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GCSE

Science A

Twenty First Century Science Suite

General Certificate of Secondary Education **J630**

Examiners' Reports

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J630/R/11

Oxford Cambridge and RSA Examinations

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General Certificate of Secondary Education

Science A (Twenty First Century) (J630)

EXAMINERS' REPORTS

Chief Examiner's Report

Candidates are generally well prepared for the styles of questions in these papers, in particular for those objective questions that do not require extended writing or calculation. Questions addressing *Ideas about Science* are generally well tackled in both Foundation and Higher Tier papers. Free-response questions are less well done than objective ones, although it was pleasing to see that the number of instances where those parts were automatically left untried has dropped. However, there are still many candidates – including those on Higher Tier papers – who do not do themselves justice in non-objective questions. As this style of questioning will receive more emphasis in examination papers for the new GCSE specifications (for all awarding bodies), it is increasingly important that candidates are encouraged to express themselves clearly, and to develop the skills of coherent explanation without repetition.

A related issue is that of presentation. Examiners report that many candidates are disadvantaging themselves seriously with handwriting which is so difficult to decipher, particularly when combined with poor spelling, that marks cannot be awarded. As candidates do not seem short of time, they must be encouraged to rush less and take a little more care in presentation.

One other shortcoming is also noted: many questions require calculations, and it was evident that many candidates did not use calculators. This seriously handicaps them and, as the new GCSE specifications require more calculation in the examinations, Centres should ensure that candidates realise that coming to a science examination without a calculator is as inadequate as coming without a pen.

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

General Comments

The paper was well attempted and scored a good mean mark. Candidates are now experienced at this style of paper and few make basic errors such as ticking the wrong number of boxes. Although many struggled with the free response questions there are fewer candidates unable to attempt them although many just wrote anything they knew about the topic without addressing the question. Very poor handwriting and spelling made some responses difficult to interpret.

Comments on Individual Questions

Q.1(a) Most candidates were able to give the correct combination of alleles for people with and without a genetic disorder. The most common error was to reverse the combinations.

Q.1(b) Diagrams showing allele A at the bottom of the second chromosome rather than at the same level were common.

Q.1(c)(i) Few candidates knew that a gene is an instruction for making a protein. Most thought it was an instruction for making DNA.

Q.1(c)(ii) Almost all candidates were able to suggest an advantage/disadvantage for the research to develop gene therapy and it was answered well despite some confusion between cure and treat. The disadvantage was usually based on cruelty to animals or against animal rights.

Q.1(c)(iii) Only the better candidates realised that cells with a normal (A) allele would make the missing protein. A significant number thought that the cells with the normal allele would be stronger than the cells without.

Q.1(c)(iv) More able candidates successfully identified embryonic stem cells as being unspecialised and able to develop into any kind of cell. The most common error was to choose specialised instead of unspecialised although many also thought that they were able to develop into eggs. An unexpected number of candidates ticked only one box.

Q.1(d) Candidates showed a good understanding of the terms risk, reliability and ethics and were able to link the statements with the appropriate term.

Q.2 Most responses showed little understanding of cloning. Correct explanations of a clone were rare and showed a lack of understanding of the concepts of DNA, genes and chromosomes. 'Same genes' was a common incorrect response and vague answers describing similar appearance were also common. Candidates also struggled to explain how natural human clones occur and sometimes their responses were confused with artificial fertilisation. Few candidates understood the need for the egg to be fertilised before splitting to form a human clone.

Q.3(a) The gas used up when fuels burn was not well known; both nitrogen and carbon dioxide appeared with approximately the same regularity as oxygen. More knew that carbon dioxide is the gas removed by photosynthesis, with oxygen being the most common incorrect response. Most were able to identify at least one of the gases which dissolve in rainwater, with the most common error being to choose nitrogen instead of carbon dioxide, possibly thinking about NOx and SO_2 causing acid rain.

Q.3(b) Most candidates were able to draw good diagrams showing a central carbon between 2 oxygen atoms. Common errors were to show the 3 atoms in a triangular arrangement or connected in the wrong order.

Q.4(a) Many candidates failed to score by limiting their responses to vague descriptions of pollution problems, especially global warming, without relating them to the gases given in the question. Better candidates clearly linked the gas with the problem eg the poisonous nature of carbon monoxide and/or the formation of acid rain from nitrogen oxides.

Q.4(b) The idea of less cars causing less pollution was understood well but the idea of a single bus replacing a number of cars was explained less well with many answers just describing an increase in use of public transport.

Q.5(a) An encouraging number of candidates correctly identified the range of the data in the graph as 10-120 $\mu g/m^3$.

Q.5(b) Almost all candidates realised that Josh was using data from the graph in his statement and most correctly chose Rajid's statement as the other one that was using data. Donna's more general statement that there was less traffic at weekends was the most common replacement for Rajid's. Candidates found it more difficult to select the statements which described a correct correlation and the cause for this correlation, with Sara's statement the most common incorrect answer for the correlation.

Q.6 Most candidates recognised that statement 1 contained data as it referred to the length of the research. Many also realised that the length of time for radio waves to reach us from the far side of the Milky Way meant that statement 5 also contained data. It was also well understood that the long time it took for the radio waves to reach us meant that stars are very far apart.

Q.7 Most candidates realised that Dr. Adams suggested that the extinction of the dinosaurs occurred at about the same time as the impact of the giant asteroid and that neither scientist talked about peer review. However, fewer were confident that both scientists were giving an explanation for the extinction or that both were using data to support their theories.

Q.8(a) Most candidates understood that other scientists did not agree with Wegener as they did not believe there was enough evidence to support his ideas.

Q.8(b) The features/events caused by movement of tectonic plates were well understood by almost all the candidates although some selected only earthquakes in spite of being asked to select two correct answers from the list.

Q.9 There were a few excellent responses to this question, which gave candidates the opportunity to show what they knew about stars, galaxies and asteroids. Most candidates scored poorly as they were unable to address the specific points raised by the questions and just wrote down random 'facts' – a significant number covered only one of the bodies. There was a lack of fundamental knowledge of astronomy with confusion between universe and solar system. (eg galaxies are in the Solar System). Most candidates had a fuller knowledge of stars than either galaxies or asteroids. The relative size of the bodies was not appreciated and the movement of asteroids was confused. Few candidates placed asteroids in the Solar System let alone between Mars and Jupiter.

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

General Comments

Candidate's performance in this paper was broadly similar to 2010. The paper discriminated well and the questions proved to be of appropriate demand. Candidates continue to show confidence in approaching the objective style questions, with hardly any left unattempted and with very few instances of candidates misunderstanding or misreading the rubric. Candidates clearly find the free responses questions more challenging. Many answers to the free response questions lacked appropriate scientific detail and in many cases candidates who appeared to know something of the subject were let down by the imprecision and lack of clarity of their answers. Although it was rare for objective questions to elicit no response, this was much less true for the free response questions. Given the increased number of free response questions that will be in the examinations for the new specification, preparing candidates for this type of question is an area on which Centres could profitably concentrate.

The questions assessing Ideas about Science were in the main well answered, with candidates showing familiarity and understanding of risk, reliability, ethics and correlation.

It is of great importance that candidates are entered for the correct tier. As there will be an increase in the number and length of the free response questions in the examination for the new specification this will become even more important.

Comments on Individual Questions

1 (a) This question discriminated well and many candidates gained full marks. The difference between dominant and recessive alleles was well known but weaker candidates were less certain of the definition of a gene.

1 (b) (i) This proved to be a difficult question. Many candidates listed the individuals with FRDA as being carriers and those who correctly identified 1 and 2 as carriers often did not realise that 6 must also be a carrier.

1 (b) (ii) Most candidates could correctly identify the probability here.

1 (c) About half the candidates either did not know that genes are instructions to make proteins or were unable to correctly apply this knowledge.

1 (d) This question was not well answered, with many candidates simply repeating information supplied in the stem of the question. Some gave very vague answers. Where candidates did gain credit it was for knowing embryonic stem cells were unspecialised; many then stated this meant the stem cells could turn into anything without specifying what or how this would help in the case of a genetic disorder. A common error was to think that dominant alleles would somehow take over and cure the condition.

1 (e) This question was well answered with most candidates gaining two or three marks.

