OCR
RECOGNISING ACHIEVEMENT

Cambridge National

Science

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

OCR Report to Centres

January 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.

CONTENTS

Cambridge National

Science R071 – R073

OCR REPORT TO CENTRES

R072-01 How scientific ideas have developed

This unit gives candidates the chance to study the processes by which scientific ideas have developed. This is achieved by considering a number of important steps in the development of modern understanding.

The first question (relating to the pre-released material/insert) provides a significant 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 advance of the examination. Very few marks were obtained by simply copying something from the document but many marks were accessible to those who had considered and discussed the pre-released material.

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

It should be noted that where a multiple choice question asks for a specific number of responses (e.g. Q1g), candidates cannot achieve full marks by giving fewer or more responses. The Level One paper will usually state how many responses are required although it may not always be the same as the number of marks available.

Candidates are entitled to use a calculator in this examination but a number of candidates resorted to doing arithmetical working in the margins of their scripts.

Questions

1. Candidates who were familiar with the contents of the pre-released document could immediately identify the answer to part (a) from the first two sentences. Those who had studied the document in class were likely to have considered the bullet points in the second section and so were ready to explain *why* readings had to be collected at regular intervals and from a wide range of locations. The common response of 'to make it a fair test' was not a sufficient explanation. Similarly, a good response to part (c) required candidates to identify examples of human activities which would explain why cities are warmer than the surrounding area.

Candidates who linked part (d) with the pre-released document could often suggest why different scientists could obtain different values. Responses to the second part of (d) were sometimes confused with the process of peer review, which precedes publication. Although part (e) offered two marks and asked for 'reasons', few candidates offered more than one reason.

In part (e) only a small number of candidates understood the concept of a range of data, even though this should have been familiar from Key Stage 3. However, most candidates could identify at least one of the correct statements about the graph (usually the first one).

2. This question was found to be challenging and most candidates did not seem to have a sound understanding of the mathematical nature of Mendel's work. Although many selected the correct explanation in part (a), the idea that plants had all been grown from the same parents was often selected.

3.

Most candidates assumed that the tall characteristic in part (b) was dominant, but credit was only given for an explanation of how this was could be deduced from the evidence.

The first calculation in part (c) was often completed correctly, but the simplest ratio was less well understood.

In part (d) most candidates understood that repeating the same experiment increases scientific confidence in results, but few were able to identify a second correct answer from those available.

Most candidates were able to give the correct answer to part (e).

4. Most candidates identified the correlation between the age and depth of the rocks in part (a). It should be noted that 'a positive correlation' does not provide an adequate answer unless the variables are also identified.

In part (b), similarities between the strata samples were identified by many candidates. Some answers lacked necessary detail, referring only to 'the same results'.

Many candidates recognised the evidence that Wegener used to support his ideas in part (c) and most could identify two other changes on the Earth's surface in the last part of the question.

5. The diagrams were usually interpreted to give good answers to the first part of this question. Candidates who had considered the differences between the uses of parts of the electromagnetic spectrum scored well on the remainder.

6. In the first part of this question, candidates were more likely to score both marks if they had read through the text under the illustration. The receptor was identified more commonly than the effector, but most candidates were not confident of either word. The use of sweating to reduce body temperature was well known (and often explained in more detail than required) with a small number of candidates explaining vasodilation. Many candidates recognised Galvani's experiment in part (c) although the first mark was more accessible than the second.

7. Part (a) was marked using level of response marking. Candidates who had read the introductory article attempted to describe selective breeding, although most did not provide enough detail for Level 3 marks. A common mistake was to describe cross-breeding with (usually) a domestic dog. Other candidates failed to score (Level 0) because they chose instead to describe the process of conditioning an individual fox by careful handling from birth – although a few claimed that they could then breed from this fox to pass on its (learned) characteristics.

In part (b), stronger candidates linked the characteristics with increased chance of survival. Running faster may indeed be a feature of foxes with long legs, but unless this was linked to ideas like catching prey or avoiding predators, it does not answer the question. Many candidates recognised Darwin in part (c) but were less likely to specify the mechanism as natural selection. There were a wide variety of answers to the final part of this question,

8. Many candidates attempted to answer this question by recycling parts of the information given on page 18. A few candidates showed that they had studied developments in this area by discussing resistance from religious authorities in part (a) but answers commonly referred vaguely to inadequate technology and occasionally to lack of space travel.
Part (b) was marked using level of response marking. The answers rarely addressed the question adequately for Levels 2 and 3, adding little to the information given in the question.

Most candidates answered part (c) correctly, although a small number failed to respond.

