Cambridge National

Science

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

OCR Report to Centres June 2015

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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OCR REPORT TO CENTRES

R071 How scientific ideas have an impact on our lives

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.

Marking by centres that have entered a number of cohorts over the years was consistent and reflected the level of achievement by their candidates. However some centres were over generous, with most of the learning outcomes being leniently marked. These centres seem to be interpreting the MB descriptors too leniently and then failing to generate evidence of the required standard from the candidates..

In some cases, 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.

Assessors should support their mark with comments on the unit recording sheet. If assessors annotate evidence then their marking will more likely match the grade criteria. It is advisable, where relevant, to support their assessment judgements by the use of witness statement and competency recording sheets.

OCR model assignments, which 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.

Model assignments must be used. If changes need to be made then centres need to discuss the proposed changes with OCR. The limit of possible changes is given in the model assignment documentation.

Scaffolding work-sheets or templates must not be used when candidates are undertaking the model assignment tasks and will trigger referral for malpractice. However assessors 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 should be included.

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

If guidance is given while 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. OCR's Unit Recoding Sheets must be used, centres cannot construct their own.

Comments on Individual Learning Outcomes

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

Some centres did not identify the geographical, environmental and climate for a specified location. Without a detailed 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. 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 analyse the efficiency both of generation and transmission quantitatively, if possible, so they can be awarded the higher mark.

LO2: To meet the model assignment requirements candidates needed to include a wide range of industrial and healthcare as well as power applications. It is expected that candidates will give 3 to 4 uses per application.

In the application "healthcare," uses might include: - radiography; radiotherapy; nuclear medicine; sterilisation

In the application "industry", uses might include:- 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 uses of ionising radiation might include:- 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, when the risk of radiation exposure is calculated, they may be included as part of a radiation treatment.

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.

LO3 To show independence, candidates should be encouraged to explain why they are using the pieces of equipment 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 of calculated energy with no context; it is important that candidates can select appropriate equations and carry out the required calculations independently to achieve the higher mark.

Assessor comments or a detailed witness statement of practical competenceswould support the assessment mark.

LO4: Few candidates decided upon a client group, what the 'problem' was and then linked this with a health education programme.

Evidence was often just "evidence" - there was no idea that relevant materials produced should have a specific client group in mind. Those candidates who produced leaflets etc targeting a client group achieved higher marks.

A lot of 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, and agrochemicals and it is expected at least four factors would be evaluated in detail supported with quantitative data.

LO5: The specification indicates the range of medical treatments that should be understood by the candidate and explanations should include some quantitative information. Only one treatment needs to be considered, but in some depth and with some quantitative analysis.

A wide range of presentational styles were used with a good example being a leaflet aimed at a patient with little medical knowledge.

Evidence for testing and clinical trials of medical treatments should have reasons for each stage of the testing.

LO6: Centres used a wide range of locations to collect evidence of pollution, from trips out to wildlife trust centre toinvestigations in 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.

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.

The grading criteria ask for visualisation of data, this could be in the form of a chart.

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

LO7: The model assignment was focused on the construction materials in a house. Candidates should label a house with the materials that were used to construct it and why they were used. . It is expected up to nine materials are listed and explained to achieve the higher mark.

However a 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 that, to achieve the higher mark, at least five materials would be explained. Quantitative data should refer to the property of the material and then explain why this data makes it appropriate to use.

LO9: The task required 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 madeThe purpose of the tests was not always evident.

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 suited to a school laboratory, so candidates can achieve a higher level of achievement appropriate for Key Stage 4.

R072-01 How scientific ideas have developed

General Comments

This unit gives candidates the chance to show their understanding of the processes by which scientific ideas have developed. It was clear that Centres had entered candidates who were suited to the structured approach of this Level 1 paper so that they were often able to demonstrate their knowledge and understanding. The language used in questions was appropriate and there was no evidence that candidates did not have sufficient time to complete the examination as all questions were attempted on the majority of papers. However candidates need to ensure that they spend sufficient time reading questions carefully so that their answers address the question fully and take account of the marks allocated (e.g. 3b, 5b, 6c).

Question 1 is based on the Case Study and provides 25% of the marks for the whole paper. Although candidates had some familiarity with this document they need to ensure that they refer back to it carefully before answering questions (e.g. 1c, 1g). It would be useful in their preparation to look in more depth at the limitations of experimental techniques (e.g. 1bii) and how data has been used (e.g. 1c).