2 This question exposed a great deal of confusion amongst candidates as to exactly what is meant by cells, nuclei, genes and DNA. Most candidates were unable to use these terms correctly and consequently failed to write creditworthy answers. Knowing that the egg cell nucleus has to be removed was the most common correct response and many candidates who understood this then gained another mark for describing the insertion of a nucleus into the "empty" egg cell. Some candidates wrote at length about IVF.

3 (a) (i), (ii) and (iii) This question was well answered. Most candidates gained two marks in (i) and a pleasing number could identify the correlation and suggested cause correctly.

3 (b) This proved to be a difficult question. Many candidates knew that nitrogen and oxygen from the air react at high temperatures or that nitrogen monoxide is oxidised to nitrogen dioxide but few could correctly identify both in order to gain the mark.

4 (a) This question was very poorly answered. Candidates did not always make it clear whether they were describing an advantage or a disadvantage although this was often clear from the answer itself. Many contented themselves with vague answers about "reducing pollution" or discussed the effect on car drivers when the question was about lorries and buses. The effect of vehicle pollution on asthma sufferers was the most common creditable response.

4 (b) This question was reasonably well answered with many candidates gaining two or three marks. Many candidates knew of catalytic converters although fewer knew how they worked, with acting as a "filter" being a common misconception. Low emission cars were also often suggested but without suggesting how this can be achieved.

5 (a) The best candidates answered this question well. Weaker candidates either: did not attempt the question, produced quite novel molecules, failed to use the correct symbols or drew carbon dioxide as COO rather than OCO. Many candidates who gained the mark for carbon dioxide drew a water molecule correctly but failed to balance the equation by drawing two water molecules.

5 (b) The removal of carbon dioxide from the atmosphere by photosynthesis was reasonably well known and many better candidates were aware of the role of rain and oceans. Candidates who simply wrote "oceans" rather than the more complete "dissolves in oceans" failed to gain the second mark.

6 Many candidates failed to answer all three part of the question or gave long descriptions of the Solar System. There was a great deal of confusion about the terminology in general and "space", "atmosphere" and "Universe" in particular. Furthermore the answers themselves were often very confused and the lack of proper sentence construction made the candidates' intensions hard to understand, especially when they were trying to say something about the relative size of objects.

7 (a) and (b) Very few candidates knew the speed of light. More knew it was a measure of distance but more commonly it was thought to be how long light takes to reach the Earth from the Sun or "how long it takes light to travel in a year".

8 Most candidates gained at least one mark but few gained all three. That neither scientist thought that an asteroid had definitely caused the extinction of the dinosaurs proved to be the hardest statement to understand.

9 (a) This question was well answered with candidates clearly well taught about Wegener and his ideas.

9 (b) Better candidates had no problem with correctly ordering the statements. Weaker candidates usually correctly started with C before losing their way.

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

General Comments

The paper was generally well attempted and produced a satisfactory spread of marks. Candidates seem to have been well prepared for the objective style of questioning. Many candidates seemed significantly less confident when tackling open response questions.

Candidates should be aware that the marking is done from scanned images of their scripts. Consequently, if candidates change their minds, any alterations must be made clearly and unambiguously. Any marks that are ambiguous – possibly made with the intention that the examiner could give credit for either of two responses, where only one is correct – will not gain credit on this paper.

The level of difficulty was appropriate for the ability range and most questions were accessible to candidates across the range. The majority of candidates generally performed well and marks were awarded across a reasonable range, demonstrating satisfactory differentiation.

Most candidates correctly followed the instructions in the questions and most made their responses appropriate to the number of marks available. A small minority, 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 This question posed some difficulties for many candidates. Part (a) included the first free response question on the paper. This differentiated well, but even more able candidates struggled to explain why the test was done five times. The idea of an outlier in the data seemed better understood in (a) (iii). Part (b) provided varying responses, with most candidates scoring one of the two marks.

2 Parts (a),(b) and (d) produced good responses across the ability range, although fewer high ability candidates than expected knew that polythene is made from crude oil. Weaker candidates struggled to answer part (c) and the majority of candidates failed to make clear if they were discussing the transportation of paper bags or polythene bags.

3 In this question a significant number of candidates failed to follow the instructions and only made two links instead of the three links required. Many candidates seemed uncomfortable in making two links to the answer 'carbon dioxide' and therefore could not score full marks here.

4 Parts (a) and (b) produced a well differentiated range of responses, with all but the very weakest candidates able to pick up some marks. Part (c) caused considerable problems and many candidates offered no response to this question. We have provided detailed guidance in the right hand column of the mark scheme to illustrate what we were looking for on this question. Centres would be well advised to make use of this to help prepare foundation tier candidates for this style of question in future examination sessions.

5 This proved to be a fairly straightforward question for most candidates, although some more able candidates got caught out on the first part of the question. This style of question has been commonplace on recent past papers and it seems clear that centres have made good use of these past examination materials to help foundation candidates prepare well for the objective style of question.

6 Almost all candidates answered part (a)(i) correctly and the more able candidates had little trouble with (a)(ii) and (b) also. For a free response question, (c)(i) was reasonably well answered, although access to the second mark was rare. Part (c)(ii) caused much confusion, with many candidates trying to link all the boxes on the left to associated boxes on the right. A single link was required here and even more able candidates failed to follow the clear instruction to do this.

7 Relatively few candidates could provide a satisfactory description of the differences between arteries and veins as required in part (a) of this question. The most common problem was the lack of a comparative statement. Most coped well with part (b), scoring an average of 3 out the 4 marks available.

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

General Comments

Generally candidates' ability to answer the free response questions is improving.

There are too many instances of questions not being read correctly, for example only giving one answer for 6(b)(iii), not giving a use AND the information in 4(b), using the data in 7(b)(ii) and not relating the function to the structure of the artery in 8(b). Lack of careful reading was not confined to weaker candidates.

Many of the answers for the calculation in 2(a)(i) showed no working, so there was no possibility of awarding some credit if the answer was incorrect.

Comments on Individual Questions

Q.1(a) Many candidates scored well on this question, with no common pattern for mistakes.

Q.1(b) Many candidates scored well on this question. Common errors were answers about other aspects of the bag, for example the making or disposal of the bags. A number of pupils talked about "car fumes" in a question clearly about lorries.

Q.2(a)(i) Most candidates correctly calculated the answer, some using the (acceptable) median value rather than the mean. Most errors were mathematical. Candidates with calculators would have had an advantage here.

Q.2(a)(ii) was generally well answered, many candidates had understood the concept of an outlier. Some missed out on the second mark as they didn't quite go into enough detail about what should be done with the outlier. Incorrect responses tended to talk about ranges in general, without referring to the values in the table.

Q.2(b) was not well answered, many candidates got some parts correct, but common errors included using 'atoms' instead of 'molecules', and 'breaking' or "tangling" instead of 'sliding past each other'.

Q.3(a) Many candidates got 3(a)(i) correct, and identified A but struggled with D in 3(a)(ii).

Q.3(b) Most candidates got some marks, a few got all the marks, although there were no obvious common errors in understanding.

Q.4(a) The majority of candidates successfully recalled the order of the electromagnetic spectrum.

Q.4(b) This was not well answered. Many candidates gave examples of the use but did not explain/understand the idea of transmitting information and gave answers with insufficient detail to gain marks.

The answer that "microwaves cook food" was seen on many papers. Some candidates explicitly identified "heat" as the information transmitted. Remote controls, mobile phones and radios were the most common successful uses described.

Q.4(c) Many candidates struggled to recall how microwaves heat food, the most common mistake referring to the energy of the photons.

Q.5(a) Candidates scored well in this section and showed a clear understanding of the arguments.

Q.5(b) The majority of candidates scored full marks, mistakes usually occurring in the last three choices.

Q.6(a)(i) Many candidates failed to realise that water is a greenhouse gas, so a common error was "only those with carbon atoms".

Q.6(a)(ii) Photosynthesis was well described, the inclusion of nitrogen being the most common mistake.

Q.6(b) Many candidates struggled with the skill of using the information supplied in answering these questions.

Q.7(a) Many candidates did not score in the first part as they did not address the symptoms and instead described other features, for example mutations. Most did well on the second part; a common error here was to name specific diseases rather than microorganisms.

Q.7(b)(i) The "catching" and "spreading" marks were readily described and this part of the question was generally answered well. However far fewer candidates scored the marks available for the "society focused" part of the answer. A number of candidates described MMR as a disease.