R072-02 How scientific ideas have developed

This unit gives candidates the chance to study the processes by which scientific ideas have developed. This is achieved by considering a number of important steps in the development of modern understanding.

A number of candidates did not score well on this paper and they would have been better advised to attempt the Level One paper.

The first question (relating to the pre-released material/insert) provides a significant 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 advance of the examination. Very few marks were obtained by simply copying something from the document but many marks were accessible to those who had considered and discussed the pre-released material.

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.

Candidates are entitled to use a calculator in this examination but a number of candidates resorted to doing arithmetical working in the margins of their scripts. A small number of candidates had extremely poor handwriting and might have been well served had their centres been able to obtain permission to use a scribe.

1. To obtain full marks on the first part of this question (ai) it was necessary to identify a reason for a scientist to measure a **higher** value and not just a different one. At this level, noting that different data might be from different places, an extra step of identifying a warmer place was required. Responses to the second part (aii) were sometimes confused with the process of peer review which precedes publication.

In part (b) it was expected that candidates would respond with more than the statement 'Cities are hot spots' from the pre-released material. Candidates who had studied the resource booklet in advance could often offer good ideas about why cities are artificially warm.

Although part (c) offered two marks and asked for 'reasons', few candidates offered more than one reason.

Part (d) was quite challenging as not many candidates seemed able to address this sort of calculation with confidence.

Part (e) required candidates to interpret data from the pre-released material. Candidates who were familiar with the booklet could answer this sort of question much more readily. It seemed that many candidates had not really considered the mechanism for possible flooding and in some cases responses to the final part of this question indicated that candidates had not considered it at all.

2. The idea that some plants would breed only tall plants was rarely well explained expressed in part (a). Few candidates seemed to understand the mathematical nature of Mendel's work. The reliability of the *results* in the table for part (b) relates to their repeatability and the similar ratios shown – not the experimental design (the fact that the number of plants was always the same). The dominant characteristics in part (ci) were not usually identified. Many candidates identified a characteristic (e.g. colour of flower) and not which colour was dominant. Few candidates could use the 3:1 ratio successfully to complete the calculation in

part (cii). The idea that two recessive genes would both be needed to be expressed in each of the parent plants was not well understood in part (ciii). The objective questions in part (d) caused fewer difficulties, although a significant number of candidates believed that advances in microscopy had assisted Watson & Crick, rather than Franklin's X-ray crystallography work.

3. Most candidates identified the correlation between the age and depth of the rocks in part (a). It should be noted that 'a positive correlation' does not provide an adequate answer unless the variables are also identified. In part (b), similarities between the strata samples were identified by many candidates. Some answers lacked necessary detail, referring only to 'the same results'. In part (c), most candidates were able to identify most of the statements, although it was disappointing at this level that some candidates did not realise they were expected to make a response for every statement. The final part of this question (d) required candidates to identify the relationship between tectonic plates and geological activity – but this was rarely appreciated.

4. Most candidates seemed to appreciate in part (a) that radio signals could not follow a 'Line of sight' across the Atlantic, but the part allegedly played by the ionosphere was not well known and a surprising number of (early) satellites were assumed to be involved. Several of the statements about waves and communications were well understood in part (b) but few candidates could suggest reasons for using optical fibres in part (c).

5. Part (a) was marked using level of response marking. Level 3 answers to this question were very rare indeed with very few candidates offering cogent examples from both sides of the issue. Most candidates did attempt to tackle both sides, but many did not look beyond repeating statements in the question. The process of natural selection was not well explained in part (b). There were a number of possible marking points available but the statement 'survival of the fittest' was a common response. Although this course is based on the development of scientific ideas, the processes of scientific research and collaboration in part (d) were not well understood. Teams which bring together people researching from different angles provide a breadth of perspective, where collaboration with others doing broadly similar work provides additional data and reliability

6. Answers to part (a) were sometimes vague, referring to lack of 'technology' (and sometimes even space travel). However, candidates often identified at least one reason for the lack of progress.

Part (b) was marked using level of response marking. Part (b) was a challenge as candidates struggled to put together the sort of answers expected at Levels 2 and 3.
A Level 3 response would have contrasted the limited understanding shown by Ptolemy and the advances described by Galileo and explained (to some extent) by Newton.
Most candidates answered part (c) correctly, although a small number failed to respond.

R073 How scientists test their ideas

This unit gives candidates the opportunity to develop their skills in designing and carrying out experimental work, including the collection of data and its analysis, interpretation and evaluation.

Candidates can select from one of three practical investigations:
– Antimicrobials
– Electrolysis
– Burning fuels

In this session candidates carried out investigations on either Antimicrobials or Burning fuels.

