RECOGNISING ACHIEVEMENT

GCSE

Science A

Twenty First Century Science Suite

General Certificate of Secondary Education **J630**

OCR Report to Centres

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Oxford Cambridge and RSA Examinations

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This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

OCR will not enter into any discussion or correspondence in connection with this report.

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Science A (Twenty First Century Science) (J630)

OCR REPORT TO CENTRES

Overview

This last entry for the 21st Century Science 'legacy' specification J630 had a much reduced entry this year, as there is usually a large entry of year 10 candidates; they would be entered for the 'new' specification J241 instead.
Results in each of the units, and in the coursework component A219, were very much in line with those obtained in previous years.

A211/01 Modules B1 C1 P1 (Foundation Tier)

General Comments

The candidates seemed to be entered for the correct tier and made good use of the time available with no evidence of running out of time. They engaged with the examination in a positive manner and they generally tried their best to match the requirements of the questions.

Candidates usually scored far better on objective type responses, although a few candidates left no response even for some “tick box” responses. The free response questions scored poorly, with many candidates failing to attempt some questions eg 9, 10, or writing very short responses that would not gain the required number of marks, for example “Big Bang” as a sole response for question 9.

There was occasional evidence suggesting incomplete coverage of the specification, with some candidates scoring heavily on many questions while getting almost no marks on others.

Comments on Individual Questions

1 **(a)** Genes. As in the previous examination, few candidates understood that a gene is an instruction for making a protein with many thinking that it is a code for making DNA. Most knew they are found in the nucleus, but many did not realise genes are made of DNA.

(b) Gender Chromosomes. A well answered question with XZ and YZ very rare choices. XX was not a common choice. The most usual error was to circle XX as well as XY, perhaps because candidates assumed that two brothers would need two choices.

(c) Alleles. One of the short response answers that was often left blank. Usual errors included “male/female”, “dominant/recessive”, “chromosome”, “gametes”, indicating that the candidates understood the question but sometimes struggled to recall the answer even though alleles appear in Q4 on page 5.

2 **(a)** Clones. Most candidates correctly identified the environmental conditions cause the difference with only a few selecting genetic causes.

(b) Identical twins. Again a well answered question with “mother and daughter are clones” as the most common error.

(c) Parkinson's disease. Many candidates put nerves as the cells to grow, presumably because brain (nerve) cells needed replacement.

3 Cystic Fibrosis, long response question. Most candidates should be congratulated for making a creditable attempt at the question. Abortion (often phrased as “get rid of the baby” or “kill the baby”) was offered by many and was the most commonly awarded mark. It was encouraging at foundation tier to find some candidates considering the moral and practical dilemmas posed. Unfortunately some candidates did not notice that the foetus had already tested positive for a genetic condition, so ideas such as the baby might not have it, or it can be cured when it is born were seen. Some responses were too generic for credit, such as “the baby will need looking after when it is born.”

4 **(a)** **(i)** Huntington's disorder. The question identifies that Mary's father and mother have different genes, many candidates lost marks for failing to identify which was which in their diagrams. There were some good attempts at this question, but also many which showed only a cursory grasp of the concept, for example showing only one gene being passed on.

(ii) Probability. Although the probability is determined from the grid, there were many who got the grid right and the probability wrong, and also vice versa. Common mistakes were likely/unlikely, 25% and 75%.

(b) Symptoms. This was generally well answered, with the idea that Huntington's disorder is recessive as the most common distraction.

5 **(a)** **(i)** Air pollution. The question was about how a bus which makes more pollution than a car could produce less pollution overall. Most candidates got the mark for "you could fit more passengers on a bus", many proceeding on to the idea that there would therefore be fewer cars, but few then finished the argument by saying that this would result in less fuel being used overall.

(ii) Atomic model for carbon dioxide. The models of methane and carbon monoxide were common errors.

(b) Where pollutants go to. A well answered question, the usual error being to not choose sulphur dioxide as causing acid rain.

(c) **(i)** Variation. Most candidates correctly identified one factor as "Chris" warming the engine, but catalytic converter ("Ashley") was a common error for difficulty reading the meter "Dave".

(ii) Reliability. "Dave" was a very common mistake, confusing "difficulty of taking a reading" with "reliability".

6 **(a)** **(i)** Hydrocarbons. There were many good answers to this, errors in the most part seemed to be random, as if the candidates were unable to recall and therefore made a guess. Only a few candidates ringed the wrong number of responses.

(ii) Burning hydrocarbons. There were many correct answers. Carbon dioxide was a common wrong answer, along with more far-fetched responses using argon, nitrogen etc from the choices in 6ai, which seems to indicate that candidates were using the overall question as a cue for their responses.

(b) **(i)** Correlation. Selecting the correct correlation is a skill that candidates seem to have grasped soundly.

(ii) Conclusions. Again well answered, the most common error was a lack of information about the number of cars on the motorway, ie a variation in the values rather than an error in the conclusion.

(iii) Effect of weather on results. Many candidates failed to express their ideas clearly and therefore made it difficult to justify the awarding of marks. This question can be answered at two levels, initially explaining how the amount of pollution is affected, and then explaining how the mechanism changes this amount.

Many candidates failed to identify how the weather could affect the value of the results, merely stating that it would change it, and therefore failed to score. Similarly many candidates related weather to the amount of driving, without then linking this to the results (level of particulates).

7 **(a)** Journals. Generally well done, indicating that candidates can access this type of question.