Q.7(b)(ii) split the candidates, who either understood the question and generally got scored well, or who missed the point and scored nothing. Only a few got one mark, for the correct description with the wrong conclusion.

Q.8(a) Again there were generally two types of response, those from well prepared candidates who scored well, and a large number of responses displaying no understanding. "Arteries pump blood" was a very common mistake; failing to describe the structure of arteries was also common.

Q.8(b) There were many good answers about what the blood carries to the heart, but candidates were not as good at describing what the blood carries AWAY. The cause of heart attacks was well known.

Q.8(c) Well answered by the majority, with no clear pattern of mistakes.

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

General Comments

Most candidates completed all the paper and there was no evidence that shortage of time was an issue. The majority of candidates seemed to understand the way the questions were designed to be answered, even if they did not produce the correct response. There seemed to be fewer examples than previously of candidates responding in a way which was difficult to mark using the on-line marking system.

The paper allowed candidates to perform well and the spread of marks was wide, showing good differentiation. Some of the open response questions asked candidates to produce answers worth two or three marks but some candidates did not seem to appreciate that more than a basic response was being asked for.

Comments on Individual Questions

1 An easy starter question – in part (a), candidates were asked to sequence steps in wind generation. In parts (b)(i) and (b)(ii), they were required to identify characters stating particular views on wind farms. Most were able to give correct responses.

2 In parts (a) and (b), candidates were asked to plot a value on the bar chart and then interpret the chart. The only part which appeared difficult was (b)(ii), where candidates often missed the key phrase "natural sources", and so gave nuclear industry as an incorrect answer. Part (c) was more challenging – although most candidates could identify ways of reducing risk, few candidates scored all 3 marks. Vague references to doctors or nurses did not score, and references to X-rays were not credited as this does not involve handling radioactive materials. Only a minority of candidates clearly stated risk in terms of cell damage or cancer.

3 Most candidates scored at least 1 out of 3 marks for identifying radioactive sources with particular properties. Most were able to indicate the source emitting the most penetrating radiation but fewer could name the sources as beta and gamma from the information given.

4 Parts (a) and (b) required candidates to select statements which provided evidence for humans directly and indirectly causing the extinction of the passenger pigeon. The statement showing a direct cause proved easier to identify.

5 Part (a) was often missed by candidates – they were asked to add an arrow to the food web to show puffins eating sand eels, but many seemed to have missed this instruction and failed to respond. Others drew the arrow in the wrong direction. Thus, only a minority scored what should have been an easy mark. Part (b)(i), selecting information from the food web, proved straightforward for most. Part (b) (ii) required candidates to choose a species with the most varied diet, and only a minority selected the correct organism. Similarly, only a minority chose competition as the correct response in part (c).

6 Part (a) asked candidates to complete a diagram showing human evolution. Most candidates were able to score at least 1 mark but few placed all three species in the correct places. Commonly chimpanzee was placed on the same branch as *Ardipithecus* rather than humans. In part (b), most candidates stated that the pelvic bones were badly crushed but very few were able to suggest that the fact that the skeleton was incomplete would also cast doubt on the theory that *A.ramidus* could walk upright.

7 Part (a) proved a challenge for many candidates. Although they were given some phrases to use, many were unable to produce coherent explanations as to why male peacocks have such large tails. Often the phrases were just restated in various ways. Most commonly, candidates did not correctly explain the different roles of male and female peacocks in the process – some thinking that the female had the bigger tails. Few used the idea of passing on genes. In part (b), most realised that fossils are remains of dead plants and animals but did not score because they could not give DNA as the chemical forming chromosomes.

8 In part (a)(i), candidates were required to explain what preservatives do – most could state that they make the food last longer but preventing the growth of microbes was rarely mentioned. Part (a)(ii) was well answered by most. In question 8(b)(ii), surprisingly few could give a food with natural chemicals posing a risk to humans. Many gave answers that were not natural, such as pesticides. Similarly, part (b)(ii) was not well answered. Most common credited answers involved farming and pesticides or fertilisers.

9 The great majority of candidates were able to score at least one mark in part (a) for identifying the jobs of the Food Standard Agency, although few selected both correct answers. Part (b) produced a similar result – most could identify at least one correct statement as true or false regarding information on food labelling but few gave all three correct answers.

9(c) Very few were able to give even two of the four main elements in proteins required for part (i). Part)(ii) asked candidates to link three statements about what happens when proteins are eaten, with the part of the body responsible. Most scored at least one mark for giving one correct link.

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

General Comments

The paper was generally well attempted. Candidates were well prepared for the objective questions, although some lost marks unnecessarily by not making their answers unambiguous: if candidates change their minds about an answer, they must make their final choice clear. If an extra choice is made, marks will be lost, even if one of the choices is correct.

Free-response questions were generally tackled better in this session. In these questions, the most successful candidates read the question carefully, and take care not to repeat themselves. Examiners do make every effort to understand the candidates' responses, but in some cases, marks could not be awarded because the answers were impossible to read.

All candidates seemed to have made good use of their time, and there was no evidence of candidates running out of time.

Comments on Individual Questions

1 (Wind farms) This question was well done by most candidates.

2 (Radiation dose) The objective parts of this question were done well. In the free-response part, on the risks to workers in the nuclear industry, better candidates followed the instructions and dealt with risk, benefit and the way in which workers are protected. Weaker responses concentrated just on the last-named, often giving a list of different ways in which workers are protected from radiation.

3 (Radioactivity) Most candidates could identify the alpha, beta and gamma radiation and the particles in (a) and (b), but only the better candidates obtained full marks for the calculation in (c). In (c), many obtained one mark for repeated halving of the count, or for identifying that there were four half-lives involved.

4 (Food webs). Many could identify the species with the most varied diet in (a)(i) and the consequence of overfishing on the seal population in (c), but recall of the word 'competition' was rarely seen in (a)(ii).

5 (Peacocks) This question was completely free-response, and was well answered. Most candidates were able to explain variation and competition in the context, but only the better candidates were clear about the successful males passing on the trait of large tails to the next generation.

6 (Passenger pigeons) This question was not well answered: many candidates found it hard to identify the correct four sentences explaining the extinction in (a), while few were familiar with the term 'biodiversity' in (b).

7 (*A ramidus*) In (a), a number of candidates found difficulty in interpreting the vertical time-line in the diagrams. In (b), only the best candidates could identify the two reasons why the evidence was inconclusive.

8 (Communication systems). This question was well tackled by nearly all candidates.

9 (SO_2 in food) In the free-response part (a), a number of candidates read the question wrongly, and tried to explain why sulfur dioxide was put in the food. Most were able to choose the correct reason for including of sulfur dioxide in (b).

10 (Martha's diet) The role of the FSA was well known in (a). In (b), only the best realised that 'low salt' included 'no salt'. In the free-response part most were able to gain a mark either for considering Martha's actual (or ideal) diet, or for explaining the consequence of excessive fat or sugar; only the best covered both. A significant number of candidates did not understand the meaning of 'element' in (c); those that did usually got full marks.

11 (Nitrogen cycle) Most candidates were able to gain one or two marks in identifying the chemical reactions as stages of the nitrogen cycle, but only the best obtained 3 or 4 marks overall.

A214/01 – Twenty First Century Science A (B3, C3, P3) Foundation Tier

General Comments

Candidates performed well on this paper and were well prepared for the examination. There was no evidence that any of the candidates ran out of time.

The paper is now marked by electronic marking after first being scanned and then fed electronically to examiners. It is now more important than ever that candidates use legible writing and restrict their responses to the boxes, spaces and lines that have been provided rather than writing in margins and other areas that may not be visible to examiners in the electronic copy.

Most centres had clearly used the pre release material to their full advantage and had prepared their students to answer the questions. Most candidates were very good at referring to the pre release material in their answers. However centres should be aware that not using the pre release material to the full, seriously disadvantages their candidates.

Overlap questions with the higher tier were 1bii, 1biii, 1ci, 2bii, 2c, 3bii, 3c and 3d.

Comments on Individual Questions

Question No. 1

This question was about "are organic foods better for us?"

Part (a) was answered well by almost all candidates. Good answers for (ai) were that it tastes better or more natural, better for the environment or contains less pesticides. Candidates who did not read the question carefully and stated they contain more vitamins or minerals did not score. Part (aii) was less well answered and about a quarter of candidates failed to score. Credit worthy answers included freshness, storage, crop variety, soil or weather.

