OCR
Oxford Cambridge and RSA

Cambridge National

Science

Unit **R071 – R073:** Cambridge Nationals Science

Cambridge National Level 1/2 Award/Certificate

OCR Report to Centres June 2014

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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General Comments:

Unit RO71 is a mandatory unit with evidence coming from OCR model assignments. The model assignments 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 centres marking was consistent it was over generous, with most of the learning outcomes being leniently marked. Centres seem to be interpreting the MB descriptors too leniently and in over-marking candidate work they are then failing to generate evidence from the candidates of the required standard. Learning outcomes were marked individually over some period of time rather than at the completion of the unit. If at internal standardisation, each portfolio is assessed as a single piece against an overall grade then leniency may be reduced. Where there is more than one assessor within a Centre then internal moderation of portfolios is essential to ensure that all assessors are marking to the same standard to avoid rank-order problems.

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.

OCR model assignments that centres must use, link logically to the grading criteria. It is expected that the learners have access to both the tasks set in the model assignment and to the grading criteria. The model assignments have been written to give centres the flexibility to make the tasks relevant to their learners.

Scaffolding work-sheets or templates must not be used when candidates are undertaking the model assignment tasks and will trigger referral for malpractice, however, teachers may use them as well as guidance comments during prior learning. Teaching materials should not be included within portfolios only the evidence required to meet the requirements of the assessment task.

It is expected that candidates will initially be taught the knowledge and skills required before undertaking the set tasks independently.

If guidance is given whilst candidates are undertaking the tasks, it will severally restrict the mark the candidate is able to obtain.

Candidates may use the comments on the grading sheets as guidance when undertaking the task so it is important that they access to them.

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.

It should be remembered that centres should send copies of the MS1 and CCS160 to the designated moderator as well as making sure the candidate’s number and full name is entered onto the Unit Recording Sheets.

Comments on Learning Outcomes:

Learning Outcome

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 up to nine 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 need to refer to the technical detail of the source as well as their environmental and social impact.

Some centres did not identify the geographical, environmental and climate for a specified location. Without a detail description of the location learners cannot make an informed choice of energy source. Without choosing a location (as indicated in the model assignment) learners could not evaluate what would be the appropriate energy source for a specific group. If centres change the location as specified in the model assignment to make the scenario more relevant to their learners then the location should be real.

When considering the transfer of energy into electricity learners should analysis the efficiency both of generation and transmission quantitatively if possible so they can be awarded the higher mark.

Some centres, for prior learning, carry out a number of practical investigations into the efficiency of sources of energy, such as the efficiency of different fuels (this would prepare students for the practical investigation in RO73), efficiency of a wide turbine or water turbine. Learners can then use the results within their evidence.

LO2: To meet the model assignment requirements candidates needed to include a wide range of industrial and healthcare as well as power applications. This could include:
In healthcare:- radiography; radiotherapy; nuclear medicine; sterilisation
In industry, ionising radiation is used in:- quality control of materials; measuring the level in containers; monitoring the thickness or consistency of paper; modification and preparation of polymeric materials and composites; irradiation of foods

In power generation the use of ionising radiation is used to:- secure the UK's energy supplies; help the UK decarbonise and meet legal low-carbon obligations; benefit the economy more widely; produce large quantities of low carbon electricity over an extended period; small power plants, as in submarines, produce large amounts of power for a small amount of material allowing submarines to submerge of months at a time

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. However, they may be included as part of a radiation treatment when the risk of radiation exposure is calculated.

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.

A centre linked the reduction of the risk of using radiation to individuals working in a variety of relevant jobs, this brought more relevance to the task.

LO3 Candidates should be encouraged to explain why they are using the pieces of equipment to show independence, especially if you wish to raise the standard of work produced by your candidates. The accuracy of collected practical data is enhanced when repeated values are collected. It is expected that the results collected by the candidates are appropriately displayed and units are included. It was noted that some candidates just produced a result sheet with no context. It is important that candidates can select appropriate equations and carry out the required calculations independently to achieve the higher mark.

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

LO4: Some candidates had decided upon a client group and what the 'problem' was but there could be better linkage with the health education programme. The client group was often poorly-defined. Evidence was often just "evidence" - there was no idea that materials had been produced with a client group in mind - it was just text/prose with little focus.

Nearly all candidates relied mainly on qualitative data in the analysis of the general factors affecting health; there should be a combination of both qualitative and quantitative data in the evidence provided. The full range of factors would include diet, exercise, smoking, drug use, pollution, noise, agrochemicals and it is expected at least four factors would be evaluated in detail.

LO5: The specifications indicate the range of medical treatments that can be explained by the candidate and should include some quantitative information. Often multiple treatments were considered, but frequently this just led to lack of depth in any one treatment and also in clinical trialling. Only one treatment needs to be considered, but in some depth and with some quantitative analysis.

