

Cambridge National

Science

Unit **R074 – R078**: Cambridge Nationals Science in the Workplace

Cambridge National Level 1/2 Certificate

OCR Report to Centres June 2014

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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.

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R074 How scientists use analytical techniques to collect data

General Comments:

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

OCR provides a choice of three model assignments and centres need to choose one, this puts the science into a scenario allowing candidates to evaluate their evidence in a context.

The evidence should be presented as laboratory notebook notes – this is the approach that OCR stipulates. A number of centres presented their evidence logically and in a format that was easy to follow. However, a few centres presented not only the evidence for the assessment but all the notes used in prior learning in a very illogical manner.

Written annotations in candidates' notebooks identifies the evidence, making assessment and moderation straight forward. This especially helps when assessing LO1 as the evidence for this learning outcome is found throughout the candidate's notebook.

With the tasks being set in a scenario, candidates were able to produce more reasoned conclusions, as they could see the purpose for carrying out the practical technique. Generally, learners performed the practical tasks well.

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 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 severely 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 have 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 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 calibration of that equipment. They will be 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 as well as the procedures used and justify improvements so they can answer questions in unit R075.

LO2: Chromatography - candidates not only recorded the data gathered from the practical investigation but also included their chromatographs from which Rf values were calculated.

Candidates needed to research: Electrophoresis – DNA analysis, Gas chromatography (GC), High performance liquid chromatography (HPLC) as alternative techniques.

LO3: Visual observation – candidates were required to use a light microscope to draw accurate drawings and calculate magnification. Most candidates could calculate magnification but biological drawings were poor. It is expected that scientific conventions are followed.

The drawing title is placed at the bottom left of the drawing and the drawing magnification calculation is shown aligned on the right at the bottom of the drawing

Objects are labelled with lines drawn with a ruler and to the right of the drawing.

Lines should be parallel and justified on their right ends such that labels appear neat and tidy.

Label lines should not use arrowheads.

Label lines should never cross one another. If it is necessary for a label line to bend it should be at an angle of 90°.

Drawings should be in pencil and errors erased, coloured pencils should not be used; if needed a note describing the colour and how translucent or not, the object is can be added.

If the object keeps repeating itself in the view do not draw them all, a few in detail is better. If the object is large with uniform appearance throughout, the detail can be indicated in a small part of the drawing. Simply note that the rest of the specimen, or area, looked similar.

Only draw what you can see, do not make it "up"; if something expected is missing just make a note that it was not seen.

Do not shade in, granular structures may be indicated using stippling - many small dots made with a sharp pencil.

Depending on the image drawn use the largest total magnification view - 400x

Candidates need to research: Electron microscopy, X-ray analysis, Ultrasound

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 repeat the test so as to check the reliability of their data.

Candidates need to research: Ion chromatography, Atomic emission spectroscopy (AES), Inductively coupled plasma-atomic emission spectroscopy (ICP-AES).

LO5: Titration – candidates are required to use a burette and an one-mark pipette which most candidates could however, few candidates repeated the process to be able to evaluate the reliability of their measurements. 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.

Candidates need to research the Spectrophotometer.

R075 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 R074.

Where questions were structured, candidates were able to demonstrate their knowledge and understanding and performed better than on those questions requiring an open response (e.g. 2bii, and 2c). It was clear that centres had appropriately entered candidates who were suited to the structured approach of this Level 1 paper. The language used in questions was appropriate and there was no evidence that candidates did not have sufficient time to complete the examination as most questions were attempted.

Most candidates seemed to have a calculator which they used for mathematical aspects of the paper where it was good practice to write down the steps carried out in a calculation to gain partial credit for correct data interpretation if the final answer was incorrect (e.g. Q4 biv). Candidates read questions requiring more than one response carefully and most selected the correct number of responses required (e.g. Q4 cii).

Comments on Individual Questions:

Question No.1

Part (a) was very well answered where candidates were required to use the pH scale. Candidates need to have a more secure knowledge of scientific terms relating to the measurement of results as there was confusion particularly relating to the terms 'accurate' and 'repeatable' in (b) and (c). The use of a second method to confirm experimental results was better understood in (cii) and many candidates gave realistic responses regarding useful extra information in parts (di) and (dii).

