OCR
RECOGNISING ACHIEVEMENT

GCSE

Science A

Twenty First Century Science Suite

General Certificate of Secondary Education **J241**

OCR Report to Centres

January 2012

2725217679 **J241/R/12J**

Oxford Cambridge and RSA Examinations

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OCR REPORT TO CENTRES

Overview

This was everyone's experience of papers for the new specification, and centres are to be congratulated on how well the candidates were prepared for the increase in extended writing, in particular the new six-mark questions. The new layout includes three six-mark questions, and their mean mark was slightly higher than the mean for the paper overall on each of the four papers. Very few candidates, even at the weakest levels, left these longer questions blank.

The three six-mark questions were each marked using 'level of response' criteria rather than allocating marks for individual points made. These questions are marked with a 'level of response' mark scheme and often have at least two distinct threads to the topic which need addressing. Answers assessed as level 3 (5 or 6 marks out of 6) will have tackled all aspects with no serious omissions or errors. Level 2 (3 or 4 marks) may have omissions, errors, or internal contradictions but clearly address the issues required. Level 1 (1 or 2 marks) will typically address only one aspect of the question, while some candidates fail to address the issues at all, and get no marks.

Other free-response questions in all papers were omitted by candidates more often than the six-markers. These shorter questions are not dissimilar to questions featured on the old specification, but are often taken further, as required by changes in the assessment. In particular, mathematical work is no longer an end in itself: it is expected to be developed in some way, such as a comment about, or evaluation of, the mathematical result. This final stage was often omitted by candidates.

Although objective questions form a much smaller proportion of the papers in the new specification, there are still problems with them to report to centres. These are very similar to points noted by examiners in the legacy specification. In the first case, candidates frequently change their minds about an answer, and alter their responses; this is fine, provided that the candidates make their final decisions clear. Ambiguous answers get no credit. Secondly, candidates are frequently instructed to tick one ('the best answer') or two boxes, but they are sometimes asked to tick **each** correct answer. Here it is not appropriate to assume that the number of marks = the number of ticks. The best way to approach this type of question is to treat each option offered as a true/false choice, and to make a decision on each option separately, on its own merits.

A141/01 – Twenty First Century Science A (B1, C1, P1) Foundation Tier

The examination discriminated well, all candidates appeared to have time to complete the paper, and candidates were entered appropriately for this tier.

1 This question was well answered. All candidates were able to demonstrate knowledge and understanding and the more able candidates scored especially highly.

The majority of candidates were aware of the symptoms of Huntington's disease, with memory loss being the mark most commonly awarded. Some candidates confused the symptoms of Huntington's disease with those of cystic fibrosis.

Most candidates showed an excellent understanding of the Punnet square. The very weakest candidates commonly used two alleles in each box for the parents' sex cells: eg

	hh	hh
HH		
hh		

In part bii] most candidates realised that the probability that Alesha has the disease would be 0.5, with 0.25 and then 0.75 being the most popular alternatives. Very few candidates chose the option of 0 or 1.

Most candidates gained at least one mark for part c], commonly for 'planning for the future' or 'stress/worry'. Stronger candidates realised that early diagnosis would not only allow Alesha to decide whether to have children but also that it might open her up to discrimination from employers or insurers. Answers which went no further than the information given in the question "so she knows/might not want to know if she has it" did not gain credit.

2 Many candidates demonstrated a basic understanding of ratio by quoting the information in the question in the form of a ratio [ie 6:4]. However only those able to simplify this as 3:2 could be awarded the mark. Rather more were able to calculate the percentage of tall plants as 76% by using the formula in part aii]. Interestingly, the common errors of 60% and 40%, though not credit worthy, did suggest an intuitive understanding of the scale of answer required.

Many candidates realised that having fewer short than tall plants showed that the allele for short plants is recessive in part b. The ablest candidates took their explanation further to gain the second mark.

Though most candidates recognised that a larger sample was used in experiment 2, few recognised that this would produce more reliable results. [part c].

3 This question was common with the Higher Tier paper, and is the first of the three six-mark free response questions. Examiners commented on the willingness of candidates of all abilities to engage with this question, even if their understanding was far from secure. Only a few scored zero, and candidates were able to gain marks appropriate to their ability. The majority gained at least some credit for discussing effects of the environment. Weaker candidates missed the significance of the word 'identical' so there were many descriptions of two eggs being fertilised, of one egg being fertilised by two sperm, and of each twin getting different genes from each parent. Crucially, this question was targeted at the C/D borderline and those who missed that significance could not gain credit. Candidates who

discussed only genetic OR environmental effects limited themselves to a maximum of two marks. Weaker candidates showed considerable uncertainty over which sex chromosomes are present in males and females.

