OCR
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GCSE

Science A
Twenty First Century Science

General Certificate of Secondary Education **J630**

Report on the Units

June 2008

J630/MS/R/08

Oxford Cambridge and RSA Examinations

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REPORTS ON THE UNITS

A211/01 – Twenty First Century Science A (B1, C1, P1) Foundation Tier

General Comments

The paper was well attempted and produced a high mean mark.

Although candidates have become more skilful in attempting this style of paper, there are still too many who tick the wrong number of responses, so limiting the marks available to them.

Comments on Individual Questions

1 (a) (i) Most candidates were able to correctly name all the parts of the Earth.

(ii) Identifying movement of the mantle as the cause of continental movement proved much more difficult with all the options appearing regularly. Many candidates rejected the choices given and wrote in 'Earth' or 'plates' instead.

(b) Candidates were confident about correctly connecting evidence with the correct theory. Many successfully connected all 4 statements.

2 (a) (i) Only the better candidates knew that the apparent movement of stars is called parallax, both light-year and twinkling were frequent choices.

(ii) Few candidates worked out that the star emitting more energy must be further away to appear just as bright, most thinking it must be nearer.

(b) Candidates struggled to complete the sentences about telescopes with a high proportion unable to successfully complete any. 'Alien life' was chosen far too often.

(c) (i) Most candidates correctly identified Bev but Sahid was chosen far less frequently. Tracey was a very popular incorrect choice.

(ii) Both Matt and Sahid were successfully selected by the majority of candidates.

3 (a) (i) Most candidates understood that the use of electric trams instead of cars could reduce city centre atmospheric pollution, with fewer seeing the potential from closing roads. A significant number of candidates only made one response.

(ii) A very high proportion of candidates successfully identified good reasons for reducing pollution.

(iii) Candidates had a good understanding of the reasons why trams are likely to make an impact on atmospheric pollution.

(b) Most candidates were able to make at least two successful links. A surprising number reversed the links between structure and name for carbon monoxide and carbon dioxide.

4 (a) Most candidates correctly identified 64 as the outlier.

(b) (i) Some candidates found it difficult to calculate 25 as the best estimate of the true value. All values from the table appeared, as did large numbers such as 125.

(ii) The range required was well understood by all but the weaker candidates.

(iii) Most candidates realised that variations in temperature of the boiler would affect the mass of carbon produced. Some thought it was because Andy took both sets of measurements.

5 (a) Many candidates were unable to connect any of the names to the descriptions. Fully correct answers were rare.

(b) The reason for 2 sets of genetic instructions in each body cell was well known. 'Cells making twice as many proteins at once' was the commonest misconception.

6 (a) (i) Most candidates realised that an inherited disease must have been passed on from one of the parents.

(ii) The symptoms of Huntingdon's disorder were not well known. 'Headaches' was a popular incorrect response.

(iii) The number of alleles needed to get a disorder caused by a dominant allele was well known. 'Three' was a common misconception.

(b) Those candidates who failed to gain this mark often did so because they only ticked one response when 2 were clearly asked for.

(c) Most candidates correctly selected Nikki as the person most concerned about the safety of the test and Mark as the one thinking about economic issues. They were less sure about who was making an ethical point. Ruth was often thought to have stated that Huntingdon's disorder was not a good reason to have a termination.

A211/02 – Twenty First Century Science A (B1, C1, P1) Higher Tier

General Comments

The paper was well attempted and produced a high mean mark.

Candidates seem to have been well prepared for this objective style of questioning.

Candidates should be aware that the marking is carried out on scanned images of their scripts. Consequently, if candidates change their minds, any alterations must be made clearly and unambiguously. Any marks that are ambiguous will **not** gain credit on this paper.

The level of difficulty was appropriate for the ability range and all questions were accessible to candidates across the ability range. The majority of candidates generally performed well and marks were awarded across a reasonable range, demonstrating satisfactory differentiation. Scores typically ranged from the low twenties to the high thirties (out of 42 marks).

Most candidates correctly followed the instructions in the questions and most made their responses appropriate to the number of marks available. Some, however, did not read the questions carefully enough.

All candidates seemed to have made good use of their time.

There was no evidence of candidates running out of time.

Comments on Individual Questions

1 Almost all candidates got full marks on part (a) of this question. Part (b) proved more challenging for some. The figure of 10 cm/year for the rate of seafloor spreading is taken directly from the specification. On the higher tier paper, candidates are expected to be able to change units (e.g. cm to mm) in answering questions.

2 In part (a), a significant number of candidates could only correctly identify Bev as one of the people discussing data, usually choosing Tracy (incorrectly) as the second person. There was some doubt over the wording of Tracy's statement with regard to part (c) of the question. She clearly has an opinion that the Gaia project should take place, but some candidates felt (correctly) that her opinion also stated that it could be done. A tolerant approach was built into the mark scheme.

3 The vast majority of candidates tackled this question well. Part (c) caused some weaker candidates difficulty, with them trying to link each effect back to a method, thereby negating one possibly correct choice in the process. Candidates seem to have got the message regarding the clear linking of boxes in this style of question.

4 Parts (b) and (c) of this question produced good differentiation across the ability range. Weaker candidates could not tackle the completion of these particle diagrams, and only the most able got the idea of balancing the reaction in part (c). Even those candidates that balanced the equation, rarely managed to show the left hand box containing two separate carbon atoms. Candidates would be well advised to prepare for this style of question in future examinations.

5 Most candidates did well on the numerical parts of this question, possibly because the numbers chosen were relatively easy to process. In part (b) it should be emphasised that examiners were looking for the mean value of the measurements provided (although in this case it was the same as the median value). Future questions may not be so straightforward to process. Candidates should therefore be reminded that calculators are

allowed in this examination. Only the most able candidates could provide the correct reason in part (c).

6 This question was very well answered by all but the weakest candidates. Some candidates showed a possible lack of understanding of the term 'ethical' in part (d) (ii). Many candidates of all abilities had problems with the last row of the table in part (e), as no direct information was provided in the question. Candidates were expected to recognise that the invasive procedure of amniocentesis at the later stage of pregnancy produced a higher risk of late termination than the chorionic villus test which can be carried out earlier.

A212/01 – Twenty First Century Science A (B2, C2, P2) Foundation Tier

General Comments

The paper was well attempted and produced a high mean mark.

Although candidates have become more skilful in attempting this style of paper, there are still too many who tick the wrong number of responses, so limiting the marks available to them.

Candidates should also remember that the scripts are marked from scanned images and so alterations need to be clear and unambiguous. Particular care must be taken when altering a T to an F or vice versa

Comments on Individual Questions

1 (a) (i) The majority of candidates could identify cotton as a natural substance.
(ii) Weaker candidates were unable to identify renewability as the important environmental advantage of natural substances; all incorrect answers were seen.
(b) (i) Most correctly selected Kevlar as most resistant to stretch; cotton and PVC were the most common distractors.
(ii) Most understood that nylon does not absorb most water but correct responses to other two statements were less common.
(iii) Resistance to stretch was correctly identified by most candidates, with strength as a common distractor.

2 (a) (i) Only the better candidates were able to identify Peter.
(ii) Most candidates were able to score 1 on this part with all names occurring frequently.
(b) (i) Most candidates were able to correctly identify the outlier.
(ii) Candidates were much less successful in calculating the mean value of 2.1 with all incorrect choices appearing frequently.
(iii) Most candidates scored at least 1 here, too many missing the second mark by only ticking one response. The idea of 'fair test' was the most popular incorrect response.
(c) Only the weaker candidates failed to score this mark.

3 Again, most candidates were able to score at least one mark. A significant number thought that white blood cells carry oxygen and some only ticked one response.

4 (a) Only a minority of candidates knew that a vaccine was a safe form of virus; many thought that it was a chemical that stopped the virus from multiplying.
(b) (i) Very few candidates failed to correctly identify either Jasmine or Jo; Saleema or Mary were common errors.
(ii) Most candidates were able to correctly identify Saleema but most chose Mary instead of Jo.
(iii) Sam was correctly selected by most candidates.

5 (a) Most candidates scored both marks with few failing to gain at least 1.
(b) The various risk factors were well understood by most candidates with most achieving all 4 marks and few gaining less than 3. The commonest error was to identify cholesterol drugs as increasing the risk.

6 This was another generally high scoring question with few candidates failing to score at least 2 marks.

7 (a) Although the majority gained both these marks a few picked ‘thinner skulls’ and some only ticked one response.

(b) Although the majority of students understood that the idea of benefit outweighing risk was the important factor here, many thought that there was definitely no risk to anyone.

(c) The information about microwave radiation was poorly understood with few candidates being able to correctly identify the validity of more than 2 statements.

8 (a) Almost all candidates were able to correctly match descriptions to labels on the diagram showing the passage of light between the Sun and the Earth; few candidates failed to score at least 1 mark. Most of the stronger candidates gained all 4 marks.

(b) A surprisingly low proportion of candidates knew that carbon dioxide is the greenhouse gas; nitrogen and oxygen both appeared frequently.