Comments on Individual Questions

Question No.1

Candidates were familiar with the nature of sound waves in (a) but in (bii) few mentioned that when measuring echo time the use of a stopwatch involves possible error due to human reaction time and instead explained how a mobile phone works in recording sounds. Candidates need to spend sufficient time referring back to the Insert before they answer, particularly in this case by looking closely at the diagram to find the total distance travelled in (c.) Most ignored the need to double the 50m to work out the speed. Similarly (g) could be answered by direct reference to the script. Given a choice of answers in (e) it is possible that candidates simply chose the one they thought was correct rather than use the table in the Insert. Either few did this or they were unable to interpret the decimal wavelength data. In (di) very few were aware of peer review and most answers referred to James Maxwell who had made further developments in this field. Very few candidates had any understanding as to why two people can use mobile phones at the same time in (h). Many preferred to describe the reason why microwaves were used rather than radio waves in terms of the size of the aerial needed. There was little recognition of the idea that they operate on different wavelengths. Part (i) was well answered as was (j); candidates usually understood that signals do not escape from fibres but fewer knew that the signal does not spread out.

Question No.2

Candidates successfully interpreted data in (a) but in (b) they usually gained credit for stating that the temperature was too high (an unqualified ‘high’ was not creditworthy); few extended their answers to explain the significance of a high temperature. In (c) candidates were aware of negative feedback systems and could identify the effector but usually identified the nerves rather than the brain as the receptor. Candidates usually answered (d) as a 1 mark question relating to a lack of proof but there was no evidence of candidates considering the inability to design tests.

Question No.3

Many candidates were not very aware of the binomial system (aii); neither the derivation of the scientific name of a plant (ai) nor being able to identify the scientist who created the system (aiii). In (bi) better candidates were usually able to state that genes are involved in determining leaf

shape but few linked it to the idea of inheritance. Answers frequently just referred to the fact that seeds had come from the same tree. Part (bii) was much better answered and illustrated that candidates did have an understanding of inheritance they had not demonstrated in (bi).

Question No.4

Many candidates identified only one factor as evidence for drift (a): either the jigsaw fit of continents or matching fossils on different continents; few considered other aspects such as matching rock strata. Candidates needed to be more careful with terminology when describing continental drift, some repeated this term rather than mention the movement of continents while others referred to countries rather than continents. Candidates were usually able to interpret statements (b) and successfully complete the calculation in (c).

Question No.5

Candidates found it difficult to describe the structure of DNA in (a), answers were usually limited to how bases link within the structure as was shown in the diagram. Only a small number of candidates were able to describe it as a double helix and few made any reference to Franklin's evidence. In (b) candidates failed to read the question properly and automatically stated the use of fingerprints. Some mentioned DNA (in the question) but many did not relate this to a sample that DNA could be taken from. In better answers candidates often simply stated that a tissue sample could be taken from the crime scene but omitted to state that a sample needed to be taken from the suspect and then a comparison made. There were several references to the fact that an individual's DNA is unique but this was not creditworthy as a standalone answer.

Question No.6

Many candidates failed to understand that (a) referred to interpreting the experimental results, preferring to either describe what foods should or should not be eaten, or refer to the patient getting medical treatment. In (b) many answers referred to the possible long term effects of diabetes in terms of heart attack or kidney failure rather than describing the immediate symptoms. In (c), as in (a), candidates did not relate their answers to what is effectively an experimental situation and often described what foods should be eaten or referred to visiting the doctor. Those candidates who recognised the experimental process unfortunately often lacked precision in their answers. They referred to repeating having a meal with seeds but did not have the concept of fair testing or carrying out a control experiment.

R072-02 How scientific ideas have developed

General Comments

This unit gives candidates the chance to show their understanding of the processes by which scientific ideas have developed. The first question (relating to the Case Study) provides 25% of the marks for the whole paper. Most candidates were familiar with this document and it seemed that they had spent time preparing in advance of the examination. It was, however, very clear that many candidates were unable to address the questions which related specifically to the bold print statements in the specification. These can only be examined on the level two paper so they must appear here.

The language of the examination was inclusive and there was no evidence that any were disadvantaged by this or cultural issues. There was little or no indication of time pressure or other constraints for most candidates although some very weak candidates did not attempt a number of questions. They would have been better advised to attempt the level one paper.

Comments on Individual Questions

Question No.

