Cambridge National

Science

Level 1/2 Cambridge National Certificate in Science in the Workplace **J816**

OCR Report to Centres June 2016

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

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OCR REPORT TO CENTRES

Content	**Page**
R074 How scientists use analytical techniques to collect data	4
R075/01 How scientific data is used	6
R075/02 How scientific data is used	8
R076 Environmental Science	10
R077 The science of fitness and health	11
R078 The science of production	14

R074 How scientists use analytical techniques to collect data

General Comments:

This unit requires candidates to undertake five practical techniques as well as carry out research on alternative techniques for each. This unit also prepares candidates for the external exam for unit R075, so it is useful if candidates write up their practicals in detail.

OCR provides a choice of three model assignments from which centres need to choose one. Each model assignment puts the science into a scenario that allows candidates to evaluate their evidence in a context.

Candidate evidence should be presented as notes in a laboratory notebook – this is the approach that OCR suggests. Written annotations, in candidates' notebooks identify the evidence making marking and assessment straightforward. Generally candidates presented their evidence logically and in a format that was easy to follow.

With the model assignments being set in a scenario, candidates were able to produce more reasoned conclusions as a purpose could be seen for carrying out the practical technique.

It is expected that candidates will initially be taught the knowledge and skills required before undertaking the model assignments independently as summative assessment.

If guidance is given while candidates are undertaking the model assignments, it will severally restrict the mark the candidate is able to obtain. 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 while the evidence is being produced constitutes help over and above that permitted, and is liable to be reported as malpractice by the moderator.

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

Comments on the Unit Recording Sheet were mostly brief; it is 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 are also 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 teachers.

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

Comments on Individual Learning Outcomes

Learning Outcomes:

LO1: The evidence for this learning outcome appears in each of the five practical techniques that the candidates carry out. Candidates should explain their choice of measuring equipment and the importance of the calibration of that equipment. Candidates are required to:

- carry out risk assessments and explain how risk will be minimised,
- understand sampling techniques,
- report findings in detail and in an appropriate format,
- evaluate the quality and validity of data
- evaluate the quality and validity of the procedures used
- justify improvements..

LO2-5 requires candidates to be introduced to alternative analytical techniques. Candidates are not expected to have a detailed understanding of how these techniques work. The focus of the candidates learning should be on the benefits of the alternative techniques, related to the quality of data these techniques can provide.

LO2: Chromatography - candidates not only record data from the practical investigation but also included their chromatographs from which R_f values are calculated.
Candidates should be able to label the phases.
Candidates need to research: Electrophoresis – DNA analysis, gas chromatography (GC), high performance liquid chromatography (HPLC) as alternative techniques. They will need to explain the benefits of at least two techniques.

LO3: Visual observation – candidates were required to use a light microscope and draw accurate drawings and calculate magnification. Most candidates could calculate magnification but biological drawings were poor. It is expected that scientific conventions are followed.
Candidates need to be able to demonstrate that they can calculate magnification, be able to calibrate a microscope and scale magnified images.
Candidates need to research: Electron microscopy, X-ray analysis, and ultrasound. They will need to explain the benefits of at least two techniques.

LO4: Chemical identification – candidates are required to identify cations and anions in samples. Most candidates were able to carry out flame tests and test for cations and anions. However, candidates tended to only test once rather than to repeat the test so as to check the reliability of their data.
Candidates need to research: Ion chromatography, atomic emission spectroscopy (AES), and inductively coupled plasma-atomic emission spectroscopy (ICP-AES). At least two types of instrumental technique to improve analysis of samples need to be described**.**

LO5: Titration – candidates are required to use a burette and a one-mark pipette which most candidates could. Candidates are required to indicate why they have selected the indicator used. From their measurements candidates are required to calculate the concentration of the unknown solution. To achieve the higher mark candidates are required to carry out the complex calculation independently and without the use of guidance from a pre-prepared template.
Candidates need to research: the pH meter and auto-titration.

LO6: Colorimetry – candidates are required to visually compare absorbance/transmission and then to plot and use a calibration curve which most candidates could do.

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R075/01 How scientific data is used

General Comments:

This examination provides candidates with opportunities to demonstrate their knowledge and understanding of the ways scientists obtain, analyse and communicate information using the context of the analytical techniques they have experienced in unit R704.

It was clear that centres had entered candidates who were suited to the structured approach of this Level 1 paper. For example, in question 2 they were able to demonstrate their knowledge and understanding better on the structured parts (2a, 2bi, 2bii) than the extended response questions (2c, 2d).

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. A common misused term was 'accurate' (2d, 3ci, 3ciii).

Comments on Individual Questions:

Question no.1
Candidates answered this question, with the exception of part (c). Many correctly identified the test for copper (part (c)(i)) but fewer the test for sulfate, and explanations that the result with barium chloride shows this were rarely seen (part (c)(iii)). Many did not attempt to answer this last part of the question and there seemed to be a lack of understanding that the test results gave the name of the compound.

Chromatography was usually incorrectly given as the other identification technique in (d)(ii) rather than spectrophotometry.