4 Many candidates had a lot of difficulty in choosing the best reason that hybrid cars make less pollution. By far the commonest wrong choice was box 2.

Part bi] was common with the Higher Tier paper, and the more able candidates had no difficulty in showing that a kilogram of petrol produces 2.1 kg of carbon dioxide. However, most of the other candidates did not attempt this part at all. The most common error was to multiply 2.1 by 16000.

Part bii] was also common with the Higher Tier paper, and a lot of candidates struggled with it. A few were able to gain one mark by working out the carbon dioxide output of the new car.

In part c], able candidates were aware that carbon dioxide dissolves in seawater, others often assumed that the carbon dioxide reacts with oxygen in the air or that it is used in respiration. Examiners were very encouraged that even the weakest candidates steered clear of the option that “carbon dioxide is deposited on surfaces”.

Part d] was the second of the six-mark free response questions. As with the other six-mark questions, it allowed candidates to score appropriately, with only a few candidates scoring zero. Most candidates were able to give at least one way to lower pollution in cars with a simplistic explanation and so gained some credit, though examiners did not give credit where the explanation of the method was merely a repetition of the question stem eg “use the car less as this lowers pollution”. Candidates who could suggest two methods and give a simple explanation of one of them immediately brought themselves up into the three- to four- mark bracket. Weaker candidates often tended to use the same explanation for both their methods, which precluded their gaining the highest marks.

Weaker candidates also often described hybrid cars, which the question specifically told them to ignore. Able candidates often gave excellent discussions of catalytic converters, though this was an area in which other candidates often demonstrated considerable misunderstanding: suggestions that the converter turns carbon monoxide into oxygen or nitrogen monoxide into nitrogen dioxide were very common.

5 The more able candidates identified the diagram of the carbon monoxide molecule missing from the equation in part a]. The carbon dioxide molecule was chosen by most of the others. Very few could explain where the carbon monoxide and dioxide come from when fossil fuels are burned. Although many candidates were able to say that oxygen comes from the air, others suggested that the burning of fossil fuels actually produced oxygen and carbon. Examiners were surprised that a significant number of candidates did not even attempt this question.

6 Most candidates showed a clear understanding of correlation and could recognise the broad trends shown by the graphs in part 6a]. Incorrect answers aligned themselves overwhelmingly with the second option, showing the significance of at least one of the graphs was understood. However, even though they were directed to then look at the period from 2005 to 2010, very few recognised the change in the sulfur dioxide graph and even fewer could then explain it.

7 Sadly candidates of all abilities assumed that S-waves are longitudinal rather than transverse, but were much more confident in their calculation of distance for part bi], with 0.04 km being the most common incorrect answer. However, there appeared to be a lot of confusion again when it came to discussing the arrival time of each wave at the detector

for part bii]. The more able candidates had no difficulty in calculating the speed of the wave from its frequency and wavelength, though they did then have problems using that information to decide if the wave was a P-wave or an S-wave. Examiners suspected that the most common error was to divide 400 by 10, as the answer 40 was often given. Very often working was not shown, so candidates who made a simple mistake were not able to gain any credit at all. Many weaker answers to the last part discussed strength or damage caused rather than speed, and many left the question unanswered.

8 Although this, the last of the six-mark free response questions, was not as well answered as 4d it was still possible for the majority to score appropriately. Most candidates knew that Wegener's theory was not accepted because he was not a geologist and they knew that jig-saws and land bridges were involved, though the task of describing the theory in a meaningful way did cause problems. Many candidates confused Wegener's theory with that of plate tectonics.

9 Most candidates recognised that Ann was talking about light pollution in part a], and also recognised Jupiter as a body in our solar system. The status of the Moon was much more problematic with far fewer selecting that as the other option, a more common choice being Ben's statement about stars.