(b) Mass extinction. Many candidates noted that Dr Baker referred to a conference on mass extinction and seemed to assume that Dr Adams' failure to explicitly do so implied that he was talking about a different topic.

(c) Explanations. This was generally well done, again the candidates clearly accessed this style of question.

(d) Alternatives. Again well done, the candidates displayed a sound grasp of the concept that data can have alternative explanations, and that there is not always “the right answer”.

8 **(a)** Rock layers. Most candidates understood that age is linked to depth, the usual error was to reverse the order of ages, only a few thought that there was no correlation between age and depth.

(b) Many candidates correctly identified that erosion causes exposure, the most common incorrect answer was that the layers were formed by sedimentation.

(c) Sequences. Many candidates correctly sequenced the process of twisting. Many who did not get full marks made the rubric error of repeating “B” in their choices.

9 Wegener. This free response question challenged the candidates. Some correctly identified that Wegener was “an outsider”. However many described a lack of evidence instead of identifying that the issue was in the interpretation of the available evidence.

10 Solar system. Many candidates confused this with the formation of the universe. Answers simply referring to the Big Bang with no description were very common. Those candidates who did address the correct process scored well. It is difficult to be certain whether those who referred to the Big Bang were using the only knowledge they had, or were confused between the two astronomical events.

11 Astronomical objects. Many candidates did well with this question, their attitude in working to the end of the examination was rewarded. The mark for the composition of a galaxy was commonly scored, errors were usually about the Sun and moon. There were very few rubric errors.

A211/02 Modules B1 C1 P1 (Higher Tier)

General Comments

This was the final examination of the J630 specification. There were a limited number of candidates, but most performed well at C grade or above with the level of difficulty differentiating effectively. Candidates managed their time well and all completed the paper.

Candidates often lost marks by not reading the stem of the questions. This was especially true in those questions requiring written answers. It will be important in the papers for the new specification that candidates understand what is meant by the command words in a question and what type of response should be given.

Comments on Individual Questions

1 **(a)** Some candidates knew that proteins which speed up chemical reactions are called enzymes, but fewer knew what proteins are used for. Some just wrote that proteins were used for 'skin' or 'hair' without qualifying this comment. This did not score the mark.

(b) Many knew the Y chromosome determined the sex of two brothers. The most common incorrect answer was that it was 'X and Y'.

(c) Again many gave the correct answer with the most common mistake being 'ovaries'.

(d) Most candidates knew that a person would have two different alleles of a gene.

2 Both parts of this question were well answered. Candidates had clear understanding of cloning and the use of stem cells.

3 **(a)** **(i)** Many candidates were able to draw a correct genetic diagram though a proportion of these lost a mark by failing to label which parent was the mother and which was the father.

(ii) Well answered. Interestingly, even if candidates could not draw the genetic diagram or drew it incorrectly they knew the probability of inheriting Huntingtons' disorder was 50%. Some, who failed to score, wrote answers such as 'likely' or 'very small'. Candidates should realise that, if they are asked for a probability in this context, a number should be given.

(b) Most candidates knew that the symptoms of Huntington's disorder do not show until later life.

4 **(a)** Pre-implantation genetic diagnosis was not well known. IVF was a common wrong answer.

(b) The mix up with IVF continued into part b. Many candidates did not understand that testing was <u>before</u> implantation and wrote about tests that take place in the early months of pregnancy. The most common mark gained was for the ethical point. Those that did understand Pre-implantation Genetic Diagnosis (PGD) also scored for designer babies. No candidate mentioned organ donation or curing an existing child of a disease even though there has been plenty of recent publicity on this topic.

5 **(a)** Many answered this by only using information given in the stem of the question and failed to score. If asked to explain candidates must give reasons that set out how or why something happens. So why does limiting cars lower carbon dioxide pollution? – Because less fuel is burned.

(b) **(i)** Many candidates answered this correctly. A few wrongly used a superscript in the formula of carbon dioxide and a few used lower case n in the formula of nitrogen oxide, but most of those who failed to score on this question did not understand what was meant by 'formula' and gave the names of the gases instead.

(ii) There were some excellent answers to this question, but many candidates are still really confused about how nitrogen dioxide is made. Common misconceptions in the responses were that carbon dioxide is involved in the reaction, that nitrogen atoms come from the fuel and that the reaction takes place in the catalytic converter.

(iii) This was not well answered. Candidates do not know that carbon dioxide dissolves in water so find it difficult to tick the correct box. Many opted for both gases being used in photosynthesis.

(c) In part (i) many candidates knew that changing variables would change the values measured, but did not realise that difficulty reading the meter would have the same effect. In part ii some seemed to miss the word 'checking' when they read the stem.

6 **(a)** Both parts of this question were done well. Candidates showed a good understanding of correlation and cause.

(b) This question discriminated well. It seemed slightly easier to work out the number of molecules of water made, than the number of molecules of oxygen required to burn a molecule of propane.

7 Many candidates gained marks on this question about Wegener by saying that he was not a geologist and that no-one could see the continents move. Some candidates' answers were too vague to score the second mark. They just said there wasn't enough evidence. Answers need to be more specific, going beyond the fossil and rock evidence, to a clear explanation of the mechanism for movement. Religion was a common wrong answer.