A212/02 – Twenty First Century Science A (B2, C2, P2) Higher Tier

General Comments

This paper had a mean mark of 29/42 and a spread from 5 to 42 marks. It was of a suitable level of difficulty for higher candidates and differentiated effectively. Strong candidates showed good knowledge and understanding of the concepts covered in these topics and all candidates managed their time effectively and were able to complete the paper.

The majority of candidates' answers were clear and easy to mark. However there were still some who corrected answers in a different coloured pen and others who superimposed answers on top of one another. Scripts are scanned in black and white and it can be impossible to see which is a candidate's latest answer unless clearly shown.

In some places candidates had not read the stem of the question. When presented with a number of statements they were unclear about how many they had to choose even when the number was given. Candidates should be encouraged to put in the correct number of answers when told, even if they have to guess. They may guess correctly. In questions where the number of statements to be ticked was not given, some ticked every box. This is unlikely to gain the candidate any marks.

Comments on Individual Questions

1 A straightforward start to the paper with almost all candidates choosing the correct answer. The few who answered incorrectly had not studied the table well enough and thought that the properties of PVC are superior to other materials.

2 (a) Part (i) was well answered with most candidates knowing why factors must be controlled in an investigation, but part (ii) proved much more difficult. Only a few candidates knew that repeating readings in an investigation makes the results more reliable. Most said incorrectly that it made the results accurate. Candidates need to be more secure in the knowledge that repeated results are more reliable and different methods of measuring give accuracy.

(b) This question was common with the foundation paper. Almost all candidates gave the correct answer to part (i) showing the idea of an outlier is well understood. Those who answered wrongly gave sample 4 which had the lowest value but which was not very different from the other readings. Calculating the mean value was more discriminating and although most candidates chose the correct answer, all four other answers were seen. Part (iii) was also well done, with most candidates choosing both correct answers. However, there were still a minority of candidates who thought the random variations in readings were because it was a fair test.

3 (a) This question tested the understanding that the number of atoms of each element in the products is equal to the number in the reactants. Half the candidates answered this correctly and there was evidence on many scripts that the concept was understood. Many candidates gained one mark by choosing two reactions that looked similar.

(b) This was a discriminating question as there was only one mark for correctly identifying the two parts of the process of making polymers from crude oil. Only the most able correctly chose the two parts.

(c) This question also discriminated well. Strong candidates knew how melting points changed with modifications to polymer structure. Some weaker candidates reversed the two answers but others guessed, or put more than one tick on a line.

(d) Almost all candidates could identify one reason for not having incinerators and most could identify both. Shortage of fuel and transport costs were the common wrong answers.

4 (a) All candidates could give one correct statement about vaccines and most identified all three.

(b) This was a common question with the foundation paper and was aimed at C and D grade candidates. Most gave the correct answer to all parts of this question. Mary was a common wrong answer to part (ii) which suggests that the identification of a decision about vaccination was made without linking to risk. Saleema was seen as the wrong answer to part (iii) which shows confusion between data and evidence.

(c) Only some candidates were able to give two reasons why there is no effective vaccine for HIV. Both wrong answers were seen.

5 (a) Almost all candidates knew that there was a correlation between cholesterol level and heart disease. It was more difficult to specify that the correlation was positive.

(b) No problems here for candidates. All gained some marks, and most three.

6 This was a discriminating question with strong candidates gaining full marks. Weaker candidates could often recognise jobs done by microwave and infra red radiation but had greater difficulty with radio waves and visible light. A few candidates confused electromagnetic radiation with radioactivity, writing alpha, beta and gamma in the answers, while others thought radioactive waves sent the signal from the TV station.

7 (a) About half the candidates knew the answer, but this was one question in which there was a high level of no response. A few candidates wrote protons rather than photons showing confusion over the meaning of these similarly spelt words.

(b) This question was poorly answered with only a few candidates gaining full marks. Some candidates did not read the instructions properly and joined up all the boxes. Others had not studied the diagram and had mistakenly chosen radiation from the sun in the first column. Of those who gave only one line there was obvious confusion between the greenhouse effect and the function of the ozone layer. It was not uncommon to find 'ultra violet radiation …is absorbed by ozone in the atmosphere…causing the earth to be warmer' as an answer.

(c) Candidates were more successful with this part of the question even though they were not told how many consequences of global warming there were. Again, confusion between the effect of a thinning ozone layer and global warming was shown by candidates who believed increases in cases of skin cancer was caused by global warming. A very few decided to tick every box in the hope of getting some marks. This does not work.

8 (a) This question was common with the foundation paper aimed at C/D grade candidates. It was straightforward for those taking the higher tier and many gained full marks. The most common mistake was to indicate that the first statement was true.

(b) Another question common with the foundation paper which gave no problems to candidates on this paper.

(c) This question about the precautionary and ALARA principles showed good discrimination. When good candidates lost marks it was usually by mixing up the two types of action.

A213/01 – Twenty First Century Science A (B3, C3, P3) Foundation Tier

General Comments

This is the third time that A213 has been available. Candidates have clearly been well trained for this style of objective paper and followed the rubric well. Candidates showed great confidence and there were very few questions that attracted no response.

Comments on Individual Questions

1 (a) Only the better candidates were able to correctly identify all three parts of stimulus response pathway. Most candidates correctly identified the brain as the co-ordinator. However, there was considerable confusion about receptors, responses and effectors.

(b) In previous papers, candidates have shown good knowledge of the differences between nervous and hormonal responses but here they were less effective at applying this knowledge.

2 (a) This was well answered with most candidates selecting the correct response, extinct.

(b) Most candidates correctly identified that less food would result in a fall in the bird population but fewer realised that high mortality of last years chicks would have the same effect.

(c) Apart from weaker candidates, most recognised that a reduction in the sea bird population would probably result in an increase in the fish population.

3 This proved to be a difficult question.

(a) Most candidates recognised that evidence from the fossil record supports evolution but fewer appreciated that mutation is important in producing variation.

(b) Candidates frequently correctly identified that breeding individuals are chosen in selective breeding and that useful features are passed on. However, fewer understood the role of variation in both natural selection and selective breeding, or that the survival of better adapted individuals is a key idea in natural selection.

4 (a) (i) This was well answered by all candidates.

(ii) Again, this was well answered by all candidates.

(b) This was also well answered by most candidates.

(c) (i) This was well answered with candidates showing that they understand risk.

(ii) Many candidates identified Peter as having decided the risks outweigh the benefits of eating sugar, whereas he was really just ignoring the risk and Danny was balancing risk and benefit.

5 (a) It was gratifying to see that most candidates knew that fertilisers contain nitrogen. Many, however, thought that fertilisers sterilised the soil perhaps linking this answer to the idea of protection against disease.

(b) (i) Some candidates here lost marks by choosing too few or too many statements, others by misunderstanding intensive and choosing the statements referring to organic farming. This was generally well answered by better candidates.

(ii) Mostly well answered but a significant minority of students thought it was enough to simply tell customers that food is organic without realising it has to meet national standards.

(c) Again, this was well answered by the majority of candidates. The most common incorrect response was to opt for 'less wildlife' on organic farms.

6 (a) Most candidates identified the 'talking heads' who were for building nuclear power stations but found it more difficult to identify arguments that were either neutral or contained arguments for and against nuclear power.

(b) This question was answered surprisingly badly by weaker candidates who perhaps misread the question and identified energy sources that did, rather than did not, produce carbon dioxide.

7 (a) Nearly all candidates correctly identified North America as being the country (or continent) at highest risk from background radiation.

(b) This proved to be difficult with most candidates simply picking out the data referring to extra dose for workers in the nuclear industry and not adding this to the background radiation to calculate a total dose, despite 'total' being emboldened in the stem of the question.

8 (a) (i) Many candidates failed to recognise that lead would block all beta radiation; each of the alternative, wrong, answers were chosen with approximately the same frequency suggesting that this is an area that candidates do not know or understand well.

(a) (ii) Except for the weakest candidates, this was answered better than (i). Many students identified the open window as giving the best measure of background radiation.

(b) and (c) were overlap questions also appearing on the higher paper.

(b) This question was common to the higher tier paper. Only the better candidates regularly identified the two correct explanations. Many candidates did not appear to have a good understanding of the terminology.

(c) As with (b,) this question was common to the higher tier paper and better candidates scored both marks; others were misled by statements about the half life or neutrons.

A213/02 – Twenty First Century Science A (B3, C3, P3) Higher Tier

General Comments

The paper was attempted well and produced a high mean mark.

Questions on this paper were all objective style.

An overall impression is that candidates were generally clear about their subject knowledge.

Most candidates correctly followed the instructions in the questions and most made their responses appropriate to the number of marks available. Some, however, did not read the questions carefully enough. A small number failed to score marks because it was not clear what their response was, such was the crossing out and change of lines.

Candidates should be aware that the marking is done from scanned images of their scripts and are marked online. On a scanned script it can be difficult to be certain what the answer was intended to be unless candidates make changes clearly and carefully. Consequently, if candidates change their minds, any alterations must be made clearly and unambiguously. It is better if the candidates follow the instructions given as to how and where to answer the questions; however, any unambiguous indication of the correct answer gained credit.

Any marks that are ambiguous will not gain credit on this paper. To put additional lines or write comments such as 'please mark the pencil' or 'the blue lines are correct' make it difficult for the examiner.