Part (b) was well answered by those candidates who were well prepared by reading and examining the pre-release material. Part (bi) was well answered if a quote was given from the pre-release such as encourages changes in diet to improve health. Those candidates that re-wrote the information often failed to score. Part (bii and biii) were overlap with the higher tier and did indeed prove to be more demanding than (bi) Good answers included "organic food being no better" and that "we get sufficient phosphorus in our diet anyway".

Part (ci) was also overlap and required students to be very familiar with the pre-release material. Ideas about testing, safety and breaking down rapidly all scored. Part (cii) proved to be a very testing question. Almost half the candidates failed to score and only those candidates that gave the idea of a predator killing an insect pest scored both of the marks.

Part (d) tested the candidate's mathematical abilities. In part (di) any answer between 19.5 to 19.9 scored the mark and approximately two thirds of candidates were awarded the mark. Part (dii) was more demanding. Credit was given for identifying sample 4 or 19.1 but the explanation had to give a clear explanation of an outlier or that it was very different from the other results. Candidates who said the score was too high or too low were not credited.

Question No. 2

This question was based on the article "Methane from the Arctic".

Part (ai) failed to discriminate. That was because most candidates did not know the answer and simply guessed. This resulted in most candidates failing to score and those that did were distributed evenly across the ability range. Part (aii) was more accessible with most candidates scoring the single mark by referring to the idea of comparing or checking.

Part (bi) was answered well by more able candidates. Good answers referred to microorganisms such as bacteria breaking down dead plants or animals. Part (bii) was overlap and was not well answered by foundation tier candidates. Those answers that referred to radiation from the Earth being trapped scored both marks.

Part (c) was also overlap and required candidates to calculate a percentage increase. Correct answers of 38% scored both marks. Candidates would be well advised to show their working as an incorrect answer can still score one of the marks for some correct working out. Those candidates that stated 100 x 107/280 but failed to obtain the correct answer still scored one mark. Only the most able scored both marks.

Part (d) also discriminated well. Good answers for (di) included melting ice or rising sea levels causing flooding or loss of habitats. Candidates who scored any marks at all were usually awarded two marks.

Part (e) was also awarded a mark for Quality of Written Communication. This was given to those candidates who considered both sides of the argument. Credit was then given to any good advantage and any good disadvantage such as it is cheap but it releases carbon dioxide when burnt.

Part (f) was well answered and even "Rudolf" was credited.

Question No. 3

This question was based on the article "Pump-head syndrome"

Part (a) was very well answered with most candidates saying that it pumps blood around the body or that it oxygenated the blood.

Part (bi) was also well answered with credit being given for lack of concentration or not being able to perform simple tasks.

Part (bii) was overlap with two thirds of candidates failing to score. Credit was given for 42%.

Part (c) was also overlap and discriminated well. Good answers included no control group, did not include patients having surgery but not on heart lung machine, only included patients on heart lung machine or it did not include patients with heart disease but no surgery.

Part (d) was also overlap and was not answered well. The vast majority failed to score any marks at all and only about 1 in 6 of candidates scored one or two marks. Although 63.84 scored two marks, once again credit would have been given to those candidates who gave the wrong answer but stated 42% x 152.

Part (e) should have been an easy mark. However two thirds of candidates failed to score. Credit was given to any answer that gave the idea of monitoring progress.

Part (f) should also have been an easy mark. However this time almost 90% of candidates failed to score. All too often answers were simply repeating data without giving an explicit conclusion. Good answers stated that pump-head syndrome was not caused by the heart lung machine or that pump-head syndrome can be caused by heart disease. Candidates need to be taught what is meant by a conclusion.

A similar story occurred with part (g) any response from diet, stress, smoking, drinking or lack of exercise would have scored but over a third of candidates failed to score a single mark on this question.

In part (h) good answers referred to reading or checking the work by another scientist. Candidates should have realised that this was a two mark question and required more than just checking the work. Any reference to replication failed to score the first mark.

A214/02 – Twenty First Century Science A (B3, C3, P3) Higher Tier

General Comments

The paper was generally well attempted, and candidates had clearly prepared the pre-release material well. There were two common shortcomings that Examiners reported: some scripts were so illegible it was extremely difficult to award marks; and an alarming number of candidates seemed to come to an examination without a calculator, which makes calculation somewhat difficult.

A number of candidates were clearly entered for this paper when the foundation tier would have been much more accessible. Their scripts were characterised by frequent Nil Responses (questions left unattempted), particularly if calculations were required, and also by extensive quoting from the pre-release material without attempting to address the questions set.

As in previous years, the fact that this paper focuses strongly on *Ideas about Science* was missed by many candidates, who attempted to answer questions in terms of scientific content alone, when they needed to address how the science in the question applied in the social context given. As an example, 3(f) asked why double-blind trials were not applied to a study of cardiac surgery, when few realised that it was ethically unacceptable but tried instead to explain what double-blind trials were.

Comments on Individual Questions

1 Organic foods

Both (a) and (b) were well answered, although in (b) (i) many explained the safety of pesticides in terms of 'killing of bugs' and in (ii) the precautionary principle often gained just one mark, for quoting 'better safe than sorry'.

Part (c) was generally well answered: most got the first mark for the higher price but only the better candidates scored the second mark for saying why money was tight. Many less successful candidates gave circular arguments about money: 'organic food expensive so people wouldn't buy because less money' with no reason given for less money.

Many candidates in (d) gave the reverse argument that intensive farming results in good yields and a low cost, which was acceptable, but many just stated that there was a need for more land without idea of lower yields.

The calculations in (e)(i) were often disappointing, as few could both identify the outlier and find the mean of the remaining five values. Those few candidates who found the median of all six values gained full credit. In (e)(ii), few realised that 'the ranges overlap' was not enough to show there was no real difference in the data sets.

2 Methane from the Arctic

The percentage calculation in (a) was often correct, although odd arithmetic approaches were taken when no calculator was available.

The answers to (b), intended to be simple recall of consequences of global warming covered in the course, sometimes used the pre-release material and referred to methane release.

The explanation of global warming in (c)(i) mostly involved the absorption of infrared radiation by the greenhouse gases, but very few understood that this was radiation emitted by the Earth, rather than the Sun. In (c)(ii), candidates often considered the effect of increased water vapour on the water cycle, rather than positive feedback of global warming, and this was acceptable.

In (d), candidates usually offered 'checking for errors' or 'confirming that the effect was not restricted to Alaska'.

Most candidates tackled part (e), asking for advantages and disadvantages of using Arctic methane as fuel, in a sensible way, gaining the mark for Quality of Written Communication for considering both sides of the issue.

In (f), comparatively few used the idea of increased exposure of the permafrost to the cold. Those that copied 'cold penetrates deeper' from source material were the most effective whereas many just re-arranged the question stem. Some talked about the snow keeping the permafrost warm.

3 Pump head syndrome

In (a), it was clear that very few understood what a causal link is, as most quoted material from the article about the effect without suggesting an explanation.

Part (b) proved difficult. Most suggested that brain function declined with age, whereas the recovery rate was the factor which needed identifying.

Most candidates could suggest at least one reason why the data was flawed in (c), but the calculation in (d) was done correctly only by those who clearly had calculators; those without calculators tried to decompose 42% into 4 × 10% + 2 × 1%, often slipping up en route.

In (e)(i) many candidates lost the mark by not giving the number of patients, as asked.

Part (f) was commented on in the general introduction, while in (g) most thought the difference in numbers of patients in each group was a design feature, rather than the numbers available to the researchers.

Part (h) was tackled well.

A219 Principal Moderator's Report – Skills Assessment

GCSE Science A, Additional Science A, Biology A, Chemistry A and Physics A

General Comments:

There has been a continued improvement in a number of areas in the interpretation and application of the assessment criteria. However, certain aspects continue to be demanding and challenging for candidates and the spread of marks over the cohort is sufficient to allow secure differentiation between grades.

The Skills Assessment component of each of the above specifications is weighted at 33% and it was still evident that some centres were not developing the underlying skills, knowledge and understanding of Ideas about Science in their candidates before an assessment took place.

