OCR
RECOGNISING ACHIEVEMENT

Cambridge Nationals

Science

Level 1/2 Cambridge National Certificate in Science **J815**

OCR Report to Centres

June 2013

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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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R071 How scientific ideas have an impact on our lives

Unit R071 is a mandatory unit with evidence coming from an OCR set model assignment. The model assignment covers 9 learning outcomes (LOs), with candidates completing a separate assessment task for each LO. There is one model assignment available, but it is written so that there is some scope for Centres to contextualise the tasks to take account of local circumstances and opportunities. The model assignment may not be used for practice and it is assumed candidates will have been taught the necessary knowledge and skills prior to undertaking the tasks set out in the model assignment.

Although most Centre marking seen this series was consistent, it was often over generous, with most of the learning outcomes being leniently marked. Learning outcomes are often marked individually, over an extended period of time, as the candidates complete each task. If, at internal standardisation, each portfolio is assessed as a single piece against an overall grade then such leniency may be identified and reduced.

Teachers are able to explain and comment on their marking on the unit recording sheet. It is advisable, where relevant, to support their assessment judgements by the use of witness statements and competency recording sheets. In order to be fit for purpose, the witness statement must relate to an individual candidate, and must refer explicitly and in detail to the contribution made by, and the evidence produce by the individual candidate.

OCR model assignments, which Centres must use, link logically to the grading criteria. It is expected that the candidates have access to both the tasks set in the model assignment and to the marking criteria. The model assignments have been written to give Centres the flexibility to make the tasks relevant to their candidates, taking advantage of appropriate local contexts.

Templates and writing frames cannot be used for the creation of assessment evidence. Candidates must independently choose layouts and make decisions about formatting when creating documents etc. presenting their assessment evidence. If guidance is given whilst candidates are undertaking the tasks, it will severely restrict the mark the candidate is able to obtain (generally to within marking band 1). Candidates may use the marking criteria as guidance before and during the assessment tasks, so it is important that candidates have access to them.

It is acceptable for teachers to employ writing frames, formative feedback and guidance comments during prior learning activities. It is expected that candidates will initially be taught the knowledge and skills required before undertaking the set tasks independently.

It may be beneficial for staff involved with the course to look again at the exemplar material provided by OCR, to see again what is required within each mark band.
LO1: Candidates tended to give a limited range of energy sources that could be converted into an electrical supply. It is expected that candidates will give a wide range of sources with a limited description, then select those energy sources that might be used in the specified location and describe those sources in detail. Candidates will also need to refer to the environmental and social impact of the selected sources.

Some Centres did not identify a specified location with geographical, environmental and climate conditions when setting the task. Without a detail description of the location, candidates cannot make an informed choice of energy source. Without choosing a location (as indicated in the model assignment) candidates could not evaluate what would be the appropriate energy source

for a specific group. If Centres change the location as suggested in the model assignment to make the scenario more relevant to their candidates then the location should be real.
When considering the transfer of energy into electricity candidates should analyse the efficiency both of generation and transmission quantitatively if possible so they can access the higher marks.

Some Centres, for prior learning activities, carry out a number of practical investigations into the efficiency of sources of energy, such as the efficiency of different fuels (this would prepare candidates for the practical investigation in unit R073), efficiency of a wind turbine or water turbine. Candidates can then use the results within their evidence.

LO2: To meet the model assignment requirements candidates needed to include a wide range of both industrial and healthcare applications. It should be remembered that X-rays and CT scans do not use nuclear ionising radiation and their descriptions would not support the evidence required for the model assignment.

Also candidates are required to suggest how risks could be reduced, this could be linked to the type (and its properties) of radiation involved. Where possible the source material of the nuclear ionising radiation used in the application should be named to support a high mark.

Guidance worksheets should not be used when generating the evidence to meet the model assignment task; however they might be used in prior learning. Then candidates can select the relevant research when producing their leaflet.

One Centre linked the reduction of the risk of using radiation to individuals working in a variety of relevant jobs, and this certainly brought more relevance to the task.

LO3: Candidates should be encouraged to explain why they are using the pieces of equipment, to show independence of choice, especially if Centres wish to raise the standard of work produced by their candidates. The accuracy of collected practical data is enhanced when repeated values are collected. It is expected that the results collected by the candidate are appropriately displayed. It was noted that some candidates just produced a result sheet with no context.