The assessment of the practical investigation includes a synoptic element and candidates need to draw on the appropriate scientific knowledge and understanding from the earlier units R071 and R072. Therefore, the teaching for this unit should be integrated into units R071 and R072 so that candidates develop their experimental skills in the context of the scientific content of these units. Centres might consider submitting work for this unit, R073, following the delivery of the two earlier units.

It would appear from the level of knowledge and understanding presented in candidates work, that candidates attempted R073 in isolation rather than it being integrated into the learning of the other two units.

Antimicrobials

This task context links to R071 module 2 were candidates study:
- types of microorganisms that cause infectious diseases
- prevention by immunisation and treatment by antibiotics.

The candidates will have also gained the necessary skills, when collecting first-hand data, on how to work accurately and safely, both individually and with others.

LO1: Be able to plan a scientific investigation
Although candidates produced adequate plans it would have be beneficial if they had been able to carry out more extensive initial research into the action of antimicrobials, thus increasing their prior knowledge. This would have also strengthened the final evaluation.

It would help to show candidate independence if they had explained why and how the equipment is to be used in their plans.

LO2: Be able to collect scientific data
Candidates had considered some risks when carrying out the investigation. However, the candidates needed to explain how risks can be minimised both when using chemicals and aseptic techniques.

Teachers need to provide clarification on their involvement in helping candidates to set up the equipment and to carry out the experimental work.

LO3: Be able to analyse scientific information
Candidates produced a good range of measurements that were clearly recorded. If a quantitative analysis is undertaken a higher mark can be given.

LO4: Be able to evaluate scientific information
In order to achieve high marks in this LO, candidates needed to provide an analysis of the limitations and reliability of the procedures used, including suggestions for improvements.

The initial research into the action of antimicrobials could have been linked to the final evaluation giving an overarching appreciation of the whole investigation.

LO5: Be able to communicate scientific information
Throughout their report candidates should present information using scientific and technical language. When undertaking their initial research candidates should have the opportunity to develop their range and understanding of scientific and technical language. Centres should encourage a greater use scientific language by candidates during the delivery of the units. This in turn should raise the quality of argument within evaluations.

Burning fuels

This task context links to R071 module 1 where candidates study:

- renewable and non-renewable fuels
- the relationships between specific heat capacity, mass, temperature change and energy
- the relationships between energy input, useful and wasteful outputs and efficiency.

The candidates will have also gained the necessary skills, when collecting first-hand data, on how to work accurately and safely, both individually and with others.

LO1: Be able to plan a scientific investigation
Although candidates produced adequate plans it would have be beneficial if they had been able to carry out more extensive initial research on the energy released when fuels with different numbers of carbon atoms are burnt, thus increasing their prior knowledge. Additionally, it would have helped if candidates had drawn the molecular structure of the fuels so as to show the number of carbon atoms and the bonds involved. This would have also strengthened the final evaluation.

It would help to show candidate independence if they had explained why and how the equipment is to be used in their plans.

In the a large number of the plans produced by candidates little consideration was given to the size, shape or material of then container, this would influence the amount of water that was used, in turn the range in temperatures that might be recorded over specific periods of time. It would also influence the heat being passed or lost to the water.

Only a few candidates considered recording the mass of the fuel burnt thus making it difficult for them to make comparisons between the fuels.

LO2: Be able to collect scientific data
The limited range of fuels provided restricted the range of results that candidates could obtain.

Candidates had considered some risks when carrying out the investigation but they should go further and explain how risks can be minimised.

Few candidates suggested stirring the water to obtain a consistent temperature throughout, having a container with the least surface area to reduce heat loss to the surroundings, a lid to stop loss of heat or considered the material of the container used to hold then water.

Teachers need to provide clarification on their involvement in helping candidates to set up the equipment and to carry out the experimental work.

LO3: Be able to analyse scientific information
A range of results were recorded giving temperature differences, however only some candidates commented on the flame size, and number did not calculate the energy transferred to the water.

The range of results was limited by the range of fuels provided.

LO4: Be able to evaluate scientific information
Candidates did not compare their results to secondary data so could not properly comment on the accuracy of their results or the limitations and reliability of the procedures. This impeded their ability to be able provide relevant suggestions for improvements

Little knowledge of the energy used in forming or breaking bonds was displayed.

LO5: Be able to communicate scientific information
Throughout their report candidates should present information using scientific and technical language. When undertaking their initial research candidates should have the opportunity to develop their range and understanding of scientific and technical language. Centres should encourage a greater use scientific language by candidates during the delivery of the units. This in turn should raise the quality of argument within evaluations.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553