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GCSE
Additional Science (combined)

AS1HP

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 many of the questions 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)(i) Identifying ‘diffusion’ as the process should have been a fairly straightforward start for most students. Despite this a significant minority managed to find it more difficult than it should have been.

(a)(ii) Students are expected to know that substances move from an area of higher concentration to one of lower concentration. With this in mind, it should have been possible to identify the difference in concentrations of particles inside and outside the model cells and so recognise that cell A had a greater concentration outside the cell than inside it, thus oxygen would have passed into this cell more quickly than into any other of the cells. A significant number of students were unable to do this.

(a)(iii) Those students who had identified the wrong cell in the previous part struggled in their explanations here and very few of these gained any credit. Even those who had selected the correct cell often phrased their response here in terms of *number* of oxygen molecules, rather than concentration, which the examiners did not consider sufficient to gain the mark. Those students who described the general principle of diffusion were also credited, thus those who had given the wrong answer in part (a)(ii) could gain the mark here.

(a)(iv) This was correctly answered by many students, although there were a number who lapsed in vague suggestions regarding 'movement', which was considered to be insufficient as the question was about cells, rather than whole organisms.

(b) Most students demonstrated a good understanding of the hierarchical organisation of cells, tissues, organs and organ systems. It was possible to gain high marks by writing relatively little, provided what was written was well-focused. However, it was by no means uncommon for students to extend their answers onto additional sheets as they described every example of tissue, organ and organ system they had ever come across in their studies.

To gain level 1 it was only necessary to give an example of one of the levels of organisation, such as 'the heart is an organ' or to describe a level of organisation, 'a tissue is a group of (similar) cells'.

Level 2 could be achieved by extending responses to include either both a description of a level of organisation along with an example, 'leaves are organs and contain several different tissues', or describe at least two levels of organisation or give examples of structures from two different levels.

Many students achieved level 3 by describing levels of organisation and giving examples of structures from those levels. However in order to gain all 6 marks students had to fully answer the question, which required examples from both plants *and* animals. A number of students gave excellent answers but restricted their examples to only animals and could not therefore be awarded full marks. It was only necessary to give one example from plants somewhere in the answer, along with the more familiar animal structures in order to gain full marks, provided the other requirements for level 3 had been met.

Students were generally well-versed in the names of tissues, regularly offering 'epithelium' and 'muscular tissue' in animals and 'epidermis' in plants. There was relatively little confusion between epidermis and epithelium. Names of organs were much more familiar to students, the most common being 'heart', 'kidney' and 'brain' in animals and 'leaf' or 'root' in plants. There was occasional confusion here, between 'a muscle' which is an organ (as it would contain tendons and blood vessels), and 'muscle' which is a tissue. The 'digestive system' was by far the most frequent example of a system in animals but students struggled more with an example of an organ system in plants, as these are much less well-defined; 'the flower' or the 'root system' would have sufficed.

The Quality of Written Communication component of this question rarely posed any problems for students. Students appeared to have made a special effort to use good English, spell and punctuate properly and paragraph their work. In almost every case, therefore, the level of scientific knowledge and understanding was at least matched by the QWC component and no marks for scientific content were amended.

Question 2 – Standard Demand

(a)(i) Approximately a fifth of students managed to obtain both marks. For those who obtained only one mark the proton mark was more likely to be correct. Charges were quite often seen with students not appreciating that only the relative mass had been asked for. Common incorrect values for the proton were '17/35' or quite often '7', where the students had counted the electrons from the energy level diagram given in the question.
For electrons a relative mass of '0' was not accepted, and answers such as 'smaller than 1' were not considered sufficient. Occasionally the fractions given on the mark scheme were seen.

(a)(ii) The term isotopes was well known.

(a)(iii) Most students knew how to determine the number of neutrons in a chlorine atom from the given mass and atomic numbers.

(b)(i) 'Covalent' was well known as the type of bonding in a chlorine molecule.