All candidates seemed to have made good use of their time. There was no evidence of candidates running out of time. A few weaker candidates did not complete the paper due to lack of knowledge, not lack of time. The number of 'no response' answers was very small indeed.

Comments on Individual Questions

1 (a) This question was also on the foundation tier and almost all candidates scored some marks here. There was no pattern to the incorrect responses.

(b) Most scored at least one mark, and many scored both knowing that the indirect cause of the reduction is noise and feeding on the fish the fishermen catch.

2 (a) This question was also on the foundation tier. Most candidates scored one mark.

(b) Most candidates scored 2 or 3 marks here.

3 (a) (i) Most candidates scored 1 mark here for knowing that 'the CNS coordinates the rest of the nervous system'. For a small number of candidates, nerve cells linking receptors to effectors was a popular answer.

(ii) Many candidates had the correct 3 letters although D proved to be a popular distracter.

(b) Most candidates gave at least one of the correct answers to explain why the control of blood sugar is hormonal.

4 (a) Many candidates were unclear about the function of the Food Standards Agency. Many answered 'carries out risk assessment' and 'promotes organically grown food'. The fourth (correct) choice was popular but even good candidates failed to gain the second mark.

(b) (i) This was almost universally answered correctly. Very few candidates failed to get full marks by writing Anna and Rajid. This was another question overlapping with the foundation tier.

(ii) Danny was usually given, although Peter was a popular alternative. This was another overlap question.

(iii) Candidates generally answered correctly. They realised that illness and the consequences of treatment meant she should change her eating habits, although many picked the first answer which only referred to illness.

5 (a) Candidates did not always follow the instructions. They were asked to draw lines from each method to the correct type of farming, therefore four lines were needed. Some only drew two. The same applied on the right hand side. A large number of candidates failed to score full marks here. Every combination of lines was seen. If candidates had read the second sentence it would have helped with their starting point. Many of the weaker candidates did not have a line coming from each method.

(b) (i) Most candidates knew that farmers have to meet the national standards for organic farming before their crops can be labelled organic.

(ii) Most candidates were correct with only the hydrogen, nitrogen and oxygen providing a wrong alternative.

(c) The belief that organic food is healthier was a popular correct answer but fewer candidates scored the second mark for people being able to choose what they eat.

6 (a) The answers were mixed here, however quite a high percentage of candidates scored 2 marks for alpha radiation not penetrating paper and being stopped by dead skin cells. This was another overlap question with the foundation tier.

(b) Many candidates scored both marks for knowing that the Sievert is based on the amount and type of radiation. Those candidates who lost a mark did so because they added a third tick. This was another overlap question with the higher tier.

(c) Most candidates failed to score in this question. Every combination of letters was seen. Both had to be correct to score the mark.

7 (a) This proved to be difficult for many candidates. Every combination of ticks was seen although most candidates scored at least one mark. Some candidates did not realise only one tick per person was needed.

(b) Very few candidates got this wrong.

(c) A large number of candidates scored 2 or 3 marks here, although several seemed to mix up fuel and control rods. Many chose nucleus for the first answer and coolant for the final answer.

8 (a) This was poorly answered with 2 and 5 mSv/year being popular answers.

(b) 0.01% proved popular although a considerable number of other values appeared

A214/01 – Twenty First Century Science A (Ideas in Context) Foundation Tier

General Comments

It was pleasing to see how well the vast majority of candidates had been prepared for the examination. Most centres had clearly used the pre-release material to their full advantage and had prepared their students well to answer the questions. Candidates were very good at referring to the pre-release material in their answers.

Comments on Individual Questions

1 (a) (i) This proved to be a nice easy start to the paper and the vast majority of candidates scored both marks on this question.

(ii) Most candidates managed to score 1 mark for saying the frame would bend, but few went on to explain a consequence of this, such as the glass would fall out.

(b) (i) Only the more able candidates scored on this question. Answers such as 'fair test' or 'to make it more accurate' were not credited. More able candidates referred to anomalous or reliable results.

(ii) Candidates scored both marks for a correct answer even if the working was not shown. However, those candidates who failed to give a correct answer and did not show their working lost the opportunity of gaining one of the two marks for using the correct method. Candidates would be well advised to always show their working.

(iii) Credit was given for correct reference to an outlier, or indicating that it was different from the other results or outside the range.

(c) (i) Only the most able candidates scored both marks on this question. Weaker candidates often failed to answer the question by not referring to a risk and a benefit.

(ii) This question proved to be slightly more accessible to candidates. Good answers referred to rats or monkeys, lack of evidence and children's livers not breaking down phthalates.

2 (a) (i) Most candidates correctly identified that there was no other treatment available or that this was the patient's last resort.

(ii) This question was also answered well, with good answers referring to identifying which cancers it will work for, if it will be effective for early cancers and the proportion of patients for whom it will work.

(iii) Most candidates managed to score at least one mark on this question, referring to comparing the drug with existing treatments and using a larger sample over a longer time.

(iv) This was not answered well. Most candidates failed to score and only the most able stated that the side effects were monitored over a long time to check how well it works and to see if the cancer returned.

(b) (i) It was anticipated that this would be a straightforward question, but only half the candidates correctly identified Caroline.

(ii) Most candidates scored one of the two marks, but only the most able managed to score the second. Correct answers referred to both Dave and Robert. It is clear that 'Ideas about Science' is causing difficulties for some candidates.

(iii) Most candidates obtained one of the two marks. Better answers referred to both cost and the fact that it was not licensed or approved.

(c) Most candidates scored this mark, but a significant proportion of them were unable to use the graph to determine the correct answer of low cost and high effectiveness.

3 (a) (i) Good answers stated 10 – 30. Those candidates who gave B – E as their answer were not credited.

(ii) This question was not answered well with most candidates failing to score. Good answers referred to a value from the chart and then compared this to other rocks. Candidates who stated that 'all the values in the chart were bigger than normal' or 'B was many times higher than normal' were credited with both marks.

(iii) Most candidates correctly identified E as the correct response.

(iv) Approximately 50% of candidates scored on this question by stating that there was no correlation or that the highest value was not the closest.

(b) (i) A wide range of responses was credited in this question, but even so only the most able scored the mark. Correct responses include the use of meteor dust, consulting other scientists or the linking of ideas.

(ii) Many candidates failed to score here because they referred to a meteorite impact rather than the effect of volcanoes or the Deccan Traps. Good answers stated that the time scale for the Deccan traps and the extinction did not match.

(c) (i) Surprisingly, a large number of candidates failed to score here. This is possibly due to it being one of the few questions that required factual learning.

(ii) This question was not answered well. Only a few candidates managed to score one of the marks available.

(iii) One mark was allowed for correct spelling. Candidates were allowed one mistake before losing the mark. Good answers stated that life would be destroyed and then went on to give a mechanism such as dust clouds or tsunamis etc.

A214/02 – Twenty First Century Science A (Ideas in Context) Higher Tier

General Comments

The performance of candidates was significantly better this year, reflecting good preparation with the pre-release materials by the centres. The number of candidates writing outside the allocated areas for answers was significantly less this year, with slightly more space given for extended answers. Candidates need to be reminded that marking is carried out on black-and-white scanned images of the papers, so they would be advised to use black pens. Less successful candidates frequently tried to answer one part of a question with the response needed for another part (higher tier candidates really need to scan the questions to see the structure before plunging in), and often did not refer to the article to justify their responses.

There were quite a few candidates who clearly did not have enough time to complete the paper, although the classic indications of inadequate time – half-finished sentences, rapidly degenerating writing – were not seen. It is quite possible that some candidates just failed to turn over the last page, despite the instruction to do so. Candidates do need to be guided by the mark allocations for questions and to manage their time efficiently in this paper.

This paper lays considerable emphasis on 'Ideas about Science', and candidates responded well to question parts assessing IaS 3 (Developing Explanations), IaS 4 (Scientific Community) and IaS 6 (Making Decisions). However:

- IaS 5 (Risk): there is continuing confusion between ALARA and Precautionary Principle.
- IaS 1 (Data and Their Limitations): it was noticeable that few candidates were alert to the presence of the outlier in question 1 (e) (i).
- IaS 2 (Correlation and Cause): the majority of candidates thought that, in this context, correlation had to mean 'negative correlation', i.e. you would expect meteoric iridium to be of lower concentration further from the putative impact site (many looked at the flat map and assumed that New Zealand was the furthest sample site from Chicxulub). Credit was given for demonstrating a lack of negative correlation from the data. Relatively few candidates appreciated the lack of any pattern in the data at all. Many candidates failed to support their statements by quoting values from the table.

Comments on Individual Questions

1 (a) Part (i) was well answered, but in part (ii) many candidates just quoted the question of part (i) as an answer, or reworded the question itself.

(b) This was tackled well by most candidates, who picked up the fact that 1960 + 50 = 2010 and stated it clearly.

(c) Generally well done, but some candidates lost marks by not clearly linking butter and cheese with fatty foods, or by assuming that the skins on tomatoes were an important factor.

(d) It was pleasing to see many candidates able to express the precautionary principle clearly in their own words, although confusion with ALARA still exists widely.