Structure of the report

Vertical black lines in the margin throughout this report highlight important areas of concern, advice and guidance by the moderating team

This report is divided into the following sections

- Section 1: Administrative issues
  General comments
  Annotation
  Internal moderation
  Type and context of work of assessed work
  Nature of practical work
  Candidate helpsheets and teacher review of coursework
  Plagiarism
- Section 2: Assessment and marking framework
  Calculating the Strand mark
  Marking strands I and P in Data Analysis and Investigations
  OCR cover sheet for candidates' work
- Section 3: Data Analysis
- Section 4: Case Studies
- Section 5: Investigations
- Section 6: Final comment

Section 1: Administrative issues

General comments

Few Centres this year included details of how each of the tasks used for assessment had been introduced and presented to candidates. Those Centres that did not provide this information meant that on occasions moderators could not support the marks that were awarded by the Centre. This did lead to mark adjustments in some cases.

Annotation

Most candidates' work was annotated with the use of the assessment criteria codes eg I(b)6, at the appropriate point in candidates' work showing where the marks were awarded. However, in far too many cases the annotation was a very generous interpretation of the criteria and sometimes completely incorrect.

Internal moderation

Effective internal moderation ensures that candidates are placed in the appropriate order of merit. If the order is felt to be unsound because marking is inconsistent between different teachers the Centre may be required to provide further samples of work and possibly re-mark the work of all their candidates. There were still too many incidences of unsatisfactory internal moderation reported by the moderating team this year.

Type and context of assessed work
Following guidance from the Joint Council for Qualifications (JCQ), coursework has to match both type (eg Data Analysis and Case Study or Investigation) and context (ie Biology, Chemistry or Physics) as appropriate for the specification concerned. Only a few Centres did not meet these requirements this year. As a reminder, if the same piece of coursework is submitted for more than one specification then it must be photocopied and put into the appropriate coursework sample package.

Nature of Practical work allowed for assessment
Coursework submitted for Data Analysis and Investigation must involve candidates having personal first hand experience of collecting data in a practical experiment. **Coursework which does not fulfil this requirement cannot be submitted for assessment.** Computer simulations or sole use of teacher demonstrations are not acceptable substitutes.

In the Investigation, marks awarded for Strategy (S) and Collecting Evidence (C) Strands must be based on an individual's contribution and not on a shared approach or shared class data or data from other secondary sources.

Candidate helpsheets and teacher review of coursework
There was evidence that some coursework from a small 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 and Centres are required to consult and abide by this http://www.jcq.org.uk/attachments/published/1260/14.%20Coursework%20ICC%201011.pdf

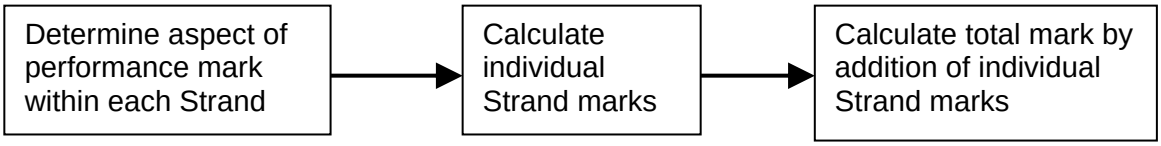
Teachers may review coursework before it is handed in for final assessment provided that advice remains at the general level. Having reviewed the candidate's coursework it is not acceptable for teachers to give, either to individual candidates or to groups, detailed advice as to how the work may be improved. 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).

Candidate helpsheets of the generic type which are applicable to any task are allowed and whilst helpful for lower achieving candidates can restrict the opportunities for those higher achieving candidates. There was evidence that some Centres were providing helpsheets which rather than giving broad headings to guide their candidates were providing a very detailed breakdown of points and leading questions involving particular words or phrases in the mark descriptions which went beyond the spirit of teacher support and guidance. In these cases Centres sometimes awarded marks when candidates repeated the same words and phrases without demonstrating any understanding. Marks had to be adjusted in these situations.

Plagiarism
Quoting from the same JCQ document as previously mentioned, "Candidates must not copy published material and claim it as their own work. If candidates use the same wording as a published source, they must place quotation marks around the passage and state where it came from. "**Candidates must give detailed references even where they paraphrase the original material"**. There was evidence that in some cases, particularly in the Case Study, candidates were not following these procedures. "These actions constitute malpractice, for which a penalty (eg disqualification from the examination) will be applied".

Section 2: Assessment and marking framework

A significant number of Centres are still not following the correct procedure for calculating the Strand mark from the appropriate aspect of performance marks and are being required to re-mark all their candidates' work.



Determination of the Aspect of performance marks
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. There was a tendency for some Centres to award marks on the basis of candidates matching one high level aspect of performance description within each Strand without ensuring that the underpinning descriptions had been matched.

Calculation of the Strand mark
(a) Three aspects of performance per Strand
Where there are three aspects per Strand the following examples illustrate how to convert aspects of performance marks into Strand marks. **Add the three aspect marks together, divide by three and round the answer to the nearest whole number.**

Example	Marks for the three aspects in a strand	Formula to be applied	Mark to be awarded for the strand
1	(a) = 4, (b) = 4, (c) = 3	[(a)+(b)+(c)] / 3	= 3.66 round up = 4
2	(a) = 3, (b) = 4, (c) = 3	[(a)+(b)+(c)] / 3	= 3.33 round down = 3
3	(a) = 4, (b) = 3, (c) = 1	[(a)+(b)+(c)] / 3	= 2.66 round up = 3
4	(a) = 3, (b) = 3, (c) = 0	[(a)+(b)+(c)] / 3	= 2.0 = 2
5	(a) = 2, (b) = 3, (c) = 0	[(a)+(b)+(c)] / 3	= 1.66 round up = 2

(b) Two aspects of performance per Strand (B and C of the Case Study)
From experience it is best to consider both strands B and C together when arriving at the final strand mark for each.

If **both** B and C average to (N + ½), then one should be rounded up and the other rounded down.
eg B(a)4(b)5 and C(a)5(b)6 then Strand B = 4 and C = 6 giving a total of 10 marks.

*If **either** B or C averages to a whole number (N) and the other to (N + ½), the ½ **could be rounded up or down on the basis of professional judgement***
eg B(a)4(b)6 Strand B = 5; C(a)5(b)6 Strand C = 5.5 which could be recorded as either 5 or 6 marks depending on judgement giving a total of 10 or 11 marks for these two strands taken together

Marking Strand I aspect (a)
This aspect involves awarding credit for processing the data which has been collected to display any patterns. This may be done either graphically or by numerical processing whichever is most appropriate in a particular Data Analysis or Investigation. If there is some evidence for both approaches, then both should be marked and **the better of the two recorded on the candidate coversheet but not both marks**.

Marking Strand P aspect (b)
The first row is concerned with recording quantitative data, the second row deals with the use of conventions and rules for showing units or for labelling in tables and the third row deals with the recording of qualitative data. Most investigations involve the collection and recording of quantitative information and in these cases, the aspect mark will be determined by averaging the mark in the first and second rows only, ignoring the third row completely. For those rare investigations which include qualitative evidence only, the mark for Aspect b should be based on the average of the second and third rows only. Where averaging results in half marks, professional judgement should be used to determine the best fit mark of the two alternatives. Once the mark for aspect (b) has been decided, it can be combined with the marks for (a) and (c) to provide the average and the mark for the strand.

For example, in an investigation providing **quantitative** evidence

Aspect of performance			**Strand P mark**
P(a)	7	7	**6**
P(b)	(i) 6 (ii) 4 (iii) n/a	5	
P(c)	7	7	

Candidate coversheet
All marks must be recorded on the OCR coversheet which is attached to candidates' work. A number of Centres did not use the latest format of the OCR cover sheet or in a very few cases did not use or fully complete a coversheet at all.

Section 3: Data Analysis

General comments

Centres are reminded that candidates must have personal firsthand experience of collecting data by performing a practical experiment. The data that they collect can be supplemented by further data from, for example, incorporating a class set of results. It is helpful if the data that is collected by the candidate themselves is clearly identified. **Work which is based purely on teacher demonstrations, computer simulations, given sets of results etc is not acceptable.**

It is most important that candidates record and present the data that they have collected and not just plot a graph or do numerical calculations without the inclusion of a data table in their report. It would also be helpful if candidates or teachers included the method that they used to collect data so that marks for E(b) could be more securely supported.

The same Strand I and E assessment criteria are used in investigations and the same marks for I and E from investigations can be submitted for Data Analysis in another specification **provided the subject context is appropriate for that specification**. If this is the case, Centres are required to indicate this on the appropriate coversheet and include appropriate photocopies of the work in both samples.