Teacher comments or a detailed witness statement of practical competences, if provided, would support the assessment mark.

LO4: Most of the candidates had decided upon a client group and what the ‘problem’ was but there could be better linkage with the health education programme. Nearly all candidates relied mainly on qualitative data in the analysis on the general factors affecting health; there should be a combination of both qualitative and quantitative data in the evidence provided. There were occasions when candidates did not present their work in a way that was relevant to their chosen client group.

LO5: The specification indicates the range of medical treatments that can be explained by the candidate. A wide range of presentational styles were used and some of the best examples seen were set as a leaflet, designed for a patient with little medical knowledge. Some candidates did not include evidence for testing and clinical trials of medical treatments. Centres could link the skills to the antimicrobial investigation in unit R073 to this learning outcome. Some Centres tested a range of antimicrobial preparations to find the best, linking this to laboratory testing of a new medicine. This prior learning would support the skills necessary in carrying out the task in R073.

LO6: Centres used a wide range of locations to collect evidence of pollution, from trips out to a Wildlife Trust Centre to their own school grounds. Consequently a range of techniques were used to collect samples. However a number of Centres used a location that provided a very

limited range of samples restricting the candidates' testing techniques. Some candidates were unclear as to why they were sampling which meant they were unable to evaluate their findings.

It was noted that a number of Centres used competency sheets, witness statements and annotation to support their assessed mark.

LO7: In some cases it was not evident what the construction project was. The model assignment is focused on the constructional materials in a house. Some candidates did label a house with the materials that were used to construct it and why they were used do so because of their properties.

However, a large number of candidates listed general construction materials with a list of material properties that were not linked to construction e.g. metal used for cooking utensils. There was a limited explanation of the chemical processes used to produce the material (balanced equations and calculations of theoretical yields),the impact of the chemical processes on the environment and little evidence of alternative production methods that can reduce environmental impact. Some candidates tended to focus on the material's environmental impact rather than the process.

In one Centre, candidates had prepared power-point presentations on a range of materials used in the construction of a house. These were then presented to the whole class and peer assessed (the feedback sheets were attached). The print out of the slides included in the portfolio evidence submitted could also have been supported with a witness statement that detailed ideas used in the presentation.

To prepare candidates for this task, there is the opportunity to carry out a number of chemical processes so candidates can focus on the environmental effect of the process. This would lead onto alternative processes and candidates could be introduced to electrolysis.

LO8: Centres used the model assignment for this task and the mark awarded was generally fair and consistent. The evidence provided was supported with a more detailed explanation of how the properties of these materials depend upon structure and bonding. A number of candidates used diagrams to explain the molecular structure of a number of materials and hence their properties.

LO9: Candidates should be congratulated on their practical skills, however the skills were not wholly integrated into the model assignment. The task requires candidates to carry out a range of tests on materials for an appropriate use. It was not always evident what the purpose of the tests carried out was for.

For certain materials without the appropriate test equipment it is difficult for candidates to test their properties and characteristics. It is suggested that investigations are chosen that are better suited to a school laboratory, so candidates can gain a higher level of achievement.

R072-01 How scientific ideas have developed

This Level One examination gives candidates the opportunity to study the processes by which scientific ideas have been developed. This is achieved by considering a number of important steps in the development of modern understanding

The first question relates to the pre –release material and provides 25% of the marks for the whole paper. Candidates who did well on the whole paper had clearly worked on this pre-release Case Study material with their teachers in class before the examination. Very few marks were obtained by simply copying form the document but many marks were accessible to those who had considered and discussed the pre-release material.

The language of the examination was inclusive and there was no evidence that any candidate were disadvantaged by this or cultural issues. There was no evidence of time pressures or other constraints for candidates.

Where multiple choice questions ask for a specific number of responses (e.g. question 1 g) candidates cannot gain full marks by giving fewer or more responses. The Level One paper usually states how many responses are required, although this may not always be the same as the number of marks awarded.

Candidates are allowed to use a calculator in this examination but a number of candidates resorted to using arithmetical workings in the margins of their scripts.