Question no. 2
Many candidates correctly identified the best apparatus to use to view various specimens in part (a) and knew how to adjust a microscope in parts (b)(i) and (b)(ii). However, few were able to use the electron microscope image to calculate a distance in part (c), many just multiplied the two given numbers together or counted the 6 lines rather than the 5 spaces.

Most candidates were unable to give a disadvantage of an electron microscope in part (d), with many giving an advantage of it or of a light microscope.

Question no. 3
Candidates were confident in using universal indicator results to find a pH in part (a).

The idea that the colour one sees depends on the individual so is a qualitative measurement was little understood in part (b), and several answers referred to different concentrations of the tablet or indicator.

Few candidates were able to give an advantage of using universal indicator in part (c)(i), answers usually relating to it being more accurate. The idea that a pH meter gives quantitative results in part (c)(iii) was not often recognised, most answers referred to 'accurate' or reproducible'.

Part (d) proved difficult for many candidates where answers simply stated agreement with the hypothesis without any use of the data. Most who used the data ignored the outlier to calculate the mean and range; errors were made in this where candidates were possibly working out the

mean by mental arithmetic. The best answers showed the 1 tablet mean doubled but did not consider the concept of the 2 tablet mean being within the '1 tablet doubled' range.

Question no. 4
Candidates understood the need for calibration in part (a) and could identify an anomalous result in part (b)(i) but many did not clearly explain the difference to the others in part (b)(ii), just stating that it was the lowest result. Candidates need to be more careful in reading data from graphs as many answers indicated they knew how to use the graph but their answers were outside the tolerance allowed.

Question no. 5
Many candidates showed no understanding of what electrophoresis results represent. They interpreted them as if it were a chromatogram and matched individual spots so that all foods contained at least one of the bacteria. Some misinterpreted the results and gave answers referring to as many as twelve people having food poisoning. Others ignored the data and gave answers relating to general warnings about cooking chicken properly to ensure it is free of bacteria. Better answers usually identified the food pattern matching the food poisoning result. The best answers identified the bacteria as well but rarely identified safe foods.

Question no. 6
Candidates were usually able to identify spots on the chromatogram that referred to specific amino acids in parts (a)(i), (a)(ii), and (a)(ii). Some candidates did not appreciate that answers in (a)(i) and (a)(ii) had to refer to the chromatogram as well as the data table, and consequently made no reference to the spots. The majority of candidates know how to carry out a chromatography experiment and correctly sequenced the necessary steps in part (d).

R075/02 How scientific data is used

Question no. 1
Candidates performed well in part (a), with the majority being able to select the best piece of apparatus to be used for the specific specimen given.

Most were also able to identify the correct part of the microscope that is used to focus a specimen and to see more of the specimen in part (b).

Part (c)was less well attempted, only the best candidates were able to use the image and the scale together to show if Jack's estimate was correct..

In part (d) many candidates did not read the question carefully and gave an advantage rather than a disadvantage of using an electron microscope.

Question no. 2
Part (a)(i) was poorly answered, with the majority of candidates describing how to take a random sample rather than a representative sample, and so they could not be awarded the mark.

Part (a)(ii) was answered better with more candidates being able to state how to avoid contamination of the samples by using clean apparatus or by using different containers for each sample. However, many made reference to wearing safety glasses or gloves which did not gain credit.

In part (c)(i), most candidates knew that by using more than one technique this would make Izzy's conclusion more reliable, although some thought that it would make the conclusion more accurate, which was not acceptable for the mark. Many candidates knew that copper gave a green colour in the flame during the flame test. However, in part (d), the first of the longer answer six mark questions, candidates did not perform well. Some candidates were able to identify the presence of sodium and bromide ions using the information in the graphs, of those few then explained how they knew this by making reference to the data in the graphs. Very few candidates were able to use the graphs to explain why the purity of the sample was less the 90% pure.

Question no. 3
In part (a)(i) the majority of candidates were able to analyse the data in both tables to compare the results for universal indicator and the pH meter. Many made a conclusion but few gave reasons for their answers. Many just stated that the results for the universal indicator agreed with those of the pH meter. Although the majority of candidates were able to give an advantage of either the universal indicator or the pH meter to gain one mark in part (a)(ii), many understood that universal indicator was cheaper or easier to use and some knew that the pH meter was more precise.

Candidates found the second of the two six mark questions in part (b) again very difficult with few being able to analyse the results of the two titrations correctly to gain credit. Those that did attempt the question often used basic common knowledge, rather than their scientific knowledge from the course. Those candidates who did attempt to answer the question simply stated that those with more stomach acid should take more tablets, which whist worthy of some credit, this was not often beyond the marks required for level 1 – 2 as their answer was not backed up with data from the tables.

Question no. 4
Question 4 proved very difficult for candidates, only a handful of candidates knew how to calibrate a colorimeter and many were not able to put into words why the colorimeter should be calibrated in part (a)(ii). Very few candidates were able to explain why the blue filter would be the best filter to use.