Data Analysis tasks.

There was a continuing variety of data tasks seen by moderators such as

Resistance of a wire	Stretching elastic bands, springs
Osmosis	Pendulum
Respiration of yeast	Cooling curves
Parachute drops	Clotting of milk
Crater impact	Bouncing of squash balls
Rates of reaction	Pulse rate and exercise
Effect of water depth on a 'tsunami'	

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

Those candidates who understood and used the terminology and concepts related to Ideas about Science, such as 'correlation and cause', 'outliers', 'reliability', 'accuracy', 'best estimate', 'real difference' found it easier to match the performance descriptions of the criteria and gain higher marks.

The majority of candidates at nearly all levels repeat their measurements when performing practical tasks which is most encouraging. However, many candidates do not necessarily appreciate the reasoning behind such practice and often those results which were clearly outliers were included in calculating averages and incorporated into conclusions. It was very rare to see that a candidate had performed further repeats to replace the outlier to ensure that the data is reliable and of the best quality. Plotting rough graphs as the data is collected may help candidates to identify outliers as they are collected so that marks for E(b) can be awarded and that their conclusion maybe more clearly and confidently established gaining credit in both I(b) and E(c).

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 a numerical analysis. Whilst many candidates now plot all their data and often include range bars the quality of graph drawing often shows lack of care in plotting the points accurately, using suitable scales and labelling axes correctly and drawing a line of best fit accurately and carefully. Many graphs were given high marks when one or more of these aspects were not of the accepted quality and more scrutiny is needed by Centres.

As a reminder the following guidelines provide more guidance about what is required but it is not intended to be comprehensive and to cover all eventualities.

- I(a) 4 – simple charts, bar charts
- 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) 6 – graph with correctly plotted points, correctly labelled and scaled axes and correctly drawn best fit line.
- I(a) 7/8 – **in addition to the requirements for 6 marks** candidates must show evidence of awareness of uncertainty in data eg range bars, scatter graphs.

If candidates use a numerical approach to analyse their data 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. Those candidates who have drawn a poor line of best fit on their graph but succeeded in calculating a gradient correctly may be awarded up to 5 or possibly 6 marks.

Some candidates included range bars when plotting bar charts and were wrongly awarded 8 marks. At best this approach might merit 5 marks. The same standards apply when marking computer-generated graphs ie they must be correctly sized and scaled with suitable grid shown and with the appropriately sized plotting points. However, it is generally better for candidates to hand draw their own best fit line.

Centres are reminded that only one single mark must be used for I(a), either that for graphical or that for numerical work but not both when determining the overall Strand I mark. Further information about the award of marks for numerical approaches is contained in the 2008 Report.

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 with little evidence to support this award. Many candidates referred to 'positive correlation' which only merits 4 marks. For 6 marks candidates should derive a more quantitative statement using their data to show what happens when for example concentration or lengths are doubled and noting the direct proportionality between variables.

Very few candidates matched the requirements for I(b)8. Candidates should review any limitations to their conclusions by considering such things as the scatter in the data, overlapping range bars between data points, 'real differences' and values of the best estimate and can the best fit line be accurately 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): Many candidates introduced their experiment by describing any related background theory even if it wasn't all relevant to the particular experiment they were doing. Candidates are better served if they link their conclusion directly with the appropriate scientific explanation that applies. Most candidates could secure a match to I(c) 4 by explaining their conclusion using scientific ideas. However, there was still some very generous marking when matching to I(c)6 and I(c)8 in terms of the detail and quality of the scientific knowledge and understanding shown. It is not just a few key words that must be considered but the actual meaning and correctness of a candidate's explanation of their conclusion that must be judged when arriving at the final mark.

Strand E: Evaluation

The majority of candidates achieved between 3 or 5 marks for this strand, showing improvement in E(a) and (b) but less so in E(c). Those candidates who used the appropriate IaS vocabulary and the knowledge and understanding of IaS 1 invariably achieved higher marks. Those candidates who used sub-headings such as 'Evaluation of procedures', 'Evaluation of data', 'Confidence level of conclusion' were more likely to focus on each area in turn and be more successful in their overall evaluation.

E(a): The E(a)4 performance description is the 'gatekeeper' to access the higher marks. It requires candidates to identify any limitations or problems in their procedures that they encountered during their practical work. However, in many cases comments were limited to human error rather than systemic experimental ones. Candidates should then consider the limitations that they have identified and suggest suitable improvements to match E(a)6 and 8. A number of the suggestions made were not always of sufficient quality to be creditworthy eg 'do it with a computer' or 'repeat my measurements more times' without any justification or explanation.

E(b): The majority of candidates generally identified a data point as an outlier either in the table of results or on the graph E(b)4 but only the better candidates provided an explanation of why a particular result had been chosen. The majority of candidates now regularly draw lines of best fit and range bars on their graphs but many of them do not make the connection when discussing reliability and accuracy of their data. A limited number of candidates used more objective ways of assessing reliability and accuracy using simple statistics such as variations of the Q test procedure. 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.

E(c): Marks were often very generously awarded and this aspect still continues to be poorly addressed. This aspect involves bringing together the discussion about the reliability of the data collected and the procedure to establish a level of confidence in the conclusion. Better candidates referred back to their conclusion in I(b) expressed in either qualitative or quantitative terms and used their discussion in E(a) and E(b) to link them all together in establishing the appropriate level of confidence. Those candidates who had expressed a conclusion in quantitative terms had more opportunity to provide a more detailed analysis and evaluation to access the higher marks.

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 eg a limited range or not enough readings at certain values, or degree of scatter too large or variable, and suggest in detail what more data could be collected to make the conclusions more secure for the particular variable under investigation.

Some candidates used other data from secondary sources to support or otherwise their conclusion. Some candidates recognised that their conclusion can only apply to the range of values that were studied because outside this range, for example, the rate is bound to slow down as one of the chemicals gets used up, the rubber band will eventually break, more exercise cannot always mean that pulse rate continues to increase.

Section 4: Case Studies

General comments

The Case Study is a critical analysis of a controversial scientific issue in which candidates use their knowledge and understanding of Ideas about Science. Those candidates who 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' found it much easier to match the performance descriptions of the criteria and gain higher marks.

Most candidates title their Case Study in terms of a question and collect appropriate evidence to illustrate both sides of a case. However, the analysis and evaluation of such evidence to derive a personal conclusion is still proving very demanding for the majority.

Many Centres provided a short list of appropriate Case Study titles for their candidates to choose from thus allowing them to select one which is the most appealing on an individual basis. It is important that titles for case studies do provide the necessary focus for candidates and don't just illicit a yes/no response but encourage a more thoughtful response with possible suggestions of future action. Those Centres who allow a more open selection of topic must closely monitor their candidates' choice to ensure that it is appropriate and firmly embedded in a scientific context with opportunities to gather evidence both 'for and against'. Surprisingly many candidates did not make full use of the relevant information and material in their student textbook often preferring to use only material from the internet.

A number of familiar examples were seen again this year but some such as 'Should smoking be banned in public places?' were seen much less frequently as their relevance diminishes.
Some examples of Case Study titles included this year –

- 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?
- Is sunbathing safe?
- Does pollution from traffic cause asthma?
- What killed the dinosaurs?

The approach adopted by candidates who presented case studies on the following issues seemed to provide limited access to the higher levels of the assessment criteria.

- Is organic food best?
- Aspects of diet eg "Is obesity inherited?"
- Should animal testing be allowed?

Assessment

In general, candidates continued to perform better in Strands A and D compared to B and C. Higher achieving 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. It was this latter aspect of personal analysis and evaluation which often differentiated candidates in terms of level of performance.

Lower achieving candidates relied too heavily on copying and pasting information from sources without the appropriate level of individual analysis and evaluation. Those candidates who did not acknowledge their sources either when they copied and pasted information or when paraphrasing original material are guilty of malpractice and can incur a significant penalty. Those reports which were presented simply as PowerPoint printouts almost always lacked sufficient detail to access the higher marks.

Strand A: Quality of selection and use of information.
There was continuing evidence of improvement in the marks awarded for this strand compared to last year.

A(a): Candidates must select and use sources of information to provide evidence to support both sides of the argument in their case study. They must select relevant extracts to quote directly and then in their own words explain what its relevance and importance is to the developing arguments in the report. It was this latter aspect that only the very best candidates were able to show.