(e) Only the most successful candidates spotted the outlier in the data, and very few were able to justify samples being different on account of the ranges of values not overlapping.

2 (a) Candidates who were successful in part (i) were those able to approach the issue from the patients' point of view. In part (ii), candidates identified the longer time and larger sample size which characterise phase 3 trials, but few picked up on the point that these trials also compare the drug with existing treatments. Those who lost marks in part (iii) were those who gave vague answers, such as 'to see what the effects are'.

(b) A number of candidates revealed in this part that they thought that 'chemotherapy' was either the same as, or similar to, radiotherapy, and stated that Herceptin was an alternative to chemotherapy, rather than an example of it. Good answers revealed an understanding of the testing required before licences are awarded. Weaker answers showed confusion about the meaning of economic benefits. Not many candidates raised ethical arguments for (rights of the individual) or against (greater good of the greater number) the use of Herceptin in (b) (i).

3 (a) Virtually everyone was clear what the range of results was, and many in (ii) could suggest good reasons why samples from one site might vary. Weaker candidates did not compare values in (iii), and the confusion over correlation in (iv) has been mentioned above.

(b) This was well done; weaker responses referred to experimental discoveries rather than imagination and creativity.

(c) This was not well done by many, although the theme of reluctance of the scientific community to accept novel ideas is developed thoroughly in the course.

(d) Many candidates did not tackle this question, possibly for reasons discussed above. Many of those who did, tended to ramble and repeat themselves instead of giving a clear structured comparison of the two theories.

A219 – Twenty First Century Additional Science A (Practical Data Analysis and Case Study)

General Comments

This is the second year of the A219 Science specification. However, for many Centres this was the first year of presenting candidates' work for moderation. The scale of the assessment and moderation operation increased significantly this year. Last year some 200 Centres were involved in Science A. This year 1000 Centres submitted work for more than 225,000 candidate entries across all the specifications listed above, representing a huge increase in the moderation required. It appears that from discussions with people attending INSET that the Principal Moderator Report for 2007 had not always been seen and read. Therefore some of the comments and guidance has been repeated again in this report.

The moderation team had to be increased substantially and included a good mixture of experienced moderators from the legacy and Pilot specifications and new moderators with experience of teaching Twenty First Century Science.

A substantial number of Centres made late (sometimes very late) entries for the Skills Assessment. One cause appeared to be lack of familiarity with UMS systems, so that Centres did not realise they needed to register candidates for coursework moderation as well as for the examination papers and subject aggregation. It is to be hoped that this will not occur again, as it put moderators under great time pressure to complete the work.

Considering the very large number of Centres involved, only a small proportion required mark adjustments to bring them into line with national standards which was very pleasing. However, there were a significant number of Centres that were very close to the tolerance allowed and will need to act on moderators' comments to ensure that there are no problems next year. The agreement between the moderator and Centre in the total marks awarded for each candidate's piece of work was generally quite close although the individual marks awarded for the strands and aspects in the assessment framework varied. Overall, teachers are to be congratulated on the very good transfer of assessment skills from the legacy to the new specifications.

Structure of the report

This report is divided into the following sections

- Administrative aspects
- Supervision and management of coursework
- Marking grids and best fit model of marking
- Marking Strands B and C in Case Studies
- Marking strands I and P
- Data Analysis
- Case Studies
- Grade Thresholds

Administrative aspects

Due to the large number of centres submitting coursework this year it was perhaps not surprising that there were a significant number of administrative problems. Moderators included in their request for the coursework sample a simple checklist for Centres to use to ensure that everything that was needed was included. This helped both centres and moderators to improve efficiency and effectiveness.

The best Centres followed this checklist and included:

- The MS1 sheet or other OCR approved method, clearly showing the total marks awarded
- A spreadsheet showing the rank order and teaching sets of candidates
- The centre authentication sheet (CCS160)
- Candidates work stapled in the left-hand corner with the appropriate OCR front cover showing the details of the mark breakdown
- Details of how each of the tasks used for assessment had been introduced and presented to candidates and any further supporting material
- Annotation on candidates' work in the sample showing where and why the marks were awarded
- Documentation with contact name, phone number and email address for the person responsible for administration of the sample of coursework
- Details of internal standardisation procedures. Some Centres marked the exemplar material provided at an OCR INSET session and discussed and noted good practice. and then selected work from within the Centre to cross-moderate.

However, a significant minority of centres did not appear to give enough care and attention to administrative aspects to ensure that their candidates received the correct total marks and that moderation proceeded smoothly. This caused numerous problems for the team of moderators given the short timescale for the completion of the moderation process.

The following were the most common problems:

- Errors in transcription to the MS1 form
- The copy of the MS1 sent to the moderator showing the marks of each candidate was often not legible
- Mark changes to candidates' work at the internal moderation stage not being carried forward to the MS1 sheet.
- Misunderstanding of the best-fit approach to awarding marks
- Missing front coversheet on candidates' work
- Poor annotation showing where the marks were awarded. In some cases the annotations did not match the mark on the coversheet. In the Practical Data Analysis, those Centres who used a simple coding, such as I(a) 4, helped considerably to identify where the evidence could be found to help moderators confirm Centres' judgements.
- Minimal description of how tasks were introduced to candidates
- Little information about internal moderation procedures.

Following guidance from the Joint Council for Qualifications (JCQ), coursework can be submitted for as many specifications as it is valid for. This means that it has to match both type (e.g. Data Analysis and Case Study) and context (i.e. Biology, Chemistry or Physics) as appropriate for the specification concerned. A number of Centres did not follow these requirements with respect to context and this will not be acceptable next year. Furthermore, if the same piece of coursework is submitted for more than one specification then it must be photocopied and put into the appropriate sample. Many Centres did not help the moderation process work efficiently in this way.

Moderators also commented that there were a significant number of Centres that did not send the mark lists and samples promptly. On occasions it was difficult for moderators to make rapid contact with the person who was responsible for the administrative paperwork to sort out any problems and this slowed the moderation process. The position of half-term in many Centres in the middle of the moderating period was recognised as a contributing factor to some aspects of this problem.

Supervision/administration of coursework

There was evidence that some coursework from a minority of Centres had been reviewed and annotated by teachers giving candidates specific guidance about how to improve their marks. This is not acceptable practice. The Joint Council for Qualifications (JCQ) have published appropriate guidelines which are available in all schools. This can be downloaded through the internet, at the following link:

(http://www.jcq.org.uk/attachments/published/315/ICE%20Coursework%202007%20FINAL.pdf)

The following quotes are from this document:

"Candidates should be clear about the criteria they are expected to meet in their coursework… they may need some further explanation or interpretation before they fully understand the nature of the skills they are expected to demonstrate."

"Teachers may review coursework before it is handed in for final assessment. Provided that advice remains at the general level, enabling the candidate to take the initiative in making amendments, there is no need to record this advice as assistance or to deduct marks. Generally one review would be expected to be sufficient to enable candidates to understand the demands of the assessment criteria."

"Having reviewed the candidate's coursework it is not acceptable for teachers to give, either to individual candidates or to groups, detailed advice and suggestions as to how the work may be improved in order to meet the assessment criteria. Examples of unacceptable assistance include detailed indication of errors or omissions, advice on specific improvements needed to meet the criteria, the provision of outlines, paragraph or section headings, or writing frames specific to the coursework task(s),"

"Once work is submitted for final assessment it may not be revised: in no circumstances are 'fair copies' of marked work allowed".

Marking grids and best fit model of marking.

The majority of Centres recorded their marking decisions on the OCR marking grids and used the completed grid as a cover-sheet for the work of each candidate as required. However, some Centres did not appreciate that in the best fit model of marking, **all** aspects of performance of a given strand must be assessed and then a 'best fit' mark selected. The award of marks is based on the professional judgement of the science teacher, working within a framework of descriptions of performance which are divided into **strands and aspects**. Each aspect of performance should be considered in turn, comparing the piece of work first against the lowest performance description, then each subsequent higher one in a **hierarchical** manner until the work no longer matches the performance description. Where performance significantly exceeds that required by one description, but does not sufficiently match the next higher one, the intermediate whole number mark should be given if available. Thus, the level of performance in each aspect is decided.

The single, overall, mark for the whole strand is then taken as the best fit to the level of performance shown. In the marking of the Data Analysis, each strand is divided into three aspects. Therefore the best fit strand mark would normally be the average of the marks judged for the individual aspects rounding to the nearest whole number. All aspects of that strand must be considered in arriving at the strand mark; if there is no evidence of achievement for an aspect, a mark of zero should be recorded and included in the calculation of the overall strand mark.