Question No.2

This question covered the experimental procedures involved in carrying out flame tests where candidates knew that flames change colour but recall of actual colours was less certain (part (ai)). They often confused the terms quantitative and qualitative in part (a ii) in relation to the flame test. Parts (bi) and (bii) indicated that candidates need a better knowledge of standard laboratory tests as ticks seemed randomly placed in (bi) and only the best candidates could recall the limewater test for carbon dioxide in (bii). Part (c) required an extended answer which provided candidates with an opportunity to describe fully the flame test procedure they would have carried out in the laboratory. The best answers were clearly ordered and included an explanation of how and why the wire loop was cleaned; others described the procedure but did not provide any explanation as required by the question.

Question No.3

Many candidates selected the correct indicator to use in a weak acid strong base titration but as in the January examination bromothymol blue was the usual incorrect choice in (a). Candidates' knowledge of variables in experiments was tested in (bi) where the main confusion was in being able to recognise an independent variable which was usually incorrectly described as 'dependent'. In part (bii) many candidates did not understand the purpose of repeating a procedure and did not provide an answer or often referred to fair testing which seems to be a default answer to this type of question. The data interpretation required in parts (ci) and (cii) was often answered well as candidates were able to take readings from a graph and use them to make a decision based on a given fact. Part (d) required candidates to give an extended answer where they had to calculate the mean and range from a short set of experimental results which included an outlier. The purpose of this was to provide an opportunity for candidates to identify the outlier and ignore it in their calculations and this was a feature of the best answers. However, some of these better answers still included the outlier in working out the range; it should be appreciated that it should be totally ignored as the result has been excluded. Most candidates' marks were limited because they did not recognise the outlier and included it in calculations. Candidates should appreciate that as the use of data is a key aspect of this course that the quality of the data should be assessed before it is used in calculations. The final aspect of this answer required candidates to use their mean value and the graph in (c) to find the mass of ethanoic acid dissolved in vinegar and consequently assess its quality and this was a feature of the best answers. In other answers there was some confusion as candidates seemed to misinterpret a statement about the quantity of ethanoic acid in vinegar and thought that if it had more than 4g it contained too much water. Some incorrectly used the range rather than the mean which could have simply been because it was easier to fit that value to the graph to find an answer.

Question No.4

This question allowed candidates to demonstrate their knowledge and understanding of the process of chromatography. Part (a) indicated that candidates might be familiar with the technique but are not very familiar with the terminology used. The mobile phase was most often correctly recognised while the pencil line was a common incorrect answer for the stationary phase. Many candidates drew lines to link up two components to each phase rather than just one. In part (bi) many candidates were able to correctly interpret a chromatogram. The meaning of a standard reference was not well known in part (bii); some knew that it was used to compare results but very few stated that it was a substance with a known value. Parts (biii) and (biv) were answered well as many were able to calculate the R_f value, identify the sugar from a table and provide a correct explanation. The statement made by Edward in (ci) was often correctly identified but few candidates were able to offer a clear explanation as to why they had made that choice. Candidates often showed an understanding of the reasons for repeating the experiment with a different solvent, usually selecting the reason 'to get more data'. In part (iii) fewer candidates were familiar with an alternative experimental method of identifying sugars; the most common answer referred to the technique of gas chromatography.

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.

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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 severely 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 have 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 therefore annotation would clearly aid 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. More information could be presented on joints and muscles.

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 need to identify the target group for their fitness programme, the model assignment refers to 11 to 19 year olds as they would be easily available in a school. Greater detail in the measurement and recording of fitness could have been presented.

Generally 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:

Learning Outcome.

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

For the musculoskeletal system, candidates should identified eight bones and label them correctly with some labelled with their 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

Four components need to be identified. Within the blood four components need to be identified by candidates with their functions and how they can be affected explained. Again, if diagrams are used candidates should select them and label them independently. Most components of the circulatory system were identified. However, few candidates went on 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, and/or 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 is affected. Wherever possible quantitative evidence should be used. Candidates could produce quantitative data when the performance of a person's respiratory system 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 first 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

Four fitness tests need to be measured (the tests themselves can be given to the candidate). It is suggested that a group are tested over a period of time so the fitness programme prescribed can be evaluate 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 and a teacher's witness statement would support this.

LO8: Be able to research career options

Again 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 and a teacher's witness statement would support this.

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