8 Candidates are very confused between the beginning of the universe and the formation of the Solar System. There was a great misconception that the Solar System was formed by the Big Bang. In fact many candidates just wrote those words for the answer. A number of candidates wrote that an asteroid hit the Earth and that was the Big Bang. Some of those who knew about the formation of the Solar System from clouds of dust and gas thought that it came together and then exploded in the Big Bang.

9 This question about developing scientific explanations and their acceptance by the scientific community discriminated well. Many found part (a) the most difficult to answer correctly as they did not recognise that Dr Baker was using observations.

10 **(a)** This straightforward calculation which required knowledge of units, caused many problems. All possible answers were seen depending on how candidates converted between cm and km and their understanding of the symmetry of the movement. Such calculations will be much more common on the new specification and candidates do need plenty of practice of them.

(b) Candidates did understand that the assumption that the spreading rate was constant had to be made before the calculation was completed. Many scored the mark on this.

(c) In this part of the question many candidates incorrectly thought that the magnetic stripes provide a mechanism for the movement of tectonic plates.

11 This question scored well. It was interesting that some students who had scored quite badly up to this point suddenly rallied and gained 3 marks.

A212/01 Modules B2 C2 P2 (Foundation Tier)

General Comments

This is a legacy GCSE Science paper with a much reduced entry for this final session. The paper was of similar format to previous sessions and had questions with a similar demand. The candidates seem to have produced a good overall performance and it was encouraging to see that they were able to demonstrate their knowledge of the three areas being tested. Candidates need to improve the way they express themselves in the questions that involve written explanations.

Comments on Individual Questions

1 Most candidates knew that nylon was a synthetic material but were unclear about the components of crude oil or how it is treated to reach the fibre stage. Few knew that most of the crude goes into producing fuels and lubricants.

2 The data handling part of the question was done well, clearly demonstrating that candidates could handle simple calculations. The recycling of beakers part of the question required the candidates to argue the case against the obvious disadvantages of recycling (uses more energy and produces more pollution). This proved to be a challenge and many failed to see the link to the finite supply of raw materials. The quality of the written answers in purely grammatical terms was very varied.

3 The graph use was done well with most being able to read the data accurately. The obvious outlier was normally marked correctly and explained as being off the line of best fit.

4 Most of the candidates understood that the door and wall of a microwave oven are a safely feature but it was surprising that very few knew that the microwaves vibrate the water molecules inside the food, thus heating up the food. The simple fact of lack of power in a mobile phone was missed when trying to explain why you cannot cook with one.

5 Energy in the form of photons was answered well and many candidates understood that they can be absorbed by the atmosphere.

6 Protection against UV damage was well known but the candidates often found it difficult to express what they wanted to say in the risk/benefit part of the question. Ideas about potential problems compared to the obvious benefits were needed. Ionising radiation, skin damage, cell mutations, skin cancer, premature ageing etc were all mentioned frequently as were sun tans, well-being, vitamin D production, fun factors etc on the benefit side, but the structure of the comparison was often not well written.

7 Energy transfers on the simple numerical level in part a) were well handled but the interpretation of the diagram in a wider context proved to be more of a challenge. The idea that more energy from the Sun would be reflected away from the Earth but that much more energy would be retained/prevented from escaping and this would lead to global warming was not demonstrated well, possibly showing that the terminology surrounding global warming is known but not fully understood.

8 The drugs trials were understood well as were the ways that increased resistance to antibiotics in bacteria can be prevented.

9 The immune system was identified frequently as our defence system but the contents of vaccines was less well known or expressed. In a similar way, the idea that each disease requires a different vaccine (explained) was also a stumbling block for many candidates. The longevity of tetanus vaccinations proved difficult to explain but most candidates knew about the idea of herd vaccination to protect the whole population from a particular disease microorganism.

10 There were many correct alternatives to part (a) of this question. Any substance enabling the heart muscle to function properly (oxygen, glucose etc) and the removal of carbon dioxide from the cells all scored marks. Fat and cholesterol were the most common answers for the substance that builds up and leads to heart attacks. It was encouraging to see in the final part of the question that the candidates knew what the risks were.

A212/02 Modules B2, C2, P2 (Higher Tier)

General Comments

The candidates seem to have made good use of their time and there was no evidence of candidates running out of time.

The paper was well attempted with few blank spaces.

Comments on Individual Questions

1 **(a)** Many candidates gave the correct answer of 12.5.

(b) There were two parts to this question and some candidates did not answer both parts and so deprived themselves of a mark.

2 **(a)** Most candidates answered these true/ false statements correctly.

(ii) Understanding of environmental issues was often couched in very vague terms, making it difficult to credit candidates who may have had good answers but lacked the language to describe clearly benefits and disadvantages of recycling and waste disposal. In particular, the different phases of a product lifecycle – extraction of raw materials, manufacture, disposal or recycling were not seen as distinct phases by the majority of candidates. Hence there was insufficient appreciation of the need to take all these phases into account when making decisions. A few candidates wrote about harming animals or the environment.

(b) Most candidates answered this question about people preferring burning rather than dumping beakers in landfill correctly.

3 **(a)** A large number of candidates could not identify the process as polymerisation. A whole range of reaction types were named and many candidates left part (a) blank.

(b) Few candidates could identify the two changes that would make the polymer less brittle but many could name one.

(c) The reason for different melting points was known by many candidates.

4 **(a)(b)** Many candidates seemed to struggle with question 4, and candidates could do it all, or not at all. Whether it was the demands of decoding the diagram or the science itself that caused problems is hard to know.