For example: E(a)5, E(b)4, E(c)6 Strand E = (5+4+6)/3 = 5 marks
E(a)6, E(b)4, E(c)6 Strand E = (6+4+6)/3 = 5 marks
E(a)7, E(b)4, E(c)6 Strand E = (7+4+6)/3 = 6 marks
E(a)7, E(b)6, E(c)2 Strand E = (7+6+2)/3 = 5 marks
E(a)7, E(b)6, E(c)0 Strand E = (7+6+0)/3 = 4 marks

This approach provides a balanced consideration of each aspect of performance involved in each strand and allows the marker to build up a profile of strengths and weaknesses in the work. Comparison of teacher and moderator judgements in each aspect allows easy identification of where a Centre marks too severely, too leniently or where marking is inconsistent. This allows moderators to make far more constructive reports back to Centres.
There was a tendency for some Centres to award marks on the basis of candidates matching one high level performance description rather than treating the descriptions in a hierarchical way and ensuring that the underpinning descriptions had been matched. A few Centres just counted the highest mark for any aspect to arrive at the strand mark.

Marking Strands B and C in Case Studies

In the marking of the Case Study, strands A and D also have three aspects and a similar best fit procedure to that described above can be used.
However, in strands B and C there are only two aspects in each, and in some cases a professional judgement has to be made when arriving at the best fit strand mark from the average, for example, if 4 marks are awarded for B(a) and 3 marks for B(b). From experience in these cases it is often best to consider both strands B and C together, when arriving at the final strand mark for each. For example, if B(a)4, B(b)3 and C(a) 4, C(b)3 are awarded, then it would be appropriate to award B = 4 by rounding up and C= 3 by rounding down (or vice versa) for a total of 7 marks for these two strands taken together.

Marking strands I and P in Data Analysis

In a few instances, dotted lines on the assessment scheme are used to indicate alternative ways of obtaining credit and a number of Centres did not seem to appreciate what to do in these circumstances. Aspect (a) of strand I and aspect (b) of strand P are sub-divided in this way. This allows increased flexibility, so that the scheme can be applied to a wider variety of different types of activity. This arrangement evolved gradually during the pilot stage of development of the specification and there are some documents with older versions of the assessment grid still in existence in some Centres. Centres should take care to use the version in the current specification, available on the web site www.ocr.org.uk.

Strand I aspect (a) involves awarding credit for processing the data which has been collected to display any patterns. This may be achieved either graphically or by numerical processing, whichever is most appropriate in a particular Data Analysis. If there is some evidence for both approaches, then both should be marked and the better of the two counted.

Strand	Aspect of performance	0	1	2	3	4	5	6	7	8	Strand mark
I	Graphical processing of data **or** numerical processing data										
	Summary of evidence										
	Explanations suggested										

Strand P aspect (b)

Strand P in Data Analysis is made up of three aspects:

P(a) describing the work planned and carried out
P(b) recording of data
P(c) general quality of communication

Aspect (b) is sub-divided into three sections to allow it to cover a wider variety of different types of investigation.

	2	4	6	8
P(b)	Major experimental parameters are not recorded. Some data may be missing.	Most relevant data is recorded, but where repeats have been used, average values rather than raw data may be recorded.	All raw data, including repeat values, are recorded.	All relevant parameters and raw data including repeat values are recorded to an appropriate degree of accuracy.
	Labelling of tables is inadequate. Most units are absent or incorrect.	Labelling is unclear or incomplete. Some units may be absent or incorrect.	All quantities are identified, but some units may be omitted.	A substantial body of information is correctly recorded to an appropriate level of accuracy in well-organised ways.
	Observations are incomplete or sketchily recorded.	Recording of observations is adequate but lacks detail.	Observations are adequate and clearly recorded.	Observations are thorough and recorded in full detail.

The first row of aspect (b) is concerned with recording quantitative data (e.g. times, voltages, volumes etc). The second row deals with the use of conventions and rules for showing units or for labelling in tables etc. The third row of aspect (b) deals with recording of qualitative data (e.g. colours, smells etc). Most Data Analysis assessments are of a quantitative nature and will provide evidence for the first and second rows; they should be considered together and a best fit mark given for aspect (b), ignoring the third row because it is not relevant in this case. For those rare Data Analysis assessments which do not include quantitative but only qualitative evidence, the mark for aspect (b) should be based on the second and third rows only. Once the 'best fit' mark for aspect (b) has been decided, it can be combined with the marks for (a) and (c) to provide the average and so the best fit mark for the strand.

For example, in a Data Analysis providing quantitative evidence:

Aspect of performance			**Strand P mark**
P(a)	7	7	**6**
P(b)	(i) 6	5	
	(ii) 4		
	(iii) not relevant		
P(c)	7	7	

Sub-dividing aspect (b) in this way allows flexibility in marking the recording of data without allowing aspect (b) to dominate the mark for the whole strand.

Data Analysis

General comments

The Data Analysis task provides the opportunity to assess candidates understanding of 'Ideas about Science', particularly IaS 1, 2, and 3. Those candidates who used the language and concepts related to IaS, such as 'correlation and cause', 'outliers', 'reliability', 'accuracy', 'best estimate', and 'real difference' found it much easier to match the performance descriptions of the criteria and gain higher marks.

The majority of Centres clearly understood the information included in the specification about the nature of the Data Analysis task that can be used for assessment purposes. **Candidates must have personal firsthand experience of collecting data by performing a practical experiment.** Candidates then analyse and evaluate this data and are assessed against the criteria in the specification. The data that they collect can be supplemented by further data from, for example, incorporating a class set of results. Work which is based purely on teacher demonstrations, computer simulations, given sets of results etc, is not acceptable. Centres which do not fulfil this requirement will put the marks of their candidates in jeopardy. Therefore, it is very important that Centres include details of how the task was presented to their candidates. It is also important that candidates record and present the data that they have collected and not just plot a graph or do numerical calculations without any reference to the original data.

The better Centres introduced their candidates to the data task and involved them in discussion of the procedures and apparatus rather than just presenting candidates with a detailed worksheet. The whole class situation allows interactive discussion of the experiment so that all candidates understand the reasons why particular methods or ranges of values were chosen. It also allows all candidates to have access to a substantial body of data to provide a firm basis for interpretation and evaluation.

The same Strand I and E assessment criteria are used in investigations in Additional Science and the same marks for I and E from investigations can be submitted for Data Analysis as well. A few Centres did not appear to appreciate this possibility and in a number of cases, on the advice of the moderator, the marks of their candidates had to be adjusted to produce a more favourable outcome.

Many candidates appeared to be better placed to make realistic evaluations of their procedures and data collected through an investigation, rather than through a standalone data analysis experiment. However, in the case of weaker candidates, the data collected was often poor in quality and quantity so that they found interpretation difficult. Therefore, in these cases data analysis activities involving whole class participation were generally the most successful.

In strand I, compared to the previous Sc1.2 criteria, there is an increased demand in the assessment of graphical/numerical skills and of the ability to summarise evidence. A similar, but less marked, effect occurs in strand E. This increased demand resulted in a greater spread of marks, reflecting the different abilities of candidates, and gave clearer differentiation and consequently more secure grading.

Data Analysis Tasks

There was a great variety of data tasks seen by moderators, which was very encouraging, such as:

monitoring pollution;	pulse rates and exercise;
osmosis;	enzyme studies;
stopping distances of bicycles;	breaking strength of hair;
stretching materials under load;	impact strength of plastic bags;
comparing thermal insulators;	resistance of a wire;
viscosity experiments;	voltage of different batteries;
rates of reaction;	objects rolling down slopes

Centres are encouraged to be innovative but must consider the science that might be required to explain any conclusion drawn by the candidates. Centres should match the task to the ability and expectations of the candidates involved.

Strand I: Interpreting Data

I(a): Most candidates analysed their data using bar charts or graphs to illustrate and process the data that they had collected rather than carrying out a numerical analysis. However, some Centres did not appreciate the nature of the 'dotted line' dividing aspect (a) into two approaches, graphical or numerical. As explained in detail earlier in this report, candidates can be assessed on graphical **and/or** numerical processing of data as appropriate and the higher mark can be used in the assessment of this aspect. There is, of course, an inherent understanding that there must be a level of comparability in level of demand between these two routes when awarding similar marks.

It was pleasing to see that the majority of candidates repeated their measurements and included range bars on their graphs indicating the spread and scatter of the results. However, in many cases the graphical work presented by candidates was not of suitable quality for the marks awarded. For example, poor care in general presentation, incorrectly labelled or scaled axes, incorrectly plotted points and poor accuracy of the best fit line. Computer-generated graphs are acceptable but it was noticeable that the best fit line was not always correctly produced and it was generally better for candidates to hand draw their own best fit line.

Some Centres were giving 7 or 8 marks for graphs which were not warranted. Centres must recognise that to be awarded 7 or 8 marks, an indication of the spread of data must be shown **in addition** to the requirements for 6 marks. Candidates generally either plotted the averages with the appropriate range bars or plotted all their raw data with a suitable key.