If no sources are credited then a maximum of 1 mark will be allowed by moderators. Higher marks require that sources represent a variety of different views or opinions and it is quality rather than quantity which separates the award of 2 or 3 marks. Many candidates who were awarded 4 marks incorrectly often made token reference to reliability but did not explain why they thought their sources were reliable. Those candidates who used the language and ideas from IaS 4 eg ideas about peer review, the nature of the source or the status of the author were much more likely to secure the top mark.

A(b): The majority of candidates included a bibliography of sources at the end of their reports. Candidates who identified their sources using incomplete references eg website homepages would be awarded 2 marks. If only one or two incomplete references are given then one mark should be awarded and if no references are given then zero marks. For 3 marks candidates included complete references to the exact url address of the webpage and when referencing books, the title, author and page references would be required. For 4 marks it is expected that candidates include some information about the nature, purpose or sponsorship of the site. It is also to be encouraged that candidates record the date when they accessed the information from an internet site.

A(c): Candidates were still not very good at clearly showing where sections of text were directly quoted. 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 also included references within the text to show the source of particular information or opinions quoting the specific author and then using, for example, numerical superscripts linking to detailed references in the bibliography. Credit is given, not so much for the quotation itself but for the comment made by the candidate to explain why it was chosen, and how the candidate thinks it contributes to the arguments being compared in the study.

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.

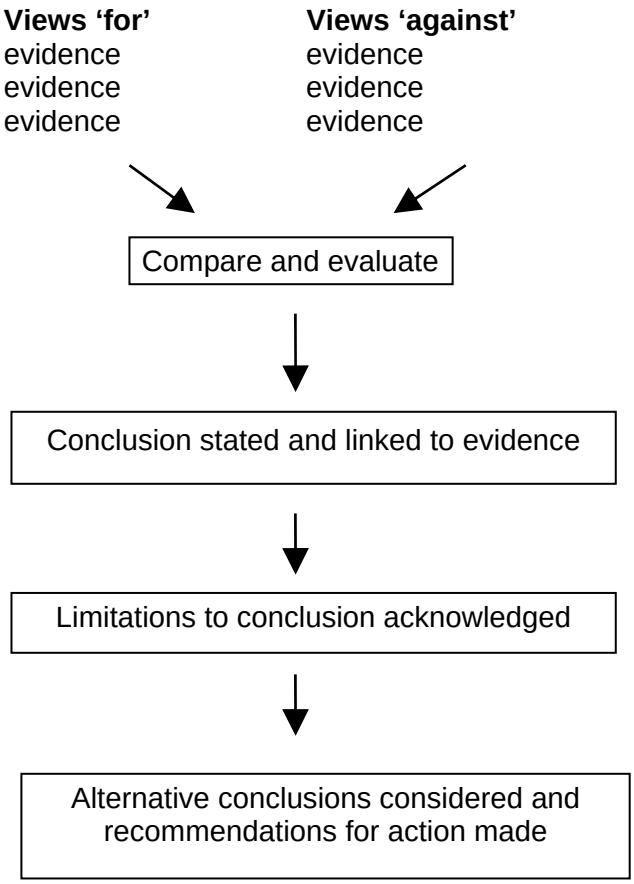
The majority of candidates described the relevant background science in the introduction to their case studies. However, it was only the most able who could integrate their scientific knowledge and understanding with the claims and opinions reported in their studies or extend the scientific knowledge base to more advanced concepts. Reporting was too often still at the 'headline level', simply repeating claims without looking behind the headline for the underlying science and/or evidence. It is useful before marking candidates' work to look at the appropriate pages in the C21 textbook about Science Explanations and the Ideas about Science and also the published OCR exemplars to know in advance what material should be included. The most successful Case Studies are usually closely related to topics in the course and it can be taken as a general guide that 6 marks in B(a) requires all of the relevant science from the student book. The 7th or 8th mark will come either for applying and integrating this correctly to the case, or for finding and explaining some more additional science related to their Case Study.

Aspect B(b) focuses on candidates' ability to identify, report and evaluate the scientific evidence that any claims and opinions are based on. Most candidates were able to recognise and extract relevant scientific content from their sources and were awarded 4 marks. Candidates who were awarded 6 marks referred to the evidence base of the various claims and opinions providing generally quantitative information from research studies. Candidates obtaining 7 or 8 marks look more critically at the quality of the evidence. They used terms like 'reliability' and 'accuracy' when considering data, they looked at the strategies involved in collecting the data and they also compared the reliability of data between sources. For many 'life-science' studies, for example the popular MMR study, the evidence is largely drawn from epidemiological studies and good candidates should be looking for evidence of factors such as sample size, or how subjects were selected to evaluate the importance of the evidence. Even strong candidates tended to rely too much on summaries of conclusions rather than describing the evidence base.

Strand C: quality of conclusions

Strand B gives credit for the level and detail of the relevant science described and for reporting the associated evidence underpinning the various claims and opinions. Strand C awards credit for candidates who provide individual input comparing and evaluating the evidence and, using their own judgement, arrive at a suitable conclusion on a controversial issue. There was evidence that many candidates were not using and applying their Ideas about Science, particularly IaS 5, sufficiently to warrant the higher marks in this strand.

Those Centres who guided their candidates to organise their reports with the following headings in mind and to encourage them to develop their critical skills invariably achieved higher marks.



An approach adopted by a number of candidates this year was to copy and paste significant amounts of information from articles on both sides of the case. In most cases, the only comment added by the candidate was a short paragraph headed 'evaluation', but which was usually just a summary of the content. This warranted lower marks than centres had awarded.

Most candidates could sort the information that they had gathered into views 'for and against' and were awarded 4 marks in C(a). Better candidates started to compare similar aspects in both their 'for and against' list and were awarded 6 marks. The best candidates built on this foundation and provided detailed comparisons and evaluation demonstrating considerable analytical and evaluative skills.

When making their conclusions, many candidates referred to the evidence that they had gathered and were awarded 4 marks in C(b) whereas those who omitted any reference were limited to 2 marks. Better candidates described their own viewpoint or position in relation to the original question justifying this by reference to the sources and to the evidence that the claims were based on. Far too often the conclusion was limited and too brief. Alternative conclusions should be considered where appropriate and recommendations for action in the future should also be included. Many candidates simply chose to report information about their topic, without any real analysis of the scientific evidence and incorporation of personal decision making.

Strand D: quality of presentation

D(a): The majority of reports included headings and/or sub-headings (2 marks) 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 (3 marks) to help guide readers quickly to particular sections. Those candidates who in addition presented a report which had a coherent, logical and consistent style were awarded 4 marks.

D(b): Many candidates only included images which were decorative rather than informative and therefore failed to clarify difficult scientific ideas and improve effective communication. If there are no decorative or informative images included then zero marks is awarded. If one image is included, a decorative front cover or other low level attempt to add interest then one 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 illustration eg 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.

D(c): The assessment of the use of scientific terminology and the level of spelling, punctuation and grammar was generally very fairly assessed by Centres.