A wide range of presentational styles were used and where best as a leaflet aimed for a patient with little medical knowledge. Some centres did not include evidence for testing and clinical trials of medical treatments.

LO6: Centres used a wide range of locations to collect evidence of pollution, from trips out to wildlife trust centre to their own school grounds. As a result 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. Candidates should have the opportunity to collect both biotic and abiotic data, to include, depending on survey: indicating vegetation count, vertebrate count or invertebrate count and pH values, chemical tests (such as for sulphates, chlorides, carbonates) and particulates counts.

Too many investigations did not have sufficient depth of numerical processing to achieve the higher mark.

Some learners 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 there 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. It is expected up to nine materials are listed and explained to achieve the higher mark.

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) and 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.

There is an opportunity, in prior learning, to carry out a number of chemical processes so learners 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. It is expected at least five materials would be explained to achieve the higher mark.

LO9: Candidates should be congratulated on their practical skills, however, they 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. At least two materials should be tested, each for two properties and then a comparison between the two materials made. 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 an investigation is chosen that is better suited to a school laboratory, so candidates can achieve a higher level of achievement appropriate for Key Stage 4

R072 How scientific ideas have developed

General Comments

This unit 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 usually worked on this document 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 little or no evidence of time pressures or other constraints for most candidates.

Where multiple choice questions ask for a specific number of responses (e.g.2b) candidates cannot gain full marks by giving fewer or more responses. The Level One paper will usually state 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 did not do so.

Questions

Q1. This question related to the pre-release material. 1 a i. was well answered and most candidates gained the mark. More able candidates also answered a ii and b i correctly. In b ii the majority of candidates gained only one mark by mentioning that the reaction times were close to the average. Similarly in b iii ,most gained one mark for repeating the tests, the other marking point of comparing with the results of others was rarely seen. The graph in 1c was poorly interpreted by most candidates, as was the data table for 1 d. Many candidates stated that Group a was included "to make it a fair test" which was not credited. Some candidates correctly had the idea that this was a control group used for comparison, however the term control was rarely used. The candidates who did not gain marks for e ii answered in very general and vague terms without reference to the data in the table, those who did use the data most commonly gained a mark for reference to slower reaction/longer response times ,and many also went on to gain a mark for increased errors/risk of accidents. f i was correctly answered by the majority of candidates and some of them also showed detailed working out, fii was less well answered.

Q2 a It was rare for candidates to score full marks, and some answers appeared to be very confused. The most commonly seen correct answers were that the Ancient Greeks had a Geocentric view and that Hubble believed the Universe is expanding. b most candidates gave at least one correct response and many gained both marks. c i more able students recognised that an individual's reaction time would not be fast enough for one mark, but very few noted that the distance was too short for the other potential mark. c ii was poorly answered with few able to gain a mark as they only stated that Jupiter's orbit would make calculation difficult. More able candidates knew the speed of light in a vacuum for c iii. In d the majority of candidates gained a mark for citing improved technology, but none went on to explain that it is easier to look for/find evidence after a prediction which was the second

mark point. In e the majority of candidates knew that electromagnetic waves travel in straight lines, far fewer knew that they also carry data.

Q3 a The most able candidates achieved 5 or 6 marks on this question but the vast majority merely restated information given in the question stem with some mentioning genes and gaining 1 or 2 marks. b and c were generally well answered with the majority of candidates gaining at least 1 mark in each section.

Q4 a The majority of candidates recognised that the concentration of CO_2 was increasing but it was rare to see the second mark awarded for the fact that the rate is increasing. Most candidates gained 1 mark in b, usually for the statement that there are more cars, it was less common for 2 marks to be gained by reference to deforestation, or burning fossil fuels. Few candidates correctly worked out the % change in c i. The most common incorrect answer being 72, which is merely the difference between the highest and lowest number in the table. c ii was well answered, the most common incorrect response being that" it increased every year". I n d the majority of answers gave effects of a change in global temperature by referring to melting ice caps or flooding which gained 1 or 2 marks. Few candidates attempted an account of the mechanism of warming to access the rest of the marks.

Q5 The majority of candidates recognised that fossils or bone evidence would be used here, but an understanding of how this would be used was rarely seen. In b very few candidates understood the concept of comparing the fossils with others found in a similar strata, or carbon dating. More able candidates gained 3 or 4 marks in c , however it was common for many candidates to state that feeding , care and training was what was needed, which does not answer the question.

R073 How scientists test their ideas

General Comments:

Candidates are able to choose from three practical investigations: Burning fuels, Antimicrobials and Electrolysis. Centres should not attempt to carry out any other experiment without prior consultation with OCR.

Scaffolding work-sheets or templates must not be used when candidates are undertaking the model assignment tasks and will trigger referral for malpractice however teachers may use them as well as guidance comments during prior learning.