In part (c)(i), most candidates were able to calculate the mean absorbance of the sample and many knew that they should ignore the value of 0.25 and could explain why. However, few then went on to use this value and the graph to find the concentration of anti-freeze in the fuel. Very few candidates were able to take this to answer part (c)(ii) to state whether the concentration of the samples would be within 10% of each other. Part (d) was better attempted with many candidates showing an understanding that another technique or checking a secondary source such as the internet would confirm the value. However, many candidates simply stated that the data should be repeated, which was not allowed credit.

Question no. 5
Question 5 proved more accessible for candidates with many being able to analyse the graph and data table together to identify the second amino acid in food A. Many also understood that as the values for isoleucine and leucine were very close together it was very hard to be sure which food B contained. In the final part, the majority of candidates were able to draw the correct positions for the R_f values of threonine and valine in food C.

R076 Environmental Science

In June 2016 there were very few candidates/centres entered for this unit and therefore it has not been possible to produce a report.

R077 The science of fitness and health

General Comments:

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 while the evidence is being produced, constitutes help over and above 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 model assignments 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.

Written comments and annotations on the candidates' work showing where evidence has been met for each marking criteria is helpful not only for assessment but also internal standardisation

The model assignment groups the learning outcomes into three tasks.

Task 1:
The evidence for Task 1 integrates evidence for LO1, LO2, LO3 and LO4, and annotation clearly aids in the assessment of this task.

Detailed evidence was presented on how the three systems are affected by health and quantitative data was used to support the relevant health effects.

Greater focus could have been made on the physiological parts of the three systems It may have helped to label a diagram of each of the three systems as well as referring to them in the text.

Task 2:
The evidence for Task 2 integrates evidence for LO5 and LO6, and detailed evidence was presented for the factors that measure/affect fitness. Candidates needed to identify the target group for their fitness programme, the model assignment referrers to 11 to 18 year olds as they would be easily available in a school. Greater detail in the measurement and recording of fitness data could have been presented.

Generally if a larger number of people could have been tested and the results compare establishing the effect of the fitness programme then greater focus could have been made on the evaluation of the fitness programme itself. Fitness trends over time could be shown by the use of graphs.

Task 3:
Evidence covering the criteria was presented based on the NHS, the change in the scenario was agreed by OCR.
The relevant health and fitness knowledge and skills fitted well in this scenario.

Comments on Learning Outcomes:

LO1: Understand the structure, function and control of the musculoskeletal system

For the musculoskeletal system, candidates should identify eight bones and label them correctly. Some candidates labelled the musculoskeletal system with the Latin names. Five muscles should be identified and labelled correctly. Pre-prepared diagrams can be used but candidates must put their labels on the diagrams independently.

Candidates need to explain the functions of the bones in the skeleton, as well as how muscles function with reference to the different joints in the body. Again diagrams can be used but candidates should label and explain these diagrams independently. Wherever possible, candidates should refer to quantitative data. Candidates could also produce quantitative data by measuring the force produced and work done by these muscles by moving or lifting weights.

LO2: Understand the structure, function and control of the circulatory system

The structure of the circulatory system should be identified. If diagrams are used candidates should select them and label them independently.. Only a few candidates were able to explain how high blood pressure or high cholesterol were caused, or how coronary heart disease (atherosclerosis, heart attack) and strokes were caused. Wherever possible quantitative data should be use. Candidates could produce data by referencing pulse and heart rate, blood pressure, electrocardiograms (ECGs) when the body is put under stress.

LO3: Understand the structure, function and control of the respiratory system

Candidates should identify seven components of the respiratory system explaining their functions and how they can be affected. Few candidates referred to reduced lung capacity or emphysema when explaining how health of the system can be affected. Wherever possible quantitative evidence should be used. Candidates could produce quantitative data when the performance of a person's respiratory system is being assessed by measuring different lung volumes (tidal volume and vital capacity).

LO4: Understand the consequences of health and fitness factors on the body

Candidates should explain five different human health risks and their effect on the relevant parts of the body. Candidates might produce the evidence for this learning outcome as leaflets in their portfolio or as they explain as part of the evidence for the three body systems. It is helpful if teachers annotate the relevant evidence when marking.

LO5: Be able to create a fitness programme for a specified group

Most candidates could explain how fitness depends on the 4Ss – strength, speed, stamina and suppleness - but did not always put in the context of their specified group.

LO6: Be able to measure a person's fitness

The fitness programme that has been explained should now be tested, that is why the model assignment suggests a group of 11 to 18 year olds is used. Four fitness tests need to be measured (the tests themselves can be given to the candidate). It is suggested that a group is tested over a period of time so the fitness programme prescribed can be evaluated as to its success. Consultation with the sports department would aid in obtaining data over a period of time.

Graphical visualisation would aid in the evaluation of the success of the programme.

LO7: Describe the purpose and structure of an organisation related to the sports or health and fitness industry

Most candidates carried out this learning outcome with reference to a local gym but a school sports department might also be used. To obtain the higher mark candidates need to carry out their research independently, referencing their information.

LO8: Be able to research career options
Candidates obtained a wide range of evidence for this learning outcome.
To obtain the higher mark candidates need to carry out their research independently, referencing their information.

R078 The science of production

In June 2016 there were very few candidates/centres entered for this unit and therefore it has not been possible to produce a report.

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