5 **(a)** Candidates scored at least one of the three marks, but few scored all three. Statements which repeated the question did not score .Expanding on the information given (ie named a form of harm) and a correct mention of risk were needed.

(b) Those who did not score only gave one way in which climbers could reduce their risk when the question asked for two ways for the ***one*** mark.

6 This was designed to be a question that stretched the most able. It was a very demanding question. Few answers put 4 correct ticks, hence few gained full marks. There were a minority of instances noted where more than 4 ticks were given. Most candidates only gained one mark.

7 **(a)** The two ways in which ozone protects living organisms was well known.

(b) Methane, water vapour and the nitrogen oxides were correct answers. Common incorrect answers included carbon dioxide, carbon monoxide, nitrogen and oxygen.

8 **(a)** Almost all candidates knew that a trial in which neither the doctor or the patient know if the patient is receiving a drug or a placebo is called a double blind trial.

(b) Answers to this question were weak due to candidates' inability to use precise descriptive language when discussing social implications of scientific decisions. Many understood that placebos would be 'unfair' but struggled to write their answers in terms of the ethics or morality of decisions. Many candidates did not seem very clear about why a placebo might ordinarily be used. A number of candidates were under the misapprehension that placebos were only used on healthy individuals and were involved in basic checking of safety of medication, rather than in determining its efficacy. Many candidates gave answers referring to false hope. The use of a placebo as dealing with a mental illness of the patient, rather than for some other reason, was observed in candidates answers.

9 **(a)** Most candidates scored 1 mark for two correct answers usually the first and last.

(b) All five correct answers were needed to score the mark, very few candidates did not score.

(c) Less than half of the candidates scored on this question. Many included one or both of the incorrect statements. Only about a quarter of candidates chose the correct statements and put them in the correct order.

(d) A large number of candidates did not cope well with this question; the terminology of correlation and cause seems to be causing difficulties.

10 **(a)** Many candidates scored the mark for their explanation of tetanus vaccinations.

(b) Most candidates stated that Amrit gave the correct explanation.

11 **(a)** Many of those who did not score confused antibodies with antigens or antibiotics.

(b) Few gained marks for rapid increase in number of antibodies or white blood cells or the idea of specific memory cells are still present.

A213/01 Modules B3, C3, P3 (Foundation Tier)

General Comments

Candidates demonstrated that they had secure knowledge of many aspects of the specification such as identification of carbon fuels, being able to recognise the advantages and disadvantages of nuclear power stations, stating whether changes were due to natural selection or selective breeding.

Candidates performed less well on areas involving radioactive materials, evolution, food chains and life processes, especially the structure of the nervous system.

The majority of candidates found it difficult to describe clearly the differences between organic and intensive farming, although there were some Centre specific examples of very detailed answers, demonstrating that the topic had been taught effectively.

Comments on Individual Questions

1 **(a)** **(i)** This question was answered very well, with almost all candidates being able to identify the correct response as gas.

(ii) The vast majority of candidates appreciated that the output and input had to equal each other, and gave the correct response of 2.

(b) Very few candidates achieved 3 marks on this question. Most were able to identify that a carbon fuel would decrease or renewable source would increase for 1 mark but not many gave both changes. Only higher ability candidates then added reasons for the changes, eg carbon fuels were non-renewable or renewable would not run out.

2 Almost all candidates achieved at least 1 mark, with a large number scoring 2 for identifying the advantages and disadvantages of nuclear power.

3 **(a)** Many candidates were able to identify that the amount of radiation emitted will decrease with time but hardly any recognised that it is an ionising radiation.

(b) **(i)** The candidates who scored one mark seemed to be evenly spread between the two correct answers.

(ii) Most candidates scored the benefit mark. A number of candidates thought the injection was an immunisation that would stop you getting the disease. Very few explained that the risk was small. Surprisingly few said that the benefit outweighed the risk – preferring to repeat the words from the question stem 'it is worth taking the risk' **–** failing to score because they had not explained why.

4 **(a)** This question was answered very well, with almost all candidates being able to identify the correct response as "scar on his face".

(b) The majority of candidates were able to identify correctly at least 2 correct responses, showing good understanding of the 2 processes of natural selection and selective breeding.

5 **(a)** This question was answered well, with most candidates being able to identify the correct response as 'Amrit'.

(b) This question was not answered as well, with less than half of the candidates identifying 'Caroline' as the correct response.

(c) The most common correct responses were lack of food and getting eaten. Some candidates scored for competition. There was a lot of confusion with this question, candidates did not realise what the question was asking. The mention of Charles Darwin and evolution in the stem lead to a lot of answers that would have scored in 7b. Unfortunately, these were sometimes not repeated in 7b.

6 **(a)** A few candidates got 'the brain' and some 'the spine' but very few went on to say 'the spinal cord'. Many other organs were offered – heart, lungs, liver, also blood, and effectors and receptors.

(b) This question was not answered very well, with less than half of the candidates being able to give the correct functions of the sensor and effector cells.

(c) Less able candidates found this question very challenging, few were able to tick the correct box –hormonal.

7 **(a)** Many candidates lost the mark for putting down extra food chains.

(b) The most common correct answer was lack of food. The other common correct answers were habitat destruction, environmental change and human activity. There were also good answers about competition, and some about disease and a new predator. The most common mistake was to talk about predation without linking this to a change (ie new predator).

8 **(a)** **(i)** Most candidates understood that organic farms do not use synthetic pesticides, but fewer realised they could be a health hazard. The 1st two options were commonly chosen.