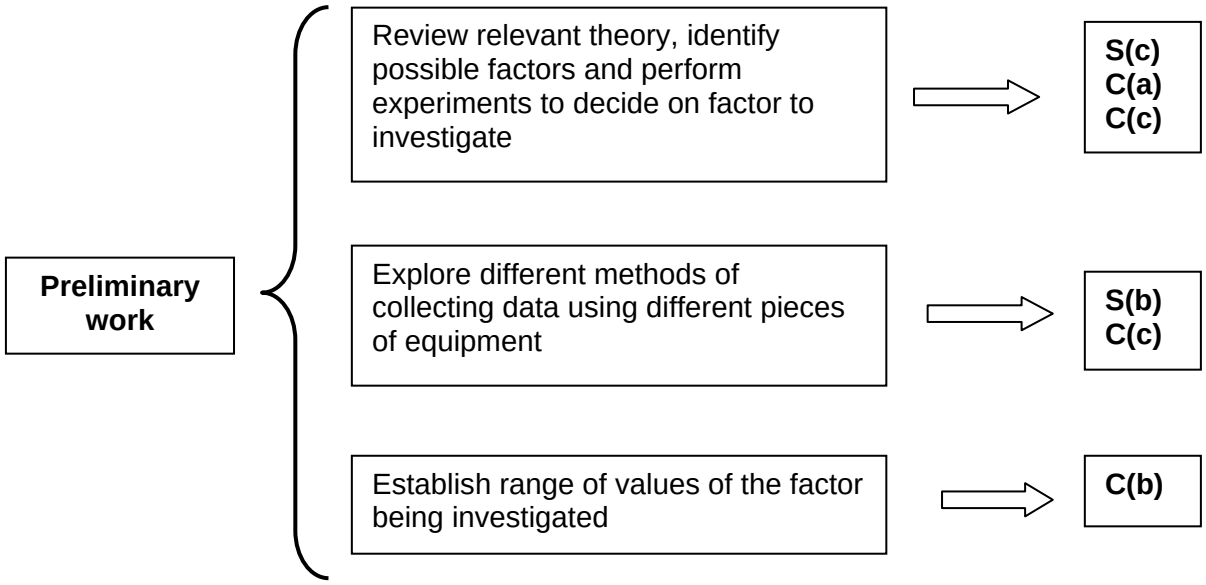
Section 5: Investigations

Rates of reaction, resistance of a wire and osmosis were still the most common investigations seen from Centres. However, there was evidence that other topics were being developed by more Centres who had gained confidence from previous years, for example, stretching of plastics and other materials, exercise and fitness routines, efficiency of wind turbines, objects rolling down slopes or ski jumps, electrolysis, investigations involving titration and electromagnets.

From an assessment point of view the 'performance descriptions' should be used to reflect the quality and performance of candidates' work rather than a formal/legalistic interpretation of particular words and phrases. There were a number of examples where credit had been incorrectly given for the inclusion of a key word or phrase but on reading the context in which it was written it was clear that the candidate had not understood or appreciated the correct meaning.

Strand S: Strategy

The importance of preliminary work cannot be over emphasised in the introductory phase of an investigation and the appropriate amount of time must be given to this aspect. Many Centres were clearly encouraging a more open ended exploratory approach and it is essential for moderation if centres provide details of how the tasks were presented to candidates (eg copies of briefing sheets etc.)



Although there was evidence of candidates doing preliminary work, it was often the case that candidates from the same centre used the same quantities of materials, the same apparatus and technique and identical ranges and values of the same variables. This clearly indicated that limited individual decision making had occurred necessitating a downward adjustment to the marks for S(c) in a number of Centres. Where candidates had been given the opportunity to show autonomy they performed well across many of the Strands.

It is important for candidates to record their preliminary data and to use it to inform and develop the main experiment. Often preliminary work appeared to provide just a limited extra set of results and did not shape the investigation in any way. Sometimes preliminary work was done but it was clear that candidates hadn't really understood why they were doing it.

Candidates should consider what factors or conditions might affect the results they will get. This will usually involve a brief review of the relevant scientific theory supported by one or two simple practical experiments to compare the magnitude of the different effects and ease of experimentation. This will allow candidates to decide which factor it would be best to study and also provide evidence which can contribute towards credit for C(a) and C(c).

Many candidates provided a list of appropriate apparatus for their investigations but had not linked it to their preliminary work and not indicated why they had been selected in preference to alternative equipment. Those candidates who exerted some choice over the apparatus they used were in a better position to achieve higher marks in S(b) and also when evaluating their procedures and methods in E(a). Candidates need to explore different methods and choose between different pieces of apparatus and adapt as appropriate to find the best way to collect good quality data C(c). Some candidates provided very simplistic justifications and Centres are reminded that it is **quality** of response in this context that is being rewarded. Many Centres provided a fixed, limited set of apparatus for candidates to use and this did not allow candidates the flexibility to try various approaches to obtain the best quality data set.

The complexity of a task, S(a), represents an overall judgement about the way a candidate has approached the task. Therefore two candidates doing the same investigation might approach it differently and therefore achieve different marks. Complexity depends on the demand and challenge involved in the approach adopted by the candidate and includes such indicators as the familiarity of the activity and method, the skills involved in making observations or measurements, single or multi-step procedures, the nature of the factors which are varied, controlled or taken into account, the precision of the measurements made and the range,

accuracy and reliability of the data collected. Too often 7 or 8 marks were awarded for straightforward approaches to the task. 'Resistance of a wire' investigations were frequently over marked in this aspect.

Strand C: Collecting data

It was pleasing to see that the majority of candidates used suitable ranges of the appropriate variable to study and appreciated the need to repeat their measurements to obtain a wide range of data. However, a discussion of the factors to control was often rather limited for C(a) and only by inspection of the results table could any evidence be found. Better candidates described in detail how the factors had been controlled and, even more importantly in some cases, monitored during the experiment. Weaker candidates often stated factors such as pH, surface area, current or temperature were kept the same but failed to explain how this was actually done or monitored. Often room temperature was mentioned as being the 'variable controlled' in rates of reaction or resistance investigations which was not the key 'temperature' variable involved.

Preliminary work is essential because if done properly it can allow access to marks of 7 or 8 in aspects (b) and (c). There was continuing evidence this year that candidates were doing preliminary work to establish the range of values of the appropriate variable to be used C(b). However, although some candidates presented their results in a table they did not use the results to explain how it informed their main method. Centres are reminded again that it is the quality of response and its relevance that is rewarded and not just that preliminary work has been done so 'jumping through hoops' is not sufficient criteria for success.

Too often, candidates did not consider their results as they were being collected so that obvious outliers were either ignored, or included without comment when calculating average values. It was very rare to see that a candidate had performed further repeats to replace the outlier to ensure that the data was reliable and of the best quality. Plotting rough graphs as the data is collected may help candidates to identify outliers as they are collected which can contribute towards credit for E(b), towards defining the trend in the results more clearly, I(b), and for an improved level of confidence in the conclusion E(c).

From inspection of results tables it was pleasing to see that candidates were taking more care and data was generally of good quality. However, there was little evidence of candidates performing preliminary work which involved making decisions about adapting the type of apparatus or method to ensure the collection of the most accurate and reliable data (C(c)).

Strands I and E

In general candidates achieved their poorest marks in these two strands. For more details see the comments in the Data Analysis section.

Many candidates still introduced their investigations with a significant amount of background theory which was not always relevant but more importantly was not used to explain the particular conclusion that the candidate had derived from the investigation. The C21 model for investigations aims to give credit for candidates who process their results, look for patterns and then suggest explanations using their scientific knowledge and understanding. Very often candidates did not link their conclusions with their scientific explanations I(c) and detailed explanations using relevant scientific theory are best left until they are needed in Strand I.

Some candidates provided further comment about the confidence level E(c) 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 and calculated resistivity and compared with data book values.

Strand P: Presentation

This Strand was generally fairly and accurately marked by Centres. Spelling, punctuation and grammar were sound and the majority of candidates' reports were well structured and organised. However, experimental methods were rather briefly described and lacked sufficient detail.

Diagrams of apparatus were not always included and although data was generally accurately recorded and presented in appropriate tabular form, units were occasionally incorrect or missing.

Section 6: Final comment

All members of the moderating team recognise the considerable effort needed by Centres in assessing and presenting candidates' work for moderation. We would like to record our thanks and appreciation for a thorough and professional job carried out by the majority of centres. However, there appeared to be an increase in **errors in calculating the Strand marks for candidates** which resulted in considerable extra work for both moderators and centres (please consult the administrative issues section in this report).

There is further guidance about the interpretation and application of the assessment criteria and also illustrative coursework exemplars on the website www.ocr.org.uk. It is highly advisable that staff have time during the year for internal standardisation meetings to share and develop expertise in the Science Department.

The structure of case studies, data tasks and investigations has been modified in the new specifications for teaching from September this year, in the light of the new regulations for controlled assessment. Training for the new model is on-going and details are available in the OCR Training Handbook.

2011 Grade thresholds for Data Analysis and Case Study combined and Investigations for the different specifications.

	Grade threshold								
Component	**Max. mark**	**A***	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Data Analysis and Case Study	16 + 24 = 40								
Investigations	40								

Previous reports from 2008, 2009 and 2010 will still be available online at www.ocr.org.uk to provide further detailed guidance.

The grade thresholds have been decided on the basis of the coursework that was presented for award in June 2010. The threshold marks will not necessarily be the same in subsequent awards.

Some adjustments may be expected to maintain consistent standards across all the OCR Science specifications.

Geoff Mines (Principal Moderator) on behalf of the Moderating Team 13.7.11

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