The following guidelines might help to clarify the assessment of aspect (a) but it is not intended to be comprehensive and to cover all eventualities:

- I(a) 7/8 - accurately plotted graph including a line of best fit and evidence of awareness of uncertainty in data, e.g. range bars, scatter graphs
- I(a) 6 - graph with a best fit line, correctly plotted points, correctly labelled and scaled axes
- I(a) 5 – a dot-to-dot graph, or axes not labelled, or incorrectly plotted point(s), or poor quality best fit line
- I(a) 4 - simple charts, bar charts

For the numerical approach it is expected that candidates will be able to correctly calculate averages from repeat readings for 4 marks, do more complex calculations such as calculate percentage differences for 6 marks and for 8 marks calculate gradients from graphs or use simple statistical methods such as box and whisker plots. There were cases when candidates used equations to process numerical data such as use of Ohm's Law, or energy change

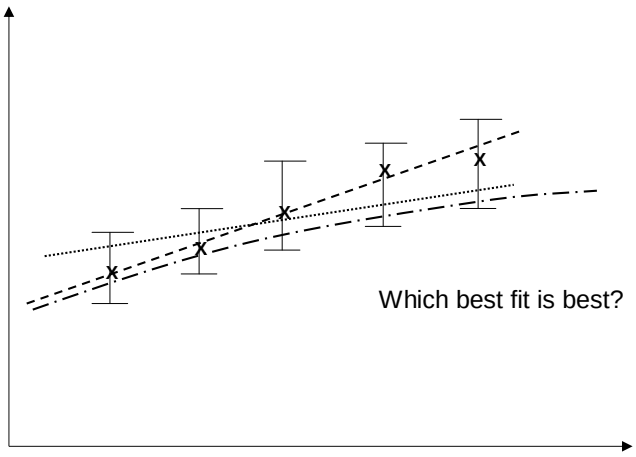
equations. The following guidelines might help when awarding marks but it must be stressed that level of complexity and demand must as always be taken into account.

- I(a) 6/7 – depending on complexity, a candidate substitutes appropriate measurements into an equation, correctly performs the appropriate calculation and excludes outliers when calculating
- I(a) 5/6 - depending on complexity, a candidate substitutes appropriate measurements into an equation, correctly performs the appropriate calculation but includes outliers when calculating averages or includes another minor error
- I(a) 4- a candidate substitutes appropriate measurements into an equation but does not calculate averages or calculates averages only.

I(b): The match to I(b)4, 'identifying trends or general correlations in the data', was well appreciated and most candidates could summarise the patterns in their data with a suitable qualitative statement. However, candidates were often given 6 marks to match I(b)6 with little evidence to support this award. Many candidates referred to 'positive correlation' when they should have said 'Y is directly proportional to X'.

Candidates should consider the patterns and trends and use their data to derive a more formal or quantitative relationship to ensure a secure match with I(b)6. For example, using and quoting the data to show 'as the concentration is doubled the rate doubles', or calculating slopes/gradients and then stating some formal or quantitative relationship between them and the variable studied. Candidates appeared to find it easier to express relationships when dealing with continuous variables. In those experiments which only involved categoric or discrete variables, candidates generally made simple comparisons of arbitrarily chosen pairs of results without bringing out any overall conclusion.

Aspect (b) at the highest level, builds on and extends that found in the previous Sc1.2 model. It requires candidates to review any limitations to their conclusions by considering such things as the scatter in the data, what might happen outside the range of values studied, any overlapping range bars between data points, 'real differences' and values of the best estimate, and whether the best fit line be precisely defined. Candidates who have derived a quantitative relationship should consider what effect the position of the best fit line might have if the scatter in the data is taken into account.



I(c): In many cases candidates did not link their scientific knowledge and understanding to explain their particular conclusion, but related it to a more general situation. However, most candidates could secure a match to I(c)4 by explaining their conclusion using scientific ideas. Introducing scientific knowledge at this mark level is proving more demanding than the comparable level in the previous Sc1.2 model. However, there was some generous marking when matching to I(c)6 and I(c)8 in terms of the depth and quality of the scientific knowledge and understanding shown. In general terms, 5/6 marks would be expected to be awarded to an explanation at about the grade C standard and 7/8 marks at about the grade A standard.

Strand E: Evaluation

The importance of considering the accuracy and reliability of data and its consequent evaluation is an essential feature of this course. It is therefore of concern that the majority of candidates only achieved between 3 or 5 marks for this strand. Candidates should be encouraged to use the appropriate IaS (Ideas about Science) vocabulary and refer to ideas from IaS 1 when discussing the quality of their data.
In many evaluations, credit was given to candidates for describing what is human error rather than an experimental error.

E(a): Candidates are expected to comment on their procedures and to describe improvements or alternative ways to collect their data. Many candidates discussed improvements to their practical procedures, E(a)6, but failed to discuss the limitations of their procedures E(a)4. There was a tendency for some Centres to award marks on the basis of any hint of matching one performance description, rather than checking each level in a hierarchical way. The E(a)4 aspect of performance is really the 'gatekeeper' to access the higher marks. Many candidates suggested possible improvements although they were not always of sufficient quality to be creditworthy e.g. 'do it with a computer', 'repeat my measurements more times' without any justification or explanation, 'be more careful next time I do the experiment' etc. References to such things as better temperature control using a thermostat controlled water bath in a rates experiment or including a variable resistor in the circuit to keep the current constant in the resistance of a wire experiment were more suitable and creditable suggestions.

E(b): Candidates generally identified a data point as an outlier either in the table of results or on the graph although it was not always clear why a candidate had selected a particular result as an outlier. Few candidates considered the range in their repeat measurements to give an estimate of reliability and the general pattern in their results, closeness of data to the best fit line for example, as a basis for assessing accuracy. Candidates' attempts to explain anomalous results were often generously marked and it is important to mark the **quality** of what has been written and not the fact that just **something** has been written.

Better candidates made a decision about whether unexplained outliers should be included in the data and in ranges of repeat readings. Some candidates used simple statistics such as variations of the Q test procedure to try and be more objective when rejecting suspect observations and relating to confidence levels.

E(c): Marks were often rather generously awarded and this aspect was poorly addressed by candidates. Candidates often just discussed the reliability of their data without really linking it to their conclusion and saying whether the uncertainty in their data is sufficient to have any significant effect on the conclusion that they have made.

For the award of 6 marks, candidates should bring together a discussion of the accuracy and reliability of their data and the precision of the apparatus they have used, to establish a level of confidence in their conclusion. Further support for this can come from awareness, in I(b), about the limitations in the conclusion. In addition, for 8 marks weaknesses in the data should be identified, e.g. a limited range or not enough readings at certain values, or degree of scatter too large or variable, together with detailed suggestions about what further data could be collected to make the conclusions more secure.

Some candidates recognised that their conclusion can only apply to the range of values that were studied because outside this range other, specific changes may occur. For example, rates of reaction are bound to slow down as one of the chemicals gets used up, rubber bands eventually break, more exercise cannot always mean that pulse rate continues to increase, etc. Many candidates provided further comment about the confidence level in their conclusions in terms of how close the agreement was to their predictions using scientific theory. Some

candidates whilst investigating the effect of length on the resistance of a wire, plotted appropriate data, calculated resistivity and then compared this with data book values.

Case Studies

General comments

Case Studies continue to be a very successful aspect of the course and have drawn a most positive and enthusiastic response from candidates of all abilities. A number of comments made in last year's report are still appropriate and relevant this year. Case Studies are used to assess candidates' understanding of all aspects of 'Ideas about Science' (IaS), but particularly IaS 4, 5 and 6. The purpose of the Case Study is to encourage candidates to use their knowledge and understanding of the IaS to make judgements when presented with controversial issues which have claims and opinions for both sides of the case. There is still a great deal of evidence that many candidates are not being taught to use these skills when approaching their Case Studies. Where candidates were able to use the language and concepts related to IaS, such as 'peer review', 'replication of evidence', 'correlation and cause' 'reasons why scientists disagree', 'precautionary principle', 'ALARA', 'risks and benefits', and 'technical feasibility and values' they found it much easier to match the performance descriptions of the criteria and gain higher marks.

Case Studies are always best formulated in terms of a question to provide a focus in an area of controversy. For example, 'does air pollution cause asthma?' rather than just 'asthma'. A question will encourage candidates to look for different opinions and views, and to consider the evidence base for claims and the reliability of sources. Studies which were presented as questions to answer were always more effective than those which simply **described** a topic. The Case Study is not a report on a topic but a critical analysis of a controversial issue. Some topics are so uncontroversial that there are no valid opposing views.

In some Centres, all candidates were given the same topic title whereas in others a broader range of opportunities was given. In general, the latter approach was more successful. However, it is wise for teachers to closely monitor their candidates' choice and perhaps limit this to topics which have been covered in course modules. This means that candidates will have access to some basic explanatory science from their student book which will provide them with a good starting position for their study, and at least one book reference for their bibliography. However, whatever arrangements were adopted it was clear that students showed a sense of 'ownership' of the study, and even very weak students managed to produce sensible reports. The key point is that the Case Study question must invite debate and discussion of both sides of the case and be firmly embedded in a scientific context so that candidates can use their scientific knowledge and understanding and their understanding of IaS to produce a balanced account.

Choice of subjects for Case Studies

It was interesting to note that there appeared to be a slight shift in the popularity of subjects for Case Studies compared to last year, e.g. less on smoking and sunbathing issues but more on cloning and energy sources for the future. Case Studies will, and should, slightly shift and evolve as different issues arise in the news and also as new information and evidence is presented to change opinions and views. This will help to maintain motivation and enthusiasm.