10 The vast majority of candidates were able to use the graph to find the distance to galaxy A. The rest of this question was common with the Higher Tier paper, and so was designed to be more stretching. Candidates had much greater difficulty in articulating what this graph showed than they did for a similar task in question 6. There were many answers such as "how far away galaxies are and how fast they move" ie the candidate described the axes but did not then relate them. In part b] very few candidates realised that there was an outlier in these results and that it had been deliberately omitted from the calculation. A significant percentage of candidates did not attempt this last part.

A141/02 – Twenty First Century Science A (B1, C1, P1) Higher Tier

General Comments

In this first examination of the new specification, it was encouraging to see how well candidates had been prepared for the increase in extended writing, in particular the new six-mark questions. However, the shorter free-response questions, particularly the mathematical ones, were more taxing and quite often left without any attempt to answer them. Objective questions were generally well done on this paper, but the points raised in the general comments at the beginning of these reports apply, particularly for less well-organised candidates for this paper.

Comments on Individual Questions

1 (Huntington's disease) The objective parts of this question were well answered by most. In part (c), the more successful candidates clearly identified the separate motives of the doctor and the employer whereas poorer answers were vague and confused the separate motives of the two.

2 (Pea plant genetics) Most correctly calculated the ratio of 3:2 in the data for experiment 1, but few could state that the expected ratio was 3:1, let alone identify the ratio in experiment 2 (152:48) as being closer to that expected value. Many wished to improve the experiment by doing a quite different type of cross rather than just using more plants.

3 (Identical twins) Level 3 answers here recognised, and explained, that Thomas and James were genetically identical and also clearly suggested and explained environmental factors which could distinguish them. Level 2 answers tended to confuse identical twins with ordinary siblings, and level 1 answers often stated that they had the same genes but showed no understanding of this in their answers.

4 (Hybrid cars) Candidates were mostly successful in calculating the mass of carbon dioxide produced by the petrol-driven car, but fewer could perform the two-stage calculation needed to calculate the drop in carbon dioxide production on switching to a hybrid car. Suggestion of possible Government measures to encourage the use of hybrid cars (some introduced since the paper was written!) were done well, but many did not notice that part (c) was about electric cars, not hybrid cars.

5 (Catalytic converters) Balancing the 'blobby' chemical equation in part (a), as expected, was done well only by the best candidates. The 6-mark part (b), focussing on oxidation and reduction in a catalytic converter, was also targeted at the higher grades. Many could explain oxidation and reduction, but then did not apply them correctly to the CO and NO present in the engine exhaust: sometimes it was claimed that solid carbon, or harmless (!) NO_2, were produced, and answers often contradicted themselves internally, claiming both that CO was oxidised and that it was reduced.

6 (Chinese atmospheric pollution) Description of the trend in coal burning was often too simplistic, referring to 'more coal burning' or 'positive correlation', while the detailed description needed identification that the **rate** of burning increased. In a similar was, the estimate of sulfur dioxide production in (a)(iii) needed detailed justification in terms of the data trends with explanation in terms of coal burning and sulfur dioxide output. In (b), few evaluated the given data in terms of production and removal of sulfur dioxide from the air,

but tended to look at the data out of context, with reference to means and potential outliers.

7 (Earthquake waves) It was very rare indeed to see any explanation of the nature of transverse waves, although many knew that S-waves could not travel through liquids (which was not asked for here). Calculation of the speed of P-waves was often well done, despite the need to subtract times first, although a number needlessly converted kilometres to metres first. Few could explain why the lag time between P- and S-waves increased as they travel further – this is the important measure used in deducing the earthquake source. In part (c), calculation of the wavelength required a two-stage calculation. Candidates found more than one was of doing this, but a large number just attempted to massage the data without any real understanding of the question.

8 (Tectonic plate movements) Level 3 answers here clearly distinguished the different ways in which tectonic plates moved relative to each other, and were able to describe and explain how these movements produced earthquakes, mountains and volcanoes. Level 2 answers usually identified more than one sort of movement, albeit not clearly, and could describe one or two of the outcomes. Level 1 answers tended to be unclear about plate movement although they often included accounts of one of the outcomes.

9 (Galaxy data) Most recognised that the graph showed that more distant galaxies were moving faster, but the treatment of the best estimate of the data provided was often the more simple approach in the old specification: recognising that an outlier had been omitted was worth a mark, but the second mark was earned only if this omission was approved of, with a reason, or if it was criticised, again with some justification.