(b)(ii) A significant number of students did not attempt the question, though the great majority of those who did obtained both marks. The examiners suspect that some students failed to notice the question in their rush to add answers to lines on the paper.
Usually if a student correctly added the shared pair of electrons they were able to carry on and complete the diagram. Most students followed the instructions to only complete the outer energy level though some were seen with a correctly drawn complement of electrons in the correct energy levels.
The first mark was for a shared pair of electrons. The electrons could be represented in any combination of dots, crosses or e^- and did not need to be in pairs. The 2 electrons constituting the shared pair needed to be within in the overlap or on the overlap lines of the outer shells.
To gain the second mark the structure had to be correct, with the correct number of electrons in the correct place. The addition of brackets around the molecule was ignored but if any charges were shown then the second marking point was not awarded.
As crosses had been given on the diagram most students used crosses throughout with just a few attempting to differentiate between the different atoms by using dots.

(c)(i) Although the reactants and products had been clearly given in the question, a significant number of students added water as a product. An arrow was required with an '=' or any other sign being insufficient.
Although a word equation was asked for, correct symbols and formulae were accepted, though few managed to correctly give Cl_2. It will be worth emphasising to students that they need to read the question carefully before starting their responses, it is easier to obtain marks through giving the names of chemicals rather than the symbols and formulae.

(c)(ii) Students needed to describe the idea of elements being 'chemically combined' to gain the mark. Acceptable alternatives to combining were 'joining' or 'bonding', but not 'fusing'. However any reference to mixing negated the mark. Many students referred to two elements but few mentioned chemical combination. There were also frequent references to two atoms joining together which again was insufficient for a mark to be credited, as this could equally apply to a simple molecule.

Question 3 – Standard Demand

(a)(i) Many students scored 2 marks for performing the calculation correctly. However, the unit given was often incorrect, or not consistent with their answer, eg the value '15510' should have the unit 'kJ', but was often given as 'J'.

(b)(i) Many students were able to select the correct equation and perform the calculation correctly, thus scoring both marks. A significant number, though, copied one or more of the values (usually the mass) incorrectly.

(b)(ii) A significant number of students did not attempt this question. Of those who made an attempt, few realised that the answer would be the same as their answer to part (b)(i) and embarked on a new calculation in the little space they had. Some realised the connection with the gravitational potential energy value, but subtracted the mass (or other arbitrary number) from their value. Some students attempted to substitute into the kinetic energy equation, either stopping when they did not have a value for the velocity, or making one up. A few students, having moved on to part (b)(iii) went back to this part and changed a correct answer by subtracting an arbitrary figure from it.

(b)(iii) Students who realised that some energy would be transferred to the surroundings generally answered the question well. However, there were many incorrect ideas as to why the increase in kinetic energy would be less than that calculated, some referring to a different change in height and some to the effect of gravity.

(c) Only around two-thirds of students realised that the extra height of the roller coaster would result in an increased velocity of the train at the bottom of the descent.

(d) Many students gained a mark for this question. The most common answer was that there should be a legal limit for the acceleration, usually linked to the idea of protecting passengers from potential harmful effects. However, where harmful effects were copied for the table, students needed to identify 'unconsciousness', rather than one of the others, which were ignored.

Question 4 – High Demand

(a)(i) Most students successfully completed the word equation for photosynthesis. Despite the indication that words were required, examiners accepted chemical symbols, however these had to be fully correct, including subscripts, to gain the marks.

(a)(ii) Most students realised that it was the uses of the glucose they had named in part (a)(i) that was being asked for here. However there appeared to be considerable confusion as to what a 'substance' actually is, with many responses being names of cellular components, including 'ribosomes', 'mitochondria' and even 'endoplasmic reticulum'. Although all of these substances should have been familiar to students, many reversed answers, suggesting that 'starch strengthens cell walls' and 'cellulose is used for storage'. The third answer was the most commonly correct one given, perhaps because a variety of possible answers were accepted.

(a)(iii) Either 'xylem' or 'phloem' would have sufficed; students are not expected to know the specific role of each of these tissues, for this unit. A wide variation of spellings was allowed, provided the word was recognisable and approximately correct phonetically.