1. Most candidates had spent some time working on the Case Study and showed an understanding of the concepts presented. The idea that a sound involved both compressions and rarefactions of the air escaped some weaker candidates, but many made a good start there. The calculation of the mean response time in part (b)(i) was well done by many, but a significant number did not have access to a calculator and chose at best to give the median value. The calculation of the speed of sound in part (b)(iii) was not easy without a calculator, but many students did not realise that the total distance travelled was 100 metres. Between these, part (b)(ii) was not well understood. Candidates did not appreciate that the "human error" would be less significant measuring a larger number.

   Part (c)(i) was the first assessment of "Learning Outcome 2" from the specification. This comprises a small number of statements about "The Process of Science" and is key to the specification for this examination. Many candidates showed a good understanding of the way in which publication of science research can move the process forward.

   Part (f) was disappointing as very few candidates appreciated that many mobile phones can communicate within a "cell" using carrier waves of different frequencies. Each frequency can then be re-used in an adjacent cell because of the relatively weak signals involved. The use of a smooth surface to reflect IR in part (g) was often described well, but candidates were much less confident about the use of optical fibre in part (h).

2. The story of Avicenna is a useful approach to the way in which experiments are designed. In part (a) good candidates understood the idea of a comparison but did not often acknowledge the concept of a control group against which the comparison takes place. The reliable, quantitative measurement of the dipstick is contrasted in part (b) with the subjective estimate from tasting the urine. Part (c) goes on to consider a contemporary approach to a similar investigation. Most candidates approached this well and were able to indicate the shortcomings of the data given. Ideas about how to extend the investigation were often quite tentative.

3. Few candidates were familiar with the term "binomial classification" and so were unable to answer this straightforward question. Candidates would benefit from a closer study of the story of Linnaeus and this will be approached in a future Case Study. Part (b) was more

commonly understood with good candidates able to explain that clipping a tree to form a hedge is an acquired characteristic (although they did not usually use that term). A good proportion of candidates were able to identify the closest relative of the bonobo in the cladogram. However, this may indicate that cladograms are intuitively easy to use as few were able to explain the relationships in part (c)(ii) and (c)(iii).

4. The previous Case Study on the work of Wegener had clearly been used to prepare candidates here. This resulted in some good descriptions of his ideas and their slow acceptance by the scientific community. The interpretation of data in part (b)(i) was largely well done with a pleasing number of candidates scoring full marks. However, quite a lot of candidates did not link the idea that these were "modern measurements" while Wegener "proposed new ideas" in 1915. They were therefore unable to score on part (b)(ii).

5. A number of candidates were aware of terms like "double helix" in respect of the structure of DNA – and also the pairing of A-T and C-G. However, candidates who could take this further and describe the structures in greater detail were rare. The subject of protein synthesis (transcription and translation) is a bold print statement in the specification and should be understood by Level two candidates. However, the responses given to part (b) suggest that very few candidates were familiar with the process. It must be stressed that candidates for this level should have studied these sections of the specification if they are to achieve good results at this level.

6. Part (a) is another example of the content which is unique to level two. Ideas of thermoregulation appear across both levels, but the specification includes "vaso-constriction and dilation" in bold print. Many of the responses gave quite good descriptions of sweating – but the question was about "changes to the blood supply in his skin" – so they failed to score. Even though many candidates understood the concepts of thermoregulation, the term "negative feedback system" was as unfamiliar as "binomial classification" in question 3. Many candidates scored a mark on part (c) for indicating that God may or may not exist but without going into any detail about the problems of designing reliable, repeatable experiments.

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 should be 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 investigation to investigation. Candidates should refer to the model assignment which lists the expected research to be carried out.

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 to 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 that 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. The accuracy will be reflected in the decimal places in the collected measurements.

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 to explain how waste material is dealt with, both chemical and biological. Assessor 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 a 3-D sketch.

Candidates must demonstrate the ability to take and record appropriate measurements

- measurements 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 – precision of the 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: A graph with a range of collected results (at least 5) will reveal trends/patterns. When drawing graphs appropriate scales and axes should be used and data plotted accurately, including where appropriate, use of lines of best fit (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. This is especially so in the antimicrobial investigation).

It is important that learners are taught the necessary mathematical skills for quantitative analysis. This can be done prior to the investigation. LO4: If candidates have clearly recorded a good range of measurements and displayed range 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. 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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