Cambridge National

Science

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

OCR Report to Centres June 2015

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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

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 from which centres need to choose one; this puts the science into a scenario allowing candidates to evaluate their evidence in context.

The evidence should be presented as laboratory notebook notes – this is the approach that OCR suggests. 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 identify the evidence making marking and assessment 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 a purpose could be seen 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 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 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.

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 teachers.

It should be remembered that centres should 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 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 and evaluate the quality and validity of data as well as the procedures used and justify improvements so they can answer questions in unit R075.

LO2-5 require 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 learning should be on the benefits of the alternative techniques, related to the quality of data these techniques can provide. [For MB3 - benefits of use explained and evaluated are required.]

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 should be aware of the limitations of equipment when carrying out paper chromatography. They should be able to label the phases as well as the calibration.

Candidates needed 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.

[For unit R075 candidates could be tested on the Mass Spectrometry – this will give a positive identification of the components of a mixture when a chromatograph is linked to a mass spectrometer.]

LO3: Visual observation – candidates were required to use a light microscope 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, Ultrasound. They will need to explain the benefits of at least two techniques.

[For unit R075 candidates could be tested on the advantages and disadvantages of the Electron Microscope.]

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), Inductively coupled plasma-atomic emission spectroscopy (ICP-AES). At least two types of instrumental technique to improve analysis of samples are described.

LO5: Titration – candidates are required to use a burette and a one-mark pipette which most candidates could however do; 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. An Instrumental analysis technique to improve analysis of samples by titration needs to be described.

[For R075 the advantages and disadvantages of a pH meter could be tested.]

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 which could be tested in unit R075.

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 so that they were able to demonstrate their knowledge and understanding better on this type of question (e.g. 1a, 1b, 1c and 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. However, candidates need to ensure that they spend sufficient time reading the questions carefully so that their answers address the question fully, particularly in extended writing tasks where aspects of required answers were often missing (e.g. 1e and 4d). Where experimental methods are described candidates need to ensure that they include relevant details from the start to the end of the process so that they do not miss out key steps (e.g. 1e).

Candidates should appreciate that the use of data is a key aspect of this course and that the quality of the data should be assessed and outliers identified before it is used in answers (e.g. 3aii); they also need to understand why an outlier may occur (e.g. 2civ).

Comments on Individual Questions:

Question No.1

Part (a) was well answered. Most of the candidates able to correctly interpret results in a chromatogram. The solvent was usually correctly identified as the mobile phase but the drop of coating was often incorrectly identified as the stationary