(b)(i) Although students are likely to have discussed limiting factors and revised their effects, they found defining the term a demanding task. The question did not limit responses to photosynthesis, although most students answered in these terms. The most common error was to suggest that a limiting factor would 'reduce', 'slow down' or even 'stop' the (rate of the) reaction, rather than restrict it from going any higher.

(b)(ii) Any value in the range '80 – 82' would have gained the mark. More discerning students looked carefully at the graph and gave '81' or '82'. The most common incorrect answer was '32' which displayed a misunderstanding of the question and the effect of the limiting factors shown in the graph.

(b)(iii) Raising the temperature or increasing light intensity in a greenhouse would inevitably be expensive. Those students who realised this gained the mark. A better answer, referring to cost effectiveness was given by those students who generally achieved higher marks on the paper, as these recognised that the extra cost might not be matched by a higher price the plants might command when sold.

(b)(iv) The effect of interactions between the various limiting factors would make it difficult for students to pinpoint exactly where the line should have been drawn. Consequently examiners accepted a line drawn anywhere below the 25 ^{o}C line. A diversion from the printed line could start at any point, provided it did not cross the 25 ^{o}C line and sloped down at some stage. A line wholly below the 25 ^{o}C line was also accepted. Those students who realised that a higher carbon dioxide concentration would increase the rate of photosynthesis (until other limiting factors came into play), so the plants would grow faster and be ready for sale sooner, as glucose would be produced more quickly were able to secure all three marks. However, although many drew the line in the right place, they often got no further than repeating what this showed, ‘faster growth’ and did not explain their answers. Some did suggest that photosynthesis would be faster but did not use their previous answers in the question to develop this idea in terms of glucose or biomass production.

Question 5 – High Demand

(a)(i) This question asked students to draw on their experience of using quadrats to suggest a method of dealing with organisms overlapping the edge of the grid. It seemed evident that many students did not have this practical experience and as a result they struggled to come up with sensible suggestions. Many only offered revamps of the method given, such as ‘count only those on the lower and right side’ which the examiners did not consider to be sufficient as this is not a ‘different method’. Others suggested they should ‘ignore all those on the edge’ or ‘include them all’, neither of which would have given a good estimate of population size. It was also quite common for students to suggest changing the dimensions of the grid to make sure that all the organisms fitted inside, answers such as ‘make the grid a bit wider’ would defeat the object of sampling a particular volume of the culture.

(a)(ii) A significant number of students failed to count the size of the population using the method given. However provided the count that had been made was clear in the student’s answer, the other two marks could be gained for following through the method correctly. A significant proportion of students were also unable to calculate the volume of the culture, 1.0 x 1.0 x 0.01, correctly, arriving at answers which, when they read the table in the next part, they might have reconsidered; though this was rarely the case.

(b)(i) A significant proportion of students got no further than stating that there was an ‘increase’ in the population of yeast cells. Unfortunately they had been told this in the question, so no marks could be awarded. The examiners were looking for an indication of the extent or a description of the increase. Some realised that the numbers ‘quadrupled every day’ or ‘doubled every 12 hours’, whilst others described the population as increasing ‘by an increasing amount’ however very few students managed to put these sorts of ideas together to gain both marks.

(b)(ii) It was surprising that many students were unable to apply their knowledge of an organism’s requirements for survival to this situation. Students who got close to gaining marks often referred to a lack of solution, rather than a lack of sugar in the solution, or simply said that the yeast cells had ‘died’. Relatively few students could link the rapid decrease in population size to ‘depletion of oxygen’, the presence of ‘a predator’ or ‘disease’. The suggestion that waste might accumulate and thus poison the yeast cells was conspicuous by its almost complete absence. However some students mistakenly suggested that the yeast cells might have died because they became ‘too hot’.

This suggestion was ignored as the culture was described in the question as being ‘in a flask’ which would not have retained ‘heat’ (unless it had been a vacuum flask).

Question 6 – High Demand

(a) Correct responses usually referred to GC-MS being accurate. Being able to detect small quantities was also seen though some students were unsure of the meanings of technical terms and gave precision or reliability as a response.