Questions

Q1. This question related to the pre-release material. Part (a) was found to be challenging and most candidates did not have a sound understanding of the mathematical concepts of percentages, or the calculations required. Some candidates gave answers lacking any mathematical content, and some did not attempt to answer at all. Many candidates did not appear to have a calculator.

Candidates who had studied the pre-release material in class were likely to have considered the section “Other studies and opinions “so could often suggest two ideas that did not support the hypothesis for part (b). Many candidates also used the information in Table 1 to state there were too few cases or that there were more cancer cases in the control group than the study group. Many answers for part (c) lacked the required detail, often referring only to FM and UHF decreasing. Some candidates gave confused responses, or continued talking about cancer cases. Most candidates were able to correctly identify from Graph 2 that the nearer the tower the greater the risk of developing cancer, and that there is a correlation between developing cancer and exposure to radiation for part (d). A significant number of candidates however thought incorrectly that this graph proved that radiation causes cancer. Most candidates could identify that the term genotoxic refers to genes or DNA but fewer linked it to the idea of damage in part (e). Many candidates simply stated that it was toxic or poisonous, or recycled the fact that that protein synthesis is disrupted which is in the pre-realease material. Stronger candidates could link the idea of a similar type of study supporting the Sutro Tower study by providing more evidence. Most candidates gained a mark for the latter point only in part (f). Most candidates recognised correctly that new techniques to diagnose cancer have been developed but not as many recognised that the equipment used to measure was not available a hundred years ago.

Q2 Some candidates did not seem to have a sound understanding of the process of rock formation and although many candidates recognised that rock layer D was the oldest, a common mistake was to choose Level A rock as the oldest. Most candidates recognised either that there were fish present in layer C, or that there must have been water present in the environment.

Stronger candidates explained the link between the two facts for part (b i). Most candidates recognised that there were differences in the rock layers, but then many simply repeated text from the question or described what was in the layers without attempting to show how conditions had changed over time or offer any explanation. Most candidates could link the evidence supplied with the correct change to the earth but were less successful in correctly linking each scientist to their particular evidence in part (c). Most candidates could correctly link Darwin to one of his theories, most commonly Evolution, but were less clear about his other theory of Natural Selection.

Q3 Part (a) was a six-mark extended-writing question which was marked using level of response marking. Stronger candidates attempted to explain how temperature control would be achieved by using the information shown in the diagram which gained a level 2 mark, and a few offered very good explanations of both heating and cooling and so gained a level 3 mark. The majority of candidates however merely restated information from the diagrams and offered little or no explanation of how or why these processes took place. The majority of candidates gave good answers for part (b i) by noting that the level of glucose rose and then fell. The majority of candidates recognised the correct response that all the results showed a similar pattern. Some candidates lost this mark however by incorrectly reading the question and ticking another response as well in (b ii) Part (c i) was less successfully answered than the similar question (b i); most candidates correctly stated that the glucose level rises again, some candidates however gave confused responses indicating that they did not compare the data presented in the two tables effectively. For (c ii) the majority of candidates recognised one correct response, either that the patient ate a snack during the test, or that Amir read the glucose monitor wrongly. Fewer candidates recognised both of these correct answers. Many candidates attempted to answer part (d) by connecting the glucose concentration in the blood and body temperature boxes to two control systems each rather than choose one control system for each. Candidates who made errors frequently chose the binomial system as an incorrect response for one or the other systems.

Q4 Candidates found this question challenging**.** Many candidates failed to give a similarity between the orbits for the first part and gave a difference in the orbits, which is the answer to the next question and so failed to score in each section. For part (a ii) the quality of written communication was assessed and the majority of the stronger candidates were awarded this mark. There was a wide variety of erroneous answers to this question from weaker candidates. Most candidates could identify that the Universe is expanding, but then many also thought that the stars move on invisible spheres. Most candidates knew that stars and galaxies give out light that can be seen from earth, but few knew the other correct answer, that light always travels at the same speed. The most frequent incorrect response chosen was that scientists can vary the speed of light to take readings.