10 (Astronomers' activities) These objective questions proved taxing, with about one-third of the candidates getting each mark. In questions of this nature it is a good policy to scan the questions before reading the stimulus material, as candidates will then be clued in to what they are looking for.

A142/01 – Twenty First Century Science A (B2, C2, P2) Foundation Tier

General Comments

This paper was one of the first of the new specification. It contained considerably more free response questions than in previous sessions and there were more marks available for quantitative work. Candidates have, in previous sessions, found these free response questions a challenge and this was also true on this paper. However, a large number of candidates made substantial attempts at the extended answers and the Level of Response questions, and there were fewer nil responses across the paper than were perhaps expected.

This paper was appropriate for the ability range of the entry and most questions were accessible to candidates across that range. There was little evidence to suggest that candidates were short of time. The spread of marks across the whole paper suggested that it discriminated well across the grades.

As in previous sessions, candidates were well prepared for the objective style of questioning. Occasionally candidates put the incorrect number of ticks in the boxes. If they are asked for two, they should only give two. Otherwise they are likely to lose marks.

There were more issues for those questions requiring extended answers. Many answers to the free response questions lacked appropriate scientific detail and clarity in their answers. For example, the use of words such as 'it' and 'they' often makes answers unclear. Candidates need to be reminded to state exactly what they are referring to.

Centres also need to emphasise to the candidates that their papers are marked electronically, after first being scanned. Therefore it is very important that candidates use legible writing and restrict their responses to the boxes, spaces and lines that are provided. On the occasions when candidates have to write outside of these spaces, they need to make it clear to the examiner that they have done so. In addition, if candidates change their minds, any alterations must be made clearly and unambiguously. Examiners will struggle to decipher a 'B' that has been written over in an attempt to make it into a 'D'. Candidates would be better to cross out and rewrite their new answer to ensure that they are awarded the appropriate number of marks.

Question 1

1(a) This was a good start to the paper with the majority of candidates able to successfully choose paper and silk. The most common incorrect response was pottery. A few candidates did not read the rubric carefully enough and only circled one response.

1(b) A significant number of candidates correctly answered this question but a larger number of candidates thought that crude oil comes from fractional distillation.

1(c)(i) The majority of candidates correctly selected PVC as the best material to replace cotton. A few candidates were confused by the table and incorrectly stated one of the properties as the best material, eg flexibility.

1(c)(ii) Those candidates that correctly identified PVC as the best replacement material in part (c)(i) were able to successfully describe why they made their choice and scored well on this question. Most candidates gave two reasons for their choice, realising that the question was worth two marks.

1(c)(iii) This question discriminated well with some excellent examples of how new materials have replaced old materials. Centres would be wise to identify those specification statements which expect candidates to state examples to support a particular scientific idea. There are many of these types of statements throughout the specification. Credit is given for any valid example but the candidates do need to have at least one prepared. A significant number of candidates were not prepared for this question and there were a high number of nil responses to this question.

2(a) This was the first Level of Response question on the paper and it encouraged the candidates to evaluate the design of a number of experiments. There were two aspects which candidates were expected to talk about. These were the idea of control and the idea of repeats. The best candidates correctly selected Jake's plan as the best one and talked about both control and repeats in detail. There were a significant number of candidates who were able to do this. However it was more common to see a response which describes the idea of control or of repeats, but not both.

With regards to control, candidates identified that Jake was keeping the size of the rubber pieces and the mass added to each piece the same. Some then went on to explain that this would ensure that all factors that might affect the outcome were controlled, except for the type of rubber (the factor being tested). This was often very simply expressed and it was common to see a reference to a fair test, but these ideas were credited.

With regards to repeats, candidates identified that Jake was repeating his test and some explained how this would lead to a better estimate and enable him to identify and remove outliers. Credit was not given for the idea of calculating a mean value from the repeats as this was given in the question.

The most common error was the belief that repeating an experiment makes it fair. Some candidates also incorrectly stated that controlling variables makes the experiment more reliable.

A few of the less able candidates selected Lewis' plan as the best. This was credited up to Level 1 since Lewis does state that he will keep the pieces of rubber the same size. Those few candidates who selected Kylie as having the best plan did not gain any credit.

2(b)(i) This question proved to be a good discriminator as only the more able candidates removed the value for sample 2 (as instructed) and correctly calculated the mean.

