobic respiration they had been given in part (a) or should have learned in their revision. Good comparisons could have generated up to four marks. The information referred to 'larger lungs', however simply repeating this information was insufficient to gain credit, but adding to this just a little to describe more 'oxygen' being taken into the lungs would gain credit.

Question 12
(a) Students found it difficult to extract the correct reactants and products from the information. A number started with carbonated water, with others giving this as the product. Citric acid commonly appeared as a reactant, with carbon and oxygen also quite common. The question asked for a word equation and although correct formulae were credited many who went down this route gave incorrectly written formulae such as CO^2 and consequently lost the mark
(b)(i) Students usually made the link that pH 4.1 was acidic and gave citric acid but were often not able to make the link to the information given to answer carbonated water.
(b)(ii) Very few correctly answered the question with a random array of answers mainly from the ingredients being seen, most of which were not ions.

Question 13

(a)(i) Little more than a third of students correctly answered that copper oxide is a base, with the other two distractors being used roughly equally.

(a)(ii) 'Sulfur' was a frequent incorrect response, as was 'citric acid' with students focussing on the information given in the previous question to give this response.

(b)(i) References to the insolubility of copper oxide were the most common correct response. Incomplete answers contained references to copper oxide not reacting with acid but not an understanding that the copper oxide was in excess, so that no acid would remain to react with it.

(b)(ii) Although many good descriptions of the crystallisation process were seen, few mentioned the initial filtration process. Of those who did, weaker students often referred to the equipment as a sieve. Others just repeated the information given in the question or gave incomplete responses.

Question 14

(a) This was poorly answered. The students needed to include 'nuclei' in their answer and unfortunately many wrote about the joining of atoms or particles or named subatomic particles. A few repeated what they had already been told or said that it 'produced energy'. Some mixed up fission for fusion or discussed fusion within stars. There were a number of answers mixing up this with some kind of chemical reaction.

(b) The students either knew this answer, or they named another part of a star's lifecycle.

(c)(i) Students needed to mention mass in some way and not just 'bigger' or 'smaller'. They had to refer to the effect on time or imply it, but not 'lower life cycle'. The majority of students answered this well. It is worth reminding students that when they are giving answers about data in tables that not only does their answer match the data but also that it makes scientific sense. So an answer 'the shorter the stars life cycle the bigger the mass' would not gain a mark even though it fits the data as the idea that life cycle time has an effect on mass is incorrect. There were a few students who tried to make a conclusion about a particular star e.g. 'Star J is the …..' rather than discussing the data as a whole.

(c)(ii) There were many vague and trivial answers to this question. The estimated times for the life cycle were millions of years so they idea that no one was around to see a complete life cycle was too weak to be awarded a mark. Many mixed up the idea of an 'estimate' with 'mean' and gave answers about variations in star data, e.g 'the star's mass varies'. If the students had asked themselves why they made guesses about something then their ideas may have been better. A few did mention 'too long to measure' or 'lack of evidence'. However 'no evidence' was not worth credit, as there is some evidence.

(d) The mark scheme seems like a long list of points they have to mention and many of them are not specific points on the specification. However, these are points which were worthy of credit and were seen in some students' responses. Each point represents an idea and how well the students express their ideas scientifically will lend more weight to its creditworthiness.

Just under a quarter of students did not attempt this question. It is difficult to ascertain whether this was because they ran out of time or simply could not offer anything from their revision.

The majority of students only attempted to describe the process of nuclear fission. This by itself only allowed access to Level 2 by failing to describe how the energy is then used.

The majority of the students knew that fission involved some kind of splitting, but struggled to articulate what caused the splitting and what actually split. The use of 'atom', instead of 'nucleus', was allowed once as a full credit idea, as was 'particle' instead of 'neutron'.

Many were good at explaining the idea behind a chain reaction.

Those that did try and attempt to explain how the energy was used gave vague and poorly sequenced ideas. The process of how the energy is used is highlighted in a sentence at the beginning of section P2.6 in the specification and it is worth remembering these sections are as important as the individual content sub sections.