(b) This appeared to have been covered well by some centres and not at all by others. There were some very full and detailed descriptions seen obtaining the marks given both for a description of the actual process and also those for an explanation of how the substances were separated. All the marking points apart from the idea of different substances having different attractions to solid material were seen quite regularly.
Of those students that didn’t gain marks, many answered in terms of paper chromatography or gave ideas relating to solubility of the substances. Others appeared to have no knowledge of the process of chromatography in any form and gave answers including incorrect links to many processes.

(c) Very few students realised the significance of the molecular ion peak, with most students describing the graph rather than giving a conclusion. Descriptive responses such as the mass to charge (m/z) ratio is 44 and the relative intensity is 100 did not give any conclusions, so were not credited.

(d)(i) There were many good descriptions / explanations seen of the weak inter-molecular forces found in simple molecules.
Weaker responses included reference to covalent or ionic bonding between molecules or these types of bonds being weak. Others confused simple molecules with graphite and talked about weak intermolecular forces between layers.

(d)(ii) The most commonly seen correct response was that there were no delocalised electrons. A variety of incorrect responses were given, with answers such as ‘there are gases’ which was insufficient as there is no indication as to why a gas wouldn’t conduct electricity.

Question 7 – High Demand

(a) Students found it difficult to answer this question and many rambling and confused answers were seen, showing little if any understanding of the question asked. Few seemed to appreciate that evaluation would involve comparing the properties of each material and making a reasoned decision about which material is best and/or worst.

The first three marking points all required reference to both the density **and** strength of a material to be awarded. Marking points 2 and 3 required that the extreme property (eg most) is given **and** a comparison of the other property is made with one of the other 2 materials. They did need however to add value to the data in the table so they could not just quote figures, many also talked about lightness and heaviness rather than density which again was not sufficient for a mark.
The justified conclusion mark did not need to refer to both strength and density, so answers such as 'wood is the worst material to use as it isn't very strong' or 'carbon nanotubes are the best to use because they don't break easily' were creditworthy.

(b) Many students did not appear to be aware of the structure of silicon dioxide. There was much comparison to graphite, with 'has no layers', 'delocalised electrons' and 'intermolecular forces' appearing quite frequently. Others linked silicon dioxide to the structure of diamond.
Some appreciated that silicon dioxide was a giant covalent structure, but others then demonstrated a confused conception of covalent bonding, with references to intermolecular bonds and electrostatic forces being common. Some even referred to ionic bonds or classed the structure as a giant covalent bond.
Silicone was seen quite frequently alongside some incorrect use of technical terms such as silicon molecules, as well as the description of the given diagram being in terms of carbon atoms. Students weren't able to use the given diagram correctly in order to obtain the correct ratio of bonding atoms, with some counting all the atoms shown and others just assuming it was a 1:1 ratio.

(c) Many students appreciated that graphite had layers whilst carbon nanotubes had not, but the differences between the two materials proved more difficult. Some students seemed to think that they both had 'hexagonal bonds' rather than a hexagonal structure and many failed to mention an obvious similarity eg both of them being giant structures or both having covalent bonds. Others talked in terms of properties of the 2 substances such as soft or slippery rather than the structure. Some were not able to use the diagram instead giving a variety of different approaches to the structure of carbon nanotubes. Graphite consisting of layers was not always well known and others thought that carbon nanotubes were in layers.

Question 8 – High Demand

(a) A little over half of the students were able to correctly calculate the percentage of aluminium in aluminium oxide, with '26%' and '42%' proving to be the most commonly selected distractors.

(b) In empirical formula calculations, students cannot just give the correct formula and gain 4 marks, they must show some related working. The first 3 marking points were for their working so that a correct final answer CrO_6 with no working gained the 4th marking point only. O_6Cr was also allowed as the formula.

Although most students used the method described in the mark scheme, alternative methods were seen, the most common of which involved initially converting the masses to percentage masses by adding the two masses given and calculating the % mass.
Students who obtained three marks usually omitted to include the formula. Formulae, when determined, were usually correctly written with upper / lower case letters and subscripts.
Common mistakes that were seen were to transpose one or both of the initial ratios 13/52 and / or 16/24, which still allowed the remaining 3 marks to be accessed. Weaker students, with no understanding of the technique to determine the empirical formula, often started by multiplying 13 x 52.