(ii) Candidates found this question difficult to understand. Some candidates answered the question by explaining about pesticides but later lost the mark because they omitted to say, or even imply, that organic farms did not use them. A number of candidates seem to think that farm animals are wildlife, the response 'they are not kept in cages' was quite common.

(b) Candidates would have benefitted by being more specific about the role of nitrogen although many gained the mark for 'crops growing more'. There were ideas about organic and intensive farming and fertilisers/rotation, although sometimes they failed to assign a type of fertiliser to a type of farmer and they also misunderstood **–** explaining how it was spread instead of what was spread.

9 **(a)** The most common correct answer was kidneys-urine. Some candidates swapped the liver and kidneys, while others swapped the digestion with the muscles.

(b) This question was answered well, with most candidates being able to identify at least 1 correct response, usually box 1 – starch is digested into glucose.

(c) Majority of candidates recognised statement 3 as incorrect but very few were also able to identify statement 4 as also being wrong.

A213/02 Modules B3, C3, P3 (Higher Tier)

General Comments

Some candidates used up answer space by repeating large sections of the stem of the question; Centres should encourage candidates not to do this.

Candidates were well drilled in the often used concepts from 21st Century Science such as benefit outweighing risk, ALARA, peer review etc. However, they tended to quote these concepts indiscriminately without really thinking about what they meant and whether they were relevant to the question at hand. Candidates who did this were unlikely to gain many marks in multi-mark questions as they tended not to contextualise or exemplify the concepts even if they had picked the right one.

Many candidates clearly entered the examination without a calculator. This lead to a number making mistakes in the calculation questions, losing marks when they were clearly on the right lines and should have been able to answer the question.

Candidates were not always able to explain their answers, particularly in the "suggest and explain" questions. Centres should encourage the identification of command words and encourage candidates to answer different command word questions in different ways.

Comments on Individual Questions

1 **(a)** Most candidates identified "The amount of radiation emitted will decrease over time," with fewer candidates gaining the second mark.

(b) The majority of candidates gained one mark here.

(c) Most candidates realised that a part of this question was on benefit verses risk, but many were unable to go beyond this and simply quoted "benefit outweighs the risk". Of those who went further, many listed a number of risks, but did not look for alternative things that would be important for a patient to know. Very few candidates thought about the risk to others or the effects of the treatment long term. Some candidates tried to answer the question from the point of view of what the patient should tell the doctor, or by thinking about things such as how the treatment was to be administered. A few candidates were concerned about possible litigation and tried to discuss legal consequences of treatments.

2 **(a)** Only about a quarter of candidates were able to correctly identify the number of elements in the diagrams.

(b) **(i)** This question was poorly answered. Candidates should be prepared for non-exact numbers in half-life calculations, due to the random nature of decay.

(ii) Just under half of candidates were able to identify that none of the treatments would have an effect on the half-life. The most common wrong answer was to combine the sample in a chemical reaction.

3 **(a)** Most candidates understood what was required here, with the majority of candidates scoring at least one mark for the total input. Of those candidates who did not score at all, the majority made a mistake here, probably due to not having a calculator in the examination. Most candidates then went on to correctly calculate the percentage. A number of candidates used the "backwards" route, calculating what 20% of 900 TWh would be, and then comparing it to the percentage quoted. A variety of methods were

used for this, such as finding 10% by dividing 900 by 10 and then multiplying that result by 2. The conclusion was not marked. This was beneficial for a number of candidates who missed the word “about” in the stem of the question or were unconvinced that 21% is about 20%.

(b) Candidates struggled with this calculation.

(c) Most candidates made at least one mistake in this question. Some chose exactly the opposite set of answers, suggesting that they were unclear about what a prediction is.

4 **(a)** Just over half of the candidates were able to pick up the mark on this question. The main error was to try to draw more than one food chain. Some had started at the top of the food chain and tried to work backwards, which meant it was harder to pick the right route.

(b) This question was well answered by candidates, who seemed well rehearsed in the possible reasons for extinction of organisms. A number of candidates were unsure about which level of the food chain they were discussing, writing about extinction of a predator and a prey. Others tried to follow the “lack of food” argument up the food chain, which only gained one mark. Some candidates were imprecise with their language, for example, some talked about “a predator eats them”, losing marks for not identifying the predator as new to the ecosystem. Some tried to include ideas about survival of the fittest in this question, mostly inappropriately. A number of candidates stated “climate change” without explaining why that would cause extinction. Similarly, “human activity” was not always fully explained.

(c) Most candidates chose the correct option in this question.

5 **(a)** The majority of candidates correctly identified Charles in this question. The most common wrong answer was Beactrice.

(b) Over half of the candidates chose the correct option for this question. Some misread the question and chose the final box.

(c) Most candidates answered this question by suggesting that there was not enough evidence. A few believed that Darwin had no evidence for evolution. There were a few candidates who tried to link other areas of the specification to this question (for example talking about peer review) and a number mixed the stories of Wegener and Darwin, suggesting that Darwin was a meteorologist. Some candidates tried to discuss evolution and mixed it with Big Bang theory.

6 **(a)** Most candidates gained this mark. Some candidates linked only half of the boxes across the question.

(b) This was well answered by the majority of candidates. The most common mistake was believing that “waving to a friend” was hormonal. Some candidates chose exactly the opposite set of answers.