Q5 The first part of this question was a six-mark extended-writing question which was marked using level of response marking. Candidates tended to score better on this question than the other six-mark extended-writing question (Q3a), and demonstrated a sound knowledge of the subject matter. Most candidates could identify similarities between the models of DNA structure and at least one difference. Some candidates lost marks for not including enough details in their responses and making rather vague statements. Most candidates chose the correct answer for part (b), that the model explained the evidence available at the time, and many also correctly chose the answer that new evidence caused them to change their ideas. In part (c), the uses and principles of X-ray crystallography were not well understood and many candidates erroneously thought that X-ray crystallography allowed the scientists to see pictures of DNA, or made vague non specific statements about finding new diseases. No candidates gained 2 marks for their response. The majority of candidates correctly identified that scientists would check their data (d) and find out if scientists on the same team agreed with them and scored both marks. Most candidates knew 3 out of 4 of the correct responses (e); the most frequent error was that the base pairs statement was thought to be false.

R072-02 How scientific ideas have developed

This Level Two examination gives candidates the chance to study the processes by which scientific ideas have developed by considering a number of important steps in modern understanding. The first question relating to the pre-release material provides 25% of the marks for the whole paper. Candidates who did well had clearly worked on this pre-release material with their teachers in advance of the examination. Very few marks are obtained by simply copying something from the document but many marks were accessible to those who have considered and discussed the pre-release material with their teachers.

The language of the examination was inclusive and there was no evidence that any candidates were disadvantaged by this or cultural issues. There was no indication of time pressure or other constraints for candidates.

1. The pre-release material contained a lot of data and it was hoped that candidates would have been helped to understand how this data could be used. It appeared that some candidates had not worked on the pre-release material in advance of the examination. The first question required candidates to compare data. Most candidates were able to identify the correct data to be used, but it was clear that many candidates did not have access to a calculator.
Some candidates understood the idea that a control group provided a chance to compare, but few went on to explain that the control needed to be unaffected by the tower in part (bi) but close enough to be similar in other respects (bii). The concept of working in teams was better understood but often in terms of splitting the workload rather than sharing ideas.
Many different approaches were possible to answer part (c). A few candidates were able to identify the way that Relative Risk or Exposure changed with distance, but not many candidates linked the two of these together. It was also rare to find candidates who confidently identified the extra evidence which would have made the conclusion secure. As the pre-release material covered contentious ground, it was hoped that teachers would have undertaken exercises such as this in preparing with their candidates for the examination.
Part (d) was better understood by candidates (presumably because such headlines are used). Many responses correctly identified the apparent correlation between relative risk and exposure to radiation but the idea that such a correlation did not prove causation was rarely seen.
The number of candidates who did not attempt to answer the final part of the question again suggests that a significant number of candidates had not considered the implications of the pre-release material in advance of the examination. Although a minority of candidates appreciated that DNA might be damaged, few went on to link this to protein synthesis.

2. A wide range of answers were acceptable for part (a) which simply sought to confirm that the upper layers of rock were younger than the lower ones – and most candidates found this accessible. However, the link between this and the idea that species have changed over time was not well explained in part (b). All the conclusions offered in part (c) were chosen by some candidates, although some did not recognise that they were being asked which were available from the rock evidence.
A pleasing number of candidates were able to link the named scientists to their evidence and even more could link the evidence to the changes in the earth that they indicated. It was disappointing that this question (and a few other objective items) were ignored even by some strong candidates.

3. Part (a) is superficially similar to the six-mark extended-writing question which was tem on the Level One paper. However this question required that candidates use the idea of negative feedback to explain and not just describe the processes involved. It is understood that there will be relatively few candidates likely to achieve the Distinction Grade on this Level Two examination paper, but there must be questions to identify these candidates. A good number of responses indicated some knowledge of thermoregulation, but very few candidates addressed the idea of negative feedback.
Part (b) gave candidates the opportunity to interpret unfamiliar data in a relatively familiar context. It should have been clear that the level of blood glucose went up for some time and then went down again. Candidates seemed able to recognise this, but many did not link it successfully to the relevant explanations in part (bi). However most candidates identified the similarities in the results as an argument for reliability in part (bii). Stronger candidates were able to score some marks on part (c) for describing the effects that either snacking or exercise would have had on the results. The control systems in part (d) were not well known, but Examiners were concerned that a large number of candidates drew far more lines than was appropriate on this question.