Question 9 – High Demand

(a)(i) A large number of students were unable to select the correct equation, the equation for momentum being the most common incorrect one chosen. For those who were able to select the correct equation, substituting the given values in the correct places often proved to be a problem. It was very common to see '4.8' (which was the acceleration) substituted as velocity. For those who substituted correctly, the next hurdle was re-arranging the equation, which many students failed to do correctly. Another common error was not realising that the sprinter's initial velocity was 0; often 4.8 was shown as the initial velocity (in addition to the acceleration) and 10 was also used. The unit m/s^2 also confused some students, who thought that they had to square the acceleration value of 4.8. Finally, for those students who avoided all of these errors and arrived at a final velocity given by 4.8 x 2.5, arithmetical mistakes were often made, possibly by those students who did not have a calculator.

(a)(ii) There was a large number of correct responses, mostly in terms of reaction time, with a few referring to the time taken for the sound to travel from the gun to the sprinter. Some students seemed to have the correct idea but their answers were imprecise, eg a fairly common answer was 'it is his thinking distance', presumably getting confused with car braking.

(a)(iii) Fewer than a third of students correctly identified that the gradient of the graph represented the 'speed' of the sprinter.

(b) This calculation was performed well by many students, who were able to select the correct equation, substitute the correct values, and rearrange correctly. The most common error was either failing to realise that the question asked for the answer to be given to two significant figures, thus losing one mark, or being unable to do this correctly from a calculated answer of 93.75. As with part (a)(i), a fairly common error was to square the acceleration value of 4.8.

(c)(i) Many students were able to state a correct relationship between wind speed and world record time. It would be preferable to use the terms ‘time increased’ or ‘time decreased’, as relevant, rather than ‘slower time’ or ‘faster time’ as students might realise that time cannot slow down or speed up, however as these terms are in common usage in sports commentaries, they were allowed in this case. Some students stated a relationship between the wind speed and the speed of the runner, which did not answer the question asked.

(c)(ii) Better answers included references to insufficient data, or lack of information about the direction of the wind. Some students seemed to think it was the same person setting the world record each time between 1969 and 2004, whilst others said that ‘they may have run at different speeds’. A not uncommon suggestion was that the results would need to be repeated to check them, students presumably not recognising the impossibility of this in the situation.

Question 10 – High Demand

(a) Few students scored both marks for this question, the most common answer being that the voltmeter reading would stay the same. Whilst some students had the idea of the current being reduced, much of the terminology was incorrect, eg ‘the current slows down’ ‘the electricity can’t get through’ or ‘the electrons find it harder to get through’. Students should be encouraged to use correct terminology if they are to gain marks.

(b) As with the previous part, few scored both marks. Whilst some students correctly stated that the voltmeter reading would remain the same, few were able to give a correct, coherent reason.

(c) Considering the practice in types of errors that students would probably have carried out, responses to this question were not as good as might have been expected, with less than one-fifth giving the correct ‘zero’ error. A high proportion did not offer a type of error, offering weak answers such as ‘instrument error’.

Question 11 – High Demand

(a)(i) A majority of students were able to identify that the force needed to lift a mass on the Moon would be less than that needed on the Earth. However, the reason given often just quoted the information given that the gravitational field strength on the Moon is less than that on Earth. Many students gave the reverse answer.

(a)(ii) Many students answered correctly, most commonly in terms of it being easier to lift heavy objects or using less energy to perform tasks.

(b) This question was reasonably well answered, although many students failed to score all three marks, often because of imprecise answers. A reference was often made to 'friction' but the two surfaces (ie the Moon's surface and the astronaut's boots) were not specified. There were also a significant number of answers which referred to 'positive electrons'. It seemed likely that some students failed to gain the third mark because they believed that having referred to 'electrons' they did not need to go on and describe them as being 'negatively charged'. However, students should be reminded that they should give as full an explanation as possible if they are to gain full marks.

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