It is essential that centres follow the JCQ *Instructions for Conducting Coursework*. In particular, the instructions which clarify what can be considered to be the candidates' own unaided work. Providing candidates with worksheets, writing frames and/or additional instructions, or providing formative feedback whilst the evidence is being produced, constitutes help over and above to that permitted, and is liable to be reported as malpractice by the moderator.

It is expected that candidates will initially be taught the knowledge and skills required before undertaking the set tasks independently.

If guidance is given whilst candidates are undertaking the tasks, it will severally restrict the mark the candidate is able to obtain.

Candidates may use the comments on the grading sheets as guidance when undertaking the task so it is important that they access to them.

Comments on the Unit Recording Sheet were mostly brief, it would be helpful if these comments are as detailed as possible and show how marks have been awarded linked to the criteria.

Witness statements with details of the candidate's practical competencies would be helpful in supporting the awarded marks.

Please ensure that you annotate all candidates' work to show where the evidence has been met as annotation is always useful in confirming the judgements made by the teachers.

Although the marking was consistent it tended to be generous.

It should be remembered that centres should send copies of the MS1 and CCS160 to the designated moderator as well as making sure the candidate's number and full name is entered onto the Unit Recording Sheets

Comments on Individual Learning Outcomes:

Learning Outcome

LO1: The range and detail of research differed from centre to centre and from investigation to investigation. In cases where candidates scored well, they have based their investigation on a range of relevant sources of secondary information. Not all candidates referenced the information gathered when undertaking their research. After initial research learners will identify the "problem" that needs to "solved".

The level of research was reflected in the detail of planning and should link why the investigation is taking place, which in turn will link to the evaluation.

From their research and prior learning candidates will be able to plan their investigation. The plan should be written so another person could follow it.

In their portfolio candidates should explain why they have chosen the equipment and why they have chosen the measurements and to what accuracy measurements can be taken using the equipment selected. This can also feed into the evaluation to support analysis of the accuracy of the result.

Candidates have also to been able to explain how errors will be minimised and linked this to the discussion of their results when they have completed the practical work in their evaluation.

LO2: All learners completed risk assessments as part of their plan. However a few referred to standard laboratory rules rather than the chemicals and processes that were to be used. Candidates are expected to have access to CLEAPSS information and Hazard Cards. Candidates need to explain the risk of the individual chemicals used or biological materials, they should also go on and explain how waste material is dealt with, both chemical and biological. Teacher comments were also included on how candidates managed risk. Although not specifically asked for in the grading criteria a competency record of the learners' skills or witness statement could be used to support the skills used by the candidate.

Teachers should indicate how candidates set up equipment considering actions such as:

- Setting up equipment on a stable platform (table)
- setting up in enough space to carry out measurements
- that equipment is stable (use of appropriate stand)
- equipment can be reached easily when taking measurements
- electrical connections made.

Candidates could refer to how equipment is set up in the plan – in terms of taking readings and ease of carrying out the practical. Diagrams and photographs could be used to indicate the equipment set up.

Diagrams should be drawn using conventional scientific techniques, such as using a ruler and pencil, labelling at the side of the document with reference lines to equipment, in 2-D rather than 3-D.

Candidates must demonstrate the ability to take and record appropriate measurements:

- measurements to taken will be relevant to the investigation
- measurements are reliable (can be repeated for the same accuracy)
- measurements read correctly (eye in correct position, enough light)
- measurements are checked against secondary data for accuracy

- measurements recorded clearly and with correct unit.

It is expected candidates will take repeat measurements – candidates should be aware of the accuracy of their measurements when taking them as they may decide to collect a number of results in a certain range (if initially 3 measurements are taken, candidates may decide to take more whilst actually carrying out the practical till 3 measurements are taken that are "close" to each other.)

Candidates should consider to what significant figure they are recording to – precision of final result will depend on the sensitivity of all readings taken.

When measurements are taken and recorded to appropriate accuracy and precision the appropriate format should be used, including use of correct units. It is expected that candidates select the appropriate recording format, they should not be given a pre-prepared template.

LO3: Learners had a tendency to draw bar chart, where a line graph is needed.

A graph with a greater range of collected results (at least 5) will reveal trends/patterns with greater precision rather than a bar chart. When drawing graphs appropriate scales and axes should be used and data plotted accurately, including where appropriate, use of lines of best fit is used (not joining points "dot to dot").

To achieve the higher mark a complex mathematical technique is required. Teachers should allow this opportunity to candidates this may mean candidates calculating areas, gradients etc. rather than just calculating mean values.

It is important that learners are taught the necessary mathematical skills for quantitative analysis, this can be done prior to the investigation and if needs be, at this point scaffolding worksheets might be used and learners reminded of the use of units.

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 identified suggestions for improvements. They should consider the accuracy and precision of their data against the equipment that they have used.

Learners 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 learners were able to use standard formats to logically organise their evidence.

It may be necessary to teach learners the necessary mathematical techniques required prior to undertaking the investigation; this includes the selection of mathematical equations, graph plotting and graphical analysis.

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