4. Many candidates scored well in part (a) with strongest candidates confidently comparing the heliocentric and geocentric views of the solar system and also usually identifying the key aspects of Newton's theories in part (b). It was again noted that the question stem specifically required two responses to be chosen, but many candidates selected the wrong number (including no response at all). In part (d) few candidates realised that all three radiation types travel at the same speed.

5. This question included the second of the six-mark extended-writing questions. Candidates were provided with a lot of information about a process with which they should have been familiar (the discovery of the structure of DNA). A competent response could be produced from judicious use of this information, but most candidates were content to copy out chunks of the information in the flow-chart in the hope that these answers would contain something worthy of credit.
Responses to part (b) suggest that the story of the competition was well understood. Part (c) was less well answered – reflecting the tendency for candidates to be familiar with ideas but lacking in their recall of factual details.
The reference to X-ray crystallography in part (d) showed up that most candidates were familiar only with the medical use of X-rays and so assumed that Bragg or Franklin had used X-rays to "take a photograph" of DNA analogous to "pictures" of a broken bone.

R073 How scientists test their ideas

Unit R073 is a mandatory unit with evidence coming from an OCR set model assignment. There is a choice of three model assignments - candidates are able to choose from practical investigations into Burning fuels, Antimicrobials and Electrolysis.

Teachers are able to explain and comment on their marking on the unit recording sheet. It is advisable, where relevant, to support their assessment judgements by the use of witness statements and competency recording sheets. In order to be fit for purpose, the witness statement must relate to an individual student, and must refer explicitly and in detail to the contribution made by, and the evidence produce by the individual candidate.

OCR model assignments, which Centres must use, link logically to the grading criteria. It is expected that the candidates have access to both the tasks set in the model assignment and to the marking criteria.

Templates and writing frames cannot be used for the creation of assessment evidence. Candidates must independently choose layouts and make decisions about formatting when creating documents and presenting their assessment evidence. If guidance is given whilst candidates are undertaking the tasks, it will severely restrict the mark the candidate is able to obtain (generally to within marking band 1). Candidates may use the marking criteria as guidance before and during the assessment tasks, so it is important that candidates have access to them.

It is acceptable for teachers to employ writing frames, formative feedback and guidance comments during prior learning activities. It is expected that candidates will initially be taught the knowledge and skills required before undertaking the set tasks independently.

Although the marking was consistent within most Centres, it tended to be generous. It may be beneficial for staff involved with the course to look again at the exemplar material provided by OCR, to see again what is required within each mark band.

LO1: The range and detail of research differed from Centre to Centre and investigation to investigation. The level of research was reflected in the detail of planning. This should include an explanation of how and why the equipment is to be used and an explanation of the range of measurements needed. Candidates should demonstrate awareness of the accuracy with which measurements can be taken. The initial research should link to a statement of why the investigation is taking place, which in turn will link to the evaluation.

Where candidates have scored well, they have based their investigation on a range of relevant sources of secondary information, and those sources have been recorded. They have also been able to explain how errors will be minimised, and linked this to the discussion of their results in their evaluation.

LO2: All candidates completed risk assessments as part of their plan. However a few candidates referred to standard laboratory rules rather than the particular chemicals, equipment and processes that were to be used. Teacher comments were also included on how candidates managed risk. Although not specifically asked for in the grading criteria, a competency record of the candidates' skills or witness statement could be used to support the skills used by the candidate.

LO3: Candidates had a tendency to draw a bar chart when a line graph would have lead itself to a greater degree of analysis.
A graph with a greater range of collected results (at least 5) will reveal trends/patterns with greater precision rather than a bar chart. It is important that candidates are taught the necessary mathematical skills for quantitative analysis; this should be done prior to the investigation.

LO4: If candidates have clearly recorded a good range of measurements and displayed error bars on their graphs then further analysis will be easier. They will be able to produce supported discussions about the limitations and reliability of the procedures, and so identify suggestions for improvements.

Candidates should be able to produce comments linked to their initial research in their evaluation and try to justify their conclusion.
LO5: Candidates tended to use scientific terminology within their initial research and in their evaluations. Most candidates were able to use standard formats to logically organise their evidence.

Centres are reminded of the importance of teaching candidates the necessary mathematical techniques which are required prior to candidates undertaking the investigation; this includes the selection of mathematical equations, graph plotting and graphical analysis.

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