7 A few candidates misunderstood this question and tried to discuss making new species in the laboratory, or mixing the DNA of species. Where candidates did pick up marks, it tended to be for the idea of reproduction. Imprecise language prevented candidates from gaining marks here, with a large number trying to describe characteristics without using the actual word. Survival of the fittest was mentioned by some candidates but they were rarely able to link adaptations with the environment.

8 **(a)** This question was poorly answered by almost all candidates. Although there had been a statement of sustainability earlier in the paper, very few candidates used this or indeed made any attempt to discuss what sustainability meant. Most tried to suggest that animal waste was “more natural” or “did not involve chemicals”.

(b) **(i)** About half of candidates picked up one mark here, generally for remembering that lightning was involved in the process. Candidates were confused by both the processes involved and the order that they would occur in.

(ii) This question was generally poorly answered. Of those candidates who did pick up marks, it tended to be those who discussed cost implications, although there was no understanding of the cost of fertiliser. Many candidates confused fertilisers with pesticides, or suggested that manure contained pests or made crops dirty. Others tried to discuss the speed of growing or used general terms like “it makes crops grow better”. A surprising number of candidates misread the question and thought that “consumers preferring organic food” was a reason not to use fertiliser. A number of arguments about taste/size/shape were given, generally not gaining marks. A very small number of candidates discussed eutrophication.

9 **(a)** Most candidates picked up one or two marks in this question.

(b) The majority of candidates identified one of the two correct answers, but were unsure about the second. Incorrect answers varied between the alternatives, but 2 and 6 were often seen.

10 Candidates often correctly identified proteins in the first gap, but were then unable to recall the break down products of amino acids. The spelling of “urea” was often incorrect.

A214/01 Ideas in Context (Foundation Tier)

General Comments

Most candidates seemed to be well prepared for the paper and made a very good attempt at answering the questions. Almost all candidates were able to show creditable performance.

However the trend for candidates to write outside the allocated areas is increasing. All too often candidates write in any white space that they can find. This is nearly always caused as a result of the candidate failing to think the answer through before commencing to write. It is common to see most of the lines allocated filled with a repeat of the question before the candidate even begins to answer it. This is a very dangerous practice that is on the increase. Due to the fact that these scripts are marked electronically, examiners do not see the whole page by default and unless there is some indication that the candidate has written outside the allocated window, it is possible that the examiner will fail to spot additional text and the candidate could lose marks. It cannot be stressed too strongly that candidates should attempt to contain their answer in the space provided.

The paper was suitably challenging and discriminated well between candidates. Very few sections were unanswered suggesting that the paper was accessible to most candidates. There was no evidence that any of the candidates ran out of time. It was also pleasing to see a decrease in the number of no-responses.

Comments on Individual Questions

1 (a) (i) This proved to be an easy start to the paper with most candidates scoring the mark. Credit was given for any reference to cancer, asthma or cardiovascular disease.

(ii) This question was more challenging with most candidates scoring only one of the marks. Good answers referred to the particulates being very small for the first mark and then stating that this allowed them to penetrate deep into the lungs for the second mark. Many candidates failed to score the first mark.

(b) This was an overlap question with the higher tier paper. It proved to be a problem for Examiners because many candidates insisted on first writing about how burning fossil fuels in a plentiful supply of air produced carbon dioxide and water vapour. This not only wasted time and took up valuable writing space but was also not credited as it was not what the question asked for. Candidates were then forced to find alternative white space to write their proper answer elsewhere on the script. Good responses referred to burning fossil fuels in a limited supply of air which creates carbon particulates.

(c) This was also overlap with the higher tier paper. It was answered well by most candidates and many were awarded the full three marks. Credit was given for an explanation that included the particulates settle on glaciers, absorbing solar radiation which in turn causes the ice to melt.

(d) This was intended to assess weaker candidates and for this reason structure was provided to guide candidates in describing the correlation. As a result most candidates correctly identified the two parts of the correlation; as particulates increase, the number of deaths rises.

(e) **(i)** The correct response for this question was the 3rd and 6th of January. However all too often candidates gave alternative dates or just gave one of the two correct answers. Another common failing was to give a whole list of dates that included the two correct ones. This strategy resulted in one mark being lost for each additional incorrect response. As a result, several candidates scored zero for this question even though their answer included the two correct responses.

(ii) This question was not well answered. Most candidates gave vague responses, such as take measurements several times each day. Responses of this type failed to score. What was required was a clear indication of taking several measurements at the same time and then calculating an average. Examiners were instructed to give credit for 'taking more measurements' providing the answer could not be interpreted as taking more single measurements. Very few candidates stated that an average should be calculated.

2 **(a)** **(i)** This was not well answered. Good answers included the idea that a gene was a set of instructions for making a protein. However the majority of candidates responded with vague and often incorrect answers that referred to parents, DNA and characteristics. This should have been two relatively easy marks, if the candidates had simply learned some basic definitions.

(ii) This question was well answered with most candidates scoring the mark for saying that scientists would be able to predict some of the diseases that Stephen was likely to get in later life.

(b) **(i)** This was answered well by candidates who understood what the question was asking for, namely implications for Stephen about the results from genetic mapping. Candidates who answered the question as if Stephen had not received the results of the test did not perform well. Good answers referred to whether or not to have children; the effect on his family; financial, employment and social implications; and treatment and lifestyle factors. Vague answers such as "he will need to deal with the information" were not credited.