Case Study titles included:

Aspects of diet, e.g. Is obesity inherited?
Food additives – are they good or bad?
Should GM crops be allowed?
Should human cloning be allowed?
Are mobile phones bad for your health?
Is nuclear power the answer to our energy needs?
Should we spend more developing alternative energy resources?
Is the MMR jab safe?
Is global warming natural or man-made?
Could life exist on other planets?
Does motor traffic cause asthma?
Should animal testing be allowed?

Some Centres used the film, 'The day after Tomorrow', as stimulus material for 'global warming'. Some centres picked on issues closer to home, e.g. 'dolphins caught in local fishing nets' as a stimulus for 'extinction' issues. There were some Case Studies which were founded on considerable ethical or moral viewpoints and limited science, and this made it difficult for candidates to access high marks in parts of Strands B and C.

Assessment

In general, candidates performed better in Strands A and D compared to B and C. The majority of candidates presented their work using good IT skills but the substance and quality of the work did not always match the high standard of presentation. However, many candidates did produce work which was quite outstanding and was a pleasure to read and moderate. The more successful candidates described the relevant science needed to understand their chosen topics and produced high quality, clearly structured, well resourced and illustrated reports involving critical analysis and individual thought with considerable personal input achieving 20 or more marks. Reports from the weakest candidates often consisted of perhaps two or three 'cut-and-paste' sections from a limited number of sources with minimal editorial comment from the candidate. Thus candidates in this group had selected relevant material from a source, made some attempt to link the facts together and present a report achieving perhaps 5 or 6 marks. Even middle-achieving candidates cut-and-pasted information from the internet and did not always comment on the information and interpret and analyse it sufficiently. The amount of added value in terms of analysis and evaluation by the candidate was often variable in these cases. This limited significantly the marks awarded in Strands B and C and also in D(c) where marks awarded for spelling, punctuation and grammar and the use of scientific vocabulary has to be decided on the words used by the candidate and not on the downloaded information.

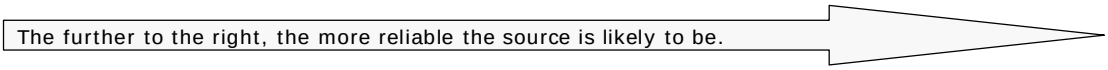
It would be most helpful for moderation if more annotation or commentary was provided for each candidate in the sample selected so that the moderator could more easily identify the evidence to support the Centre's marks. In many cases only the final mark awarded was recorded.

Strand A: Quality of selection and use of information

There was some evidence of improvement in the marks awarded for this strand compared to last year.

A(a): The key aspect here is for candidates to use sources of information to provide evidence for **both sides** of their case study. Websites from the internet were by far the most common source but many candidates referred to their course textbook and their own class notes to collect information. The quality of extraction of information depends on careful selection of relevant extracts to quote directly, and the intelligent re-wording of content to bring out its relevance to the developing arguments in the study.

If no sources are credited then a maximum of 1 mark will be allowed by moderators, unless annotation confirms that a suitable range of sources were used. Higher marks require that sources represent a variety of different views or opinions, but there is not a 'magic number' of sources which divides 3 marks from 2,; quality is more important than quantity. Only the better candidates, in addition to the requirements of 3 marks, attempted to assess their sources in terms of reliability in any rigorous and appropriate way.
For 4 marks it would be expected that candidates consider, for example, whether the source of information is from a 'respectable pressure group' or from the 'quality media' or a school textbook or science magazine, or a peer reviewed science journal or government report. Just saying' I think that the information is reliable because it is from the BBC' is not sufficient. The status of the author and the author's affiliation/institution should also be considered. Therefore if the source of information is a peer reviewed journal, written by a leading expert in the field who is based in a major university then it is more likely to be considered a reliable source. Those candidates who used the language and ideas from IaS 4 in discussing the reliability of sources such as ideas about peer review, the nature of the source or the status of the author, invariably achieved higher marks.



Publication	Website or newsletter of a private individual or a fringe group	Respectable pressure group website or newsletter	'Quality' media e.g. BBC, *The Times, The Independent, The Guardian, Daily Mail*	School textbook or science magazine e.g. New Scientist, Focus, Catalyst.	Peer reviewed science journal or government report
Nature of the data	Based on little or no data	Based on some data, but of questionable validity or reliability, e.g. small sample, not representative of population.	Based on just one study (or several small studies). Little information about sample, or procedures followed.	Valid and reliable method e.g. health study with large sample size, carried out over many years	Results repeated by different scientific studies, each using a valid and reliable method,
Science explanation	No support within the science community	New explanation, but with basis in accepted scientific ideas	One among several explanations discussed with the science community	Agreed by most, but not all, within the science community	Agreed by everyone within the science community
Status of the author	Someone who knows little or no science. Someone known to have a particular point of view	An inexperienced scientist or science student	A professional scientist whose expertise is in a different field	A professional scientist working in the area – though not regarded as a top expert by his/her peers	A recognised expert in this field of science
Author's affiliation or institution	A non-science institute	An scientific institute or company that represents particular views only	An scientific institute with a doubtful reputation	A recognised university or scientific institute	A leading university or scientific institute, or the research lab of a major company

A(b): The majority of candidates included a bibliography of sources at the end of their reports and most provided references to any websites that had been used. For 2 marks candidates identified their sources using incomplete references. In general, when applied to website addresses this meant that candidates referred to the homepages only e.g. www.bbc.co.uk. If only one or two incomplete references are given then one mark should be awarded and, of course, if no references are given then zero marks.
For 3 marks, candidates included complete references to the exact url address of the webpage which would allow direct access to the source of information. When referencing books, title, author and page references are required to match this mark. It was clear that more able candidates were including more detail, and this has begun to re-define the standard at 4 marks for 2009. Candidates working at this level included the date that the site was visited and also some information about the nature or sponsorship of the site. For example, a candidate presenting a Case Study on cloning included the following reference:

http://exchanges.state.gov/forum/journal and went on to explain that it was the US Bureau of Educational and Cultural Affairs and included information from the Advances in Biotechnology journal to provide teachers with resources about breakthroughs in biotechnology.

A(c): Candidates were still not very good at clearly showing where sections of text were directly quoted. It should be made clear to candidates that they are expected to copy some, reasonably short, material from their sources but it is essential that they make this completely clear. Use of quotation marks, use of a different font or colour highlighting were some of the methods used by the better candidates. The better candidates included references or specific links within the text to show the source of particular information or opinions using, for example, numerical superscripts linking to references in the bibliography. Credit is given, not so much for the quotation, as for the editorial comment to explain why it was chosen, and how the candidate thinks it contributes to the arguments being compared in the study. If this referencing is not done, then candidates may also suffer in strand B, where they cannot easily show that they have recognised and evaluated the scientific content of particular sources, and in strand C, where they compare different opinions.

A number of candidates handed in full print-outs of their sources which was not necessary. Some candidates gathered information from self-constructed questionnaires which also added to the pool of material for their Case Study, but occasionally this distracted them from the underlying science and scientific evidence.

Failure to discuss reliability of the sources, failure to fully indicate and reference quotations and failure to indicate the relevance of the quotations selected in the study prevented many candidates from being awarded 4 marks in this strand.

Strand B: quality of understanding of the Case

In simple terms, this strand assesses candidates' ability to consider the claims and opinions they have collected from their sources, to describe and explain the underlying relevant science, and to recognise and evaluate the scientific evidence on which the claims were based (IaS 1, 2 and 3). Those candidates who had clearly been taught IaS used the appropriate language and concepts, and achieved higher marks. However, there was some general improvement in this area compared to last year with more candidates including relevant KS3 and KS4 scientific ideas and targeting their report towards the suggested audience of intelligent Year 9 students.

B(a): The majority of candidates described in the introduction to their case studies the relevant background science, with the more able candidates going in to a greater depth and detail. However, most candidates did not go much further and it was only the most able who could link their scientific knowledge and understanding to the claims and opinions that they had found from their sources. Reporting was too often still at the 'headline level', simply repeating claims without looking beyond the headline for the underlying science.

For topics which are related to course modules, it can be taken as a general guide that 6 marks requires all that is available in available supporting text books. The 7^{th} or 8^{th} mark will come either for applying this correctly to the case, or for finding and explaining some more specialised knowledge (e.g. the way in which up to 8 mobile phones can "time-share" a single frequency to reduce total radiation loads and increase capacity).