$2.1 + 2.4 + 2.2 + 2.1 = 8.8 \quad 8.8/4 = 2.2$

It is possible that some candidates were without calculators which will have made the calculation more difficult. Centres are advised to make sure their candidates have calculators with them, especially as there is a higher proportion of marks assigned to quantitative work on these new specification papers.

2(b)(ii) The majority of candidates recognised that the value for sample 2 was different to the others but they did not always express their ideas very well. It was common to see ideas about the value being the 'odd one out' or 'not fitting in' (with the other values). This was not sufficient for the mark as candidates need to realise that the value is far away from the others or does not lie within the range of the other values. A large number of candidates correctly identified the value for sample 2 as an outlier, although this was not always spelt correctly.

3(a) Many candidates correctly identified the size of a nanoparticle as 50 nanometres.

3(b) The majority of candidates scored at least one mark here. The most common error was not realising that nanoparticles can be made by scientists but can also occur naturally.

3(c) This was a similar style of question to 1(c)(iii) in that candidates were expected to give their own example of a use of nanoparticles and then describe how the nanoparticles change the properties of the material. Many candidates selected the examples given on the specification, ie the use of silver nanoparticles to give fibres antibacterial properties or the use of nanoparticles in sports equipment to make the plastic stronger. Others gave good original examples such as self-cleaning glass or reducing the visibility of sunscreen. There were a large number of nil responses seen here and a significant number of candidates just referred to the nanoparticles making the material stronger, without giving a clear example of what the material was or what it was used for.

4(a) Almost all candidates correctly identified the burning of fossil fuels as arrow E.

4(b) This question was a good discriminator. A large number of candidates were unclear about whether carbon dioxide was taken in or given out in photosynthesis. Most were unable to recognise that the arrow did not represent photosynthesis because it shows the plant giving out carbon dioxide. A small number of candidates talked about the movement of oxygen instead of the movement of carbon dioxide.

5(a) This question was a good discriminator with candidates either seeming to know the names of both regions or neither of them.

5(b)(i) This question (and the remainder of question 5) caused some significant difficulties. The answers relied heavily on the use of the graph rather than on prior knowledge and yet there was evidence to suggest that some candidates did not refer to the graph at all. Those that did use the graph were confused about what it showed. It was common to see confusion between the radiation absorbed by the atmosphere and the radiation getting through the atmosphere and reaching the Earth's surface. In this part question, few candidates recognised that the higher frequency radiations were towards the right hand end of the graph, despite the fact that the horizontal axis gives this information. Only the best candidates correctly described the line being at the bottom of the graph at 0%. This shows that all of these radiations are absorbed.

5(b)(ii) This part question was slightly better answered with more candidates realising that the radiation needs to be able to travel to the satellites beyond the atmosphere. Therefore the radiation must be able to pass through the atmosphere and the graph shows that 100% of radio and (lower frequency) microwaves are able to do this.

5(c) Candidates struggled with this question. The mention of ultra-violet light triggered lots of responses about the ozone layer and global warming whereas the question was looking for the candidates to describe the pattern shown by the graph. A few candidates identified the drop in the percentage of radiation getting through the atmosphere but very few linked this to the increase in frequency.

6(a) This question was well answered with the majority of candidates scoring at least one mark, and many scoring two. This area of the specification is an area where candidates appear to be confident and demonstrate good understanding.

6(b) Similarly, the majority of candidates scored two marks here and the question was very well answered.

7 Candidates found this the most challenging Level of Response question on the paper. They were asked to describe the differences between digital and analogue signals and also to suggest an advantage of digital signals for television. The majority of candidates achieved Level 1 by stating an advantage of using digital signals. Far fewer candidates were able to identify differences between digital and analogue and express them clearly. The most successful candidates drew a diagram of the analogue and digital signals. This was an unambiguous way of showing the ideas and describing an explicit difference between the two signals. This diagram enabled some candidates to achieve Level 3. If a question suggests that diagrams are drawn to help their response, candidates should be advised that it is probably a good idea to draw one. Complicated ideas can often be expressed more successfully via a simple diagram.

In terms of advantages of a digital signal over an analogue one, there were lots of vague answers given without any qualification. A common incorrect response was the idea that digital signals are faster. The most common correct answer was the idea that digital signals are less affected by noise and hence produce a better picture on the TV. A few candidates recognised that digital information can also be stored and processed, or referred to the greater number of channels on digital TV. Some of the less able candidates were clearly out of their depth and did not really understand what the question was asking. Some answers included descriptions of digital displays on clocks compared to the traditional clock face.