(ii) This question was not well answered. Many candidates thought that gene therapy was some kind of counselling and gave answers that dealt with Stephen dealing with the stress of knowing that he had sudden death syndrome. Good answers referred to replacing faulty genes or finding a cure for the condition.

(c) **(i)** Most candidates identified Peter as the correct answer.

(ii) Most candidates identified Mary as the correct answer.

(iii) Surprisingly many candidates gave the only incorrect response by stating that Anita was talking about ethical issues.

(d) This was an overlap question with the higher tier paper and was not answered particularly well. Candidates needed to realise that the answers were not issues referring to Stephen in particular but issues that needed to be decided by society as a whole. The QWC mark for stating issues that referred to different points of view was rarely awarded. Most candidates gave one or two vague issues that were often about Stephen's own particular case rather than concerning themselves with the larger picture about issues for society regarding gene mapping. Good answers gave an argument against gene mapping such as ethical issues; reliability of results; and freedom of information concerns. They then went on to give an argument for, such as treatment and being able to plan for the future.

(e) This was also an overlap question with the higher tier paper and it also proved to be a challenging question for foundation tier candidates. Good answers clearly indicated that the risk was just a possibility and then went on to give a reason why the genes might not be expressed. Credit was given for any correct answer, and this included any epigenetic examples as well as genes interacting or being switched on or off. Common correct responses were that poor diet could increase the risk of heart disease in someone with a gene that predisposed them to coronary heart disease.

3 **(a)** This was well answered with many candidates scoring both marks. Credit was given for "has a tail, blurry or smudge, and appears to move".

(b) This was also well answered with most candidates scoring at least one of the two marks. The most common failing was to think that the Milky Way could not be seen until telescopes were used, or that 'the galaxy' could only be seen with a telescope. Credit was given for Uranus, other galaxies, nebulae and thousands of stars.

(c) This question was not answered well. Most candidates failed to realise that the question was asking about the nebula from which the Solar System was formed. Good answers included dust and gas although credit was given for any element that could have been present in the nebula.

(d) Many candidates scored the first mark by stating that galaxies are outside the Milky Way. However fewer went on to say that the proof was provided by Hubble when he measured the distance to some of the galaxies.

(e) This was an overlap question with the higher tier paper and as such, proved to be more challenging. Both the prediction and the observation were needed to gain the single mark. Good answers referred to the Big Bang and microwave radiation, or Hershel's discovery of a comet which by observation of its motion turned out to be Uranus.

(f) **(i)** Most candidates scored both marks for correctly plotting all three points.

(ii) Far too many lines of best fit were simply drawn free hand, wobbly, or consisted of several lines sketched onto the paper. This should have been an easy mark and indeed would have been if the candidates had drawn a single straight line with a ruler.

(iii) This was marked based on the candidate's line of best fit and most candidates managed to score the single mark.

A214/02 Ideas in Context (Higher Tier)

General Comments

The paper was generally well attempted, and candidates had clearly prepared the pre-release material well. There were fewer candidates taking this examination this year, as there is a substantial year 10 cohort in the entry. Candidates seemed to find the paper rather more demanding than in previous years, and there were a number of candidates entered who would have been more successful taking the Foundation tier paper. As last year, these candidates' 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 some 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. In the other extreme, there were cases when candidates' answers were too vague and lacked specificity.

Comments on Individual Questions

1 Particulate perils

There were a number of marks available in this question which could be attained by judicious quotation from the article. Many candidates managed this well, but then failed to develop the ideas with their own thoughts.

Parts (a), (b) and (c) were well answered, although in (c) (i) only the better candidates could suggest an extension to the Boston study and the evidence it could then produce to compare with the original.

In part (d)(i), few candidates could clearly explain what exceeding the daily average meant in terms of the graph, although many could identify that the 4th and 5th January were significantly different. To judge by the answers, some seemed confused as to what the value of the European limit actually was.

In (d)(ii), many candidates gave good suggestions for reduction in particulate production, although some failed to link the action to the actual context specified.

2 Scientist knows his own future

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

In (a)(i),many tried to lump insurance companies and employers together so it was often difficult to see what action was really intended. Often the shortest answers, where clear, gained both marks. In (a)(ii),few candidates managed to explain the difference between the gene mapping and family trees, with most marks being gained for the idea that genetic testing was more accurate.

Part (b) was generally poorly answered. Some wrote about ethical or religious issues in a vague way, and it was very clear that a number of them had no idea what 'technically feasible' meant.

Part (c) was generally correct, but a number failed to specify that the important discussion point was whether gene mapping should be done or not.

In (d), most could identify a question that could be answered with reference to the Human Genome Project database, and could also explain why genes alone cannot predict world class athletic performance.

Part (e) was a good discriminator with a full range of marks. Many started by saying it was raising 'ethical, educational and political issues' but then didn't give any examples. The most common one-mark response was for stating religious reasons would preclude gene mapping, as it is up to God to decide.

In part (f), many gained a mark here which tended to be for the influence of lifestyle/environment, although there were a number of responses which correctly identified the fact that a 50% chance of getting a disease may mean, or may not mean, that any one individual will contract it.

3 Observing the night sky

In (a), candidate's understanding of the motion of the Moon and planets was poor; this question was intended to be very straightforward, but it seemed as though only a minority of candidates understood that, in our Solar System, the Moon orbited the Earth while the planets, including Earth, orbit the Sun.