B(b): This aspect focuses on candidates' ability to recognise and evaluate the scientific evidence that any claims and opinions are based on. Most candidates were able to recognise and extract relevant scientific content and data in their sources and were awarded 4 marks. Candidates who were awarded 6 marks referred to the evidence base of the various claims and opinions, e.g. an experiment, a collection and review of existing data, a computer simulation etc. Candidates obtaining 7 or 8 marks looked more critically at the quality of the evidence. They

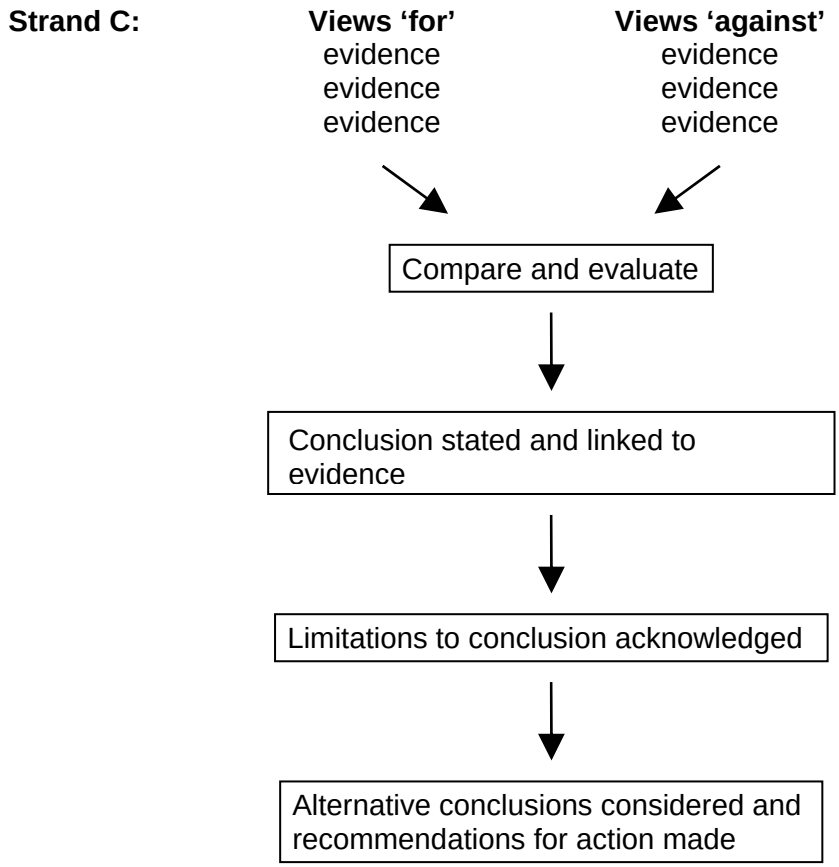
used terms like 'reliability' and 'accuracy' when considering data, they looked at the design of experiments and the issue of sample size and they also compared the reliability of data between sources. For example, whether the evidence has been collected using a valid and reliable method, e.g. a health study with a large sample size over many years, or whether the results have been repeated by other people and the same conclusion drawn.
The information they find can be used towards credit for D(b) as well, if presented as graphs, charts or tables, or as informative schematic diagrams.

It was noted that in the Data Analysis component of this course, most candidates were able to some extent discuss and evaluate the data that they had personally collected in their practical experiments. However, in the context of the Case Study the vocabulary and use of terms from Ideas about Science were not used very frequently. Many candidates included tables/bar charts/graphs of relevant data but did not use or comment sufficiently on the information presented.

Strand C: quality of conclusions

In this strand, candidates should consider aspects of IaS 5 about actual and perceived risks and the ALARA principle and in IaS 6 about how society should respond. There was again evidence that candidates were not using and applying their 'Ideas about Science' sufficiently to warrant the higher marks in this strand.

The aspects for Strand C can be summarised in the following simple flowchart



Lower achieving candidates reported the information that they had collected without sorting it in any particular way and were awarded 2 marks. However, most candidates could sort the information that they had gathered into views 'for and against', sometimes in a tabular form if appropriate. Those who just listed it in this way were awarded 4 marks. Better candidates

started to compare and balance arguments against one another in both their 'for and against' list and were awarded 6 marks. The best candidates began to analyse, compare and evaluate the claims and opinions, describing their own viewpoint or position in relation to the original question and justifying this by reference to the sources. There should be evidence that the sources used have been compared to check for consistency and to identify areas of conflict or disagreement. In this way it is clear that B(b) and C(a) are closely linked. There should also be evidence that the underlying science has been used to try to resolve any differences. Alternative conclusions should be considered where appropriate and recommendations for the future should also be included.

Several candidates scored less marks than they were probably capable of, particularly in Strand C, because they simply chose to report information about their topic, without any real analysis of the scientific evidence they were based on. Opinions from a variety of sources were often quoted but without reference to the source or to the evidence that the claims were based on. Although most candidates made an effort to give two different views in their studies, these were rarely compared, and conclusions often seemed to lack any clear basis in the evidence shown. This approach rarely leads to marks above 4 or 5. It was very rare indeed for even the better candidates to attempt any judgement of the quality or reliability of any of the scientific evidence offered by their sources. The best candidates will not simply state an answer to their own question ('I think mobile phones are dangerous', 'too much sun is bad for you') they will also use the evidence they have presented in their study as a basis for recommendations about what to do ('use a hands-free kit', 'text don't talk', 'avoid sunbathing at midday', 'wear sun screen' etc). Thus, the most successful titles were often questions where the answer would lead to some recommendations for action.

Strand D: quality of presentation

D(a): It was pleasing to see that the majority of reports included headings and/or sub-headings to provide the necessary structure. There was a definite improvement in this aspect and the better candidates included a table of contents and numbered the pages in their report to help guide readers quickly to particular sections. Those reports which were presented simply as PowerPoint printouts achieved good marks in this aspect but often lacked sufficient detail for high marks in the other strands. However, PowerPoint printouts which had notes to accompany each slide were much more successful in obtaining higher marks. It would be helpful for moderation purposes if these could be printed out in the format which gives one slide and the accompanying notes on a single A4 sheet. The slide can then concentrate on headings or visual impact, with the notes supplying the detail, references to sources, etc.

D(b): Suitable diagrams and graphics should be incorporated as appropriate to clarify difficult ideas and encourage effective communication, but in practice the visual impact was often variable. Too often images were decorative, rather than informative. Of course, many textbooks include decorative rather than always informative images and this may be a source of confusion for some candidates. A mixture of both is usually the best route to provide an interesting and informative report. Rather too little use was made of diagrams, charts, tables or graphs as compact ways of conveying large amounts of information, or to visualise difficult concepts. The best candidates always made good use of explanatory diagrams by referring to them and using the information that they contained. They integrated illustrations into their report, making comments about what was shown by the illustration, and how it was relevant to the study.

If there are no decorative or informative images included then zero marks is awarded. If one image is included, or a decorative front cover or other low level attempt to add interest is present, then 1 mark is appropriate. Two marks would be awarded for the inclusion of decorative images only, or perhaps for the minimal use of informative images. Three marks would be given for including a variety of informative illustrations, e.g. charts, tables, graphs, or schematic diagrams, and 4 marks if this is fully integrated into the text, referred to and used.

Too often downloaded images from the internet were not clear, too small and not referred to in the text.

Some candidates included a useful glossary of scientific terms that had been used within the report.

Final comment

All members of the moderating team remarked on the care and effort put in by teachers to provide varied opportunities and motivating contexts for their candidates to achieve the best results in this new assessment framework. We would like to record our thanks and appreciation for a good job, thoroughly well done.
The importance of cluster group meetings, attendance at OCR INSET meetings both in- and out-of house, using the OCR consultancy service for checking marked scripts, and consulting and using the teacher guidance booklets on www.ocr.org.uk are all available methods to improve the awareness and understanding of this new assessment programme. It is highly advisable that staff have time during the year for internal standardisation meetings to share and develop expertise in the Science Department.

2008 Grade thresholds for Data Analysis and Case Study combined

		Grade thresholds							
Component	**Maximum mark**	**A***	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Data Analysis and Case Study	16 + 24 = 40	33	29	25	21	17	13	10	7

The grade thresholds have been decided on the basis of the coursework that was presented for award in June 2008. The Data Analysis and Case Study grade thresholds are only in their second year of being awarded for the new specifications. Thus, the threshold marks will not necessarily be the same in subsequent awards. Some adjustments may be expected as experience with the criteria grows, and a wider range of Centres becomes involved.

Grade Thresholds

General Certificate of Secondary Education
Science A (Specification Code J630)
June 2008 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
A211/01	Raw	42	N/A	N/A	N/A	32	28	24	20	16	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A211/02	Raw	42	36	34	30	27	23	21	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	0
A212/01	Raw	42	N/A	N/A	N/A	32	28	24	21	18	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A212/02	Raw	42	35	32	28	24	19	16	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	0
A213/01	Raw	42	N/A	N/A	N/A	32	28	24	21	18	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A213/02	Raw	42	34	31	27	23	19	17	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	0
A214/01	Raw	40	N/A	N/A	N/A	23	18	14	10	6	0
	UMS	34	N/A	N/A	N/A	30	25	20	15	10	0
A214/02	Raw	40	25	22	17	13	9	7	N/A	N/A	0
	UMS	50	45	40	35	30	25	23	N/A	N/A	0
A219	Raw	40	33	29	25	21	17	13	10	7	0
	UMS	100	90	80	70	60	50	40	30	20	0

A219 (Coursework) - The grade thresholds have been determined on the basis of the work that was presented for award in June 2008. The threshold marks will not necessarily be the same in subsequent awards.

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A*	A	B	C	D	E	F	G	U
J630	300	270	240	210	180	150	120	90	60	0

The cumulative percentage of candidates awarded each grade was as follows:

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
J630	2.2	13.5	35.6	63.2	81.4	92.4	98.0	99.8	100	111 111

117 993 candidates were entered for aggregation this series

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

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