A significant number of candidates made no attempt at this question.

8(a) This question proved to be a good discriminator with the majority of candidates scoring one mark, and fewer scoring both. The most common error seemed to be in the middle sentence where candidates often selected dead or stem cells in place of memory cells.

8(b)(i) This question caused the candidates some difficulties. A few of the most able correctly calculated the change in the number of cases of measles.

100 - 50 = 50 cases.

The main issue was the incorrect reading of the graph axes. The number of cases of measles is represented on the graph by the triangles. Most candidates realised this but then used the axis on the left hand side of the graph rather than the one on the right. Candidates need to take care before answering questions based on graphs. It is advisable to spend a short time looking carefully at the graph before moving onto the questions so that the candidate can be certain they are using the correct plot, scale, axes labels and units. The most common incorrect response was 37 where candidates had read 100 on the right hand axis and 63 on the left hand axis without realising that these axes were in fact describing different things.

8(b)(ii) In general, this question was also rather poorly answered. Only those candidates who had correctly calculated the increase in measles cases in part (b)(i) went on to correctly select 100%.

50/50 x 100 = 100%

8(c) This question was rather poorly answered considering that the marks were awarded for a simple description of the decrease followed by an increase. In many cases, candidates were clearly describing the wrong line and instead looking at the number of cases of measles rather than the uptake of the MMR vaccine (the bars). A significant number of candidates did not describe the graph but instead described the correlation between the number of cases of measles and the uptake of the vaccination, possibly by copying Nigel's statement in part (d).

8(d) This question part was also poorly answered. Few candidates seemed to appreciate that the increase in MMR vaccinations in 2010 would be likely to reduce the number of cases of measles in the future.

9(a) Most candidates were able to correctly identify the three ways of reducing heart disease. Occasionally candidates only ticked two boxes despite being asked to tick three. The most common incorrect response was taking fewer breaks so you could go home earlier.

9(b) This question discriminated well with the majority of candidates able to recognise that the fatty deposits would lead to a blockage but fewer then able to correctly describe the consequences of this blockage on the heart. Only a few candidates correctly described how it would be the blood supply to the heart that would be restricted. A larger number of candidates described how the blockage would restrict the blood pumping around the body and that this would make the heart 'work harder' and cause a heart attack. A small minority thought that the blockage would occur in veins or capillaries.

9(c)(i) Very few candidates were successfully able to name the process as peer review.

9(c)(ii) The majority of candidates had a clear idea about why peer review is carried out, despite not knowing what it was called in (c)(i).

10 The majority of candidates made a good attempt at this question and achieved Level 1 by stating a difference between the data in the tables. Many candidates were then able to correctly link the differences in data to the activity on Day 2. There were some excellent descriptions of how exercise leads to increased sweating and breathing and these responses were worthy of a mark at Level 2.

Candidates were not so able to talk about the differences in urine production seen on the two days. Some candidates identified that there was less water lost via urine on Day 2 (the day that exercise took place) but reasons for this were less clear. Many candidates suggested that Jessica wouldn't have had the time to drink as much water or go to the toilet because she was busy with her exercise. Candidates seem to have the misconception that the production of urine is entirely linked to the intake of water from drinking, rather than the idea that it is a result of homeostasis and the body balancing the water out with the water in. Few candidates realised that the water in and out was in fact the same on both days.

That said, there were some very good responses which scored at Level 3 because they clearly stated that an increase in water loss from breathing and sweating would mean that the body would have less water in it and therefore less urine would be produced. The very best candidates even described the role of the kidneys in this process.

A142/02 – Twenty First Century Science A (B2, C2, P2) Higher Tier

General Comments

This was one the first set of papers for the new science specification. The style of the papers has changed, with more written response questions, including 6 mark ones. Questions ask candidates to apply their knowledge and understanding in different contexts and there is more emphasis on the use of mathematics in science. The paper discriminated well with a good range of marks though it was clear that a few candidates had problems with time or with the content of the paper. These candidates would have been better suited to the foundation tier paper.

Many candidates performed well on the written answers, including the 6 markers. Some were unable to link their knowledge to unfamiliar situations and the mathematical questions were not done well. Candidates need, whilst working through the course, to be encouraged to put detail in their answers to questions. They need practice in answering questions in different contexts and in applying mathematics, especially graphs, to science. Sometimes candidates had not spent time reading and understanding the question and so lost marks.