Part (b) asked candidates why two expert astronomers could have very different explanations of nebulae. The most popular explanation was that they used different equipment, or at different locations. Few used the idea that each might have his own treasured theory and be reluctant to abandon it, or to consider ideas which contradicted it.

In part (c), many lost a mark by not reading the question, and attempting to answer in terms of the Shapley-Curtis debate on nebulae, which was excluded. For the one mark here it was essential that the suggested prediction taken from the article should have details of the prediction which tested it: many quoted the object seen by Herschel (which he initially thought was a comet) but failed to get the mark as they did not then state that the observation which tested it was observations of its motion – they just wrote 'It was Uranus'.

Plotting of the graph points in (d) was well done, but many of the best-fit straight lines were poorly done, often free-hand and with a thick pen or multiple pencil lines. Better candidates could calculate the gradient, but there was little working shown, so very many candidates could not be awarded a 'method' mark as there was no clue how they arrived at their answer. The very best candidates realised that the graph should go through the origin because the entire Universe started at one point.

Part (e) was revealing. Many just quoted the fact that the Universe had started in a Big Bang as a learned fact, and did not pick up the point here that the new evidence undermined that theory, with the consequence that the theory would need to be modified, or the new data confirmed, before the explanation could be considered completely adequate or replaced with an alternative.

A219 Twenty First Century Science A Practical data analysis and case study

General Comments

This is the last year of operation of this specification and it has clearly been a most rewarding experience for the teachers and students involved. It has also been a pleasure for the moderating team to see the imaginative ideas that teachers have developed to engage their students and inspire them to show the best of their skills in the assessment. **For next summer, tasks will be set by OCR under the new Controlled Assessment procedures and Centres must check the new unit entry codes and other requirements.**

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

Section 1: Administrative issues

Whilst the majority of Centres have excellent administrative procedures in place there were still a significant number who caused the moderating team a considerable amount of extra work to ensure that candidates were credited with the correct marks. Few Centres included details of how each of the tasks used for assessment had been introduced and presented to candidates and this meant that on occasions moderators could not easily find the evidence to support the marks that were awarded by the Centre.

Most candidates' work was annotated with the use of the assessment criteria codes, however, in a number of cases the annotation was a very generous interpretation of the criteria and sometimes completely incorrect.

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. Another example of unacceptable assistance included the use of helpsheets giving detailed task specific points and leading questions involving particular words or phrases in the mark descriptions.

There was evidence that in some cases, particularly in the Case Study, candidates were copying and pasting information from websites without acknowledgement and referencing of the source. This action constitutes malpractice, for which a penalty may be applied.

Section 2: Assessment and marking framework

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

Section 3: Data Analysis

General comments

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' and '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 repeated their measurements when performing practical tasks. However, they did 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.

Strand I: Interpreting data

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 or using suitable scales and labelling axes correctly or 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.

The match to I(b)4, 'identifying trends or general correlations in the data', was well appreciated. However, many candidates referred to 'positive correlation' which only merits 4 marks rather than the 6 marks which was often awarded. 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.

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.

Strand E: Evaluation

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.

Most candidates could identify limitations or problems in their procedures to match E(a)4 although in many cases comments were limited to human error rather than systemic experimental ones. A number of the suggestions for improvements were not of sufficient quality to securely match E(a)6.

The majority of candidates generally identified a data point as an outlier either in the table of results or on a graph with range bars to match 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 to reliability and accuracy when discussing their data.

Marks for E(c) were often very generously awarded and this aspect still continues to be poorly addressed. 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.

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, found it much easier to match the performance descriptions of the criteria and gain higher marks.

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.

Strand A: Quality of selection and use of information

The majority of candidates included a bibliography of sources with the majority from the internet at the end of their reports with complete references to the exact URL address of the webpage. Only the better candidates provided some information about the nature, purpose or sponsorship of the site. Candidates were still not very good at clearly showing where sections of text were directly quoted. Better candidates also included references within the text to show the source of particular information quoting the specific author and then explaining why it was chosen and how it contributed to the arguments being compared.

Strand B: Quality of understanding of the Case

Only the most able candidates 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. 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 looked 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.

Strand C: Quality of conclusions

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, the best 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. 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

The majority of reports included headings and/or sub-headings (2 marks), a table of contents and numbered pages (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. More candidates now include informative images but only the best candidates refer to and use the information to clarify difficult scientific ideas and improve effective communication.

Section 5: Investigations
Rates of reaction, resistance of a wire and osmosis were still the most common investigations seen from Centres.

Strand S: Strategy
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. The best candidates performed preliminary work and used the data collected to inform and develop the main experiment. These candidates considered what factors or conditions might affect their results which usually involved 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 allowed candidates to decide which factor it would be best to study and also provide evidence which could 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 the apparatus had been selected in preference to alternative equipment.
The complexity of a task, S(a) depends on the demand and challenge involved in the approach adopted by the candidate and 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 the better candidates described in detail how the factors had been controlled and monitored during the experiment.
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. 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.
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.
The Twenty First Century Science 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).

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. The structure of Case Studies, Data Tasks and Investigations has been modified in the new specifications 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. There is further guidance about the interpretation and application of the new assessment criteria on the website www.ocr.org.uk.

This seems an appropriate opportunity to thank Centres for the care taken each year in presenting work in such a well organised manner, and to wish you continued success with the new Controlled Assessment.

Geoff Mines (Principal Moderator) on behalf of the Moderating Team 1.7.12

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