Comments on Individual Questions

1 Part (a) provided a straightforward start to the paper with many candidates correctly linking the modification of a polymer to changes in its properties and to the reason why it works. Of the three modifications, increasing the crystallinity of a polymer was the least well known. In part (b) most candidates had no problem recognising the diagram of cross linking in a polymer.

2 This was a common question with the foundation tier. Almost all candidates taking the higher tier paper scored marks in both parts of this question. In part (a) the most common error was thinking that creams which absorb ultraviolet do not protect the skin.

3 Part (a) was the first of the 6 mark questions on the paper. It was well attempted with many writing at appropriate length, and with sufficient detail, to gain 3 to 6 marks. Those who didn't had failed to explain the reasons for their choice of answer. However, it was disappointing not to see greater use of words such as control, variable, best estimate of the true value in the answers. A good portion of this module is practical-based and candidates should have the opportunity of using such scientific vocabulary.

Part(bi) was a question about outliers. The specification statement on outliers has changed. It states that an outlier should, if possible, be checked and if not it should be used unless there is specific reason to doubt its accuracy. This was not reflected in the answers given by most candidates. Marking, in this session's paper allowed for the wording of both the old and new specifications. Centres should be aware of this change and the fact that such questions may be marked more rigorously in future.

Scoring in (bii) was lower than similar questions in past papers. Some candidates did not recognise *best estimate of the true val*ue as requiring the mean, whilst others did not read the question properly and thought the decision was on whether the outlier should be kept.

4 Both parts of this question were discriminating. In part (a) the link between molecular size and boiling points was known by many, but few could explain why. A number of misconceptions were common in the answers. Candidates would use the words 'boil' and 'burn' or the words 'boil' and 'melt' in the same context within their answer. Many thought that there were fewer small molecules that boiled quickly and many larger molecules that took a long time to boil. Some wrote about bonds breaking when liquids boiled.

In part(b) few identified the number of molecules of propane and ethene. Diagrammatic representations of reactions are in the specification for both C1 and C2. They should be practised in both these modules.

5 Many scored the mark in part (a). The most common error was to write process A instead of process B. Part (b) proved very difficult with all wrong answers being seen. Candidates were unable to interpret the diagram of the carbon cycle mathematically.

6 This was the first of two graph questions on the paper. Many scored well on parts (a) and (bi), but found the other parts of this question and interpreting the graph very difficult. In (bii) only a few candidates linked low photon energies with low frequency microwaves which meant they could not interpret the graph correctly. In part(c) some wrote about the whole graph rather than region A whilst others completely ignored the graph and wrote about global warming or the ozone layer. Some candidates knew about high photon energy and ionisation in (d) but could not apply it in the context of the atmosphere.

7 Another 6 mark question and most candidates wrote what they knew about digital and analogue signals. It was pleasing to see some clear labelled diagrams, accompanied by a correct and detailed explanation of the clarity of digital signals compared to analogue ones. These gained full marks.

8 Part (a) was straightforward with many scoring full marks. The rest of the question was based on a graph showing the uptake of the MMR vaccine and the incidence of measles over a 10 year period. These questions were much more difficult for candidates. In (bi) when they were asked to calculate the percentage increase in measles cases, many incorrectly took numbers from the axis showing the uptake of vaccine. Of those who were able to read the correct values very few knew how to calculate a percentage increase. Although candidates were familiar with increases in uptake of vaccine reducing the incidence of the disease, very few recognised the time lag shown by the graph. Most candidates scored at least 1 mark in part(d). Some limited themselves to 1 mark by either agreeing or disagreeing with Nigel's comment, presumably because they had not read the question correctly.

9 Most could pick out the four correct sentences telling how stress caused heart attacks in part (a). Part (bi) was much more challenging with few using information from the article to work this out correctly. Many scored in part (bii) though candidates should be aware that using words from the rubric of the question rarely gains them a mark. Part (c) was well answered with many able to identify peer review and explain it. A common misconception about peer review is that all the work is repeated by other scientists.

10 Six marks for this final question on this paper. Many candidates knew how the figures of water loss would change when Jessica is more active. Few could describe how her body would balance her water levels. No credit was given to those who wrote about the effect of drinking water as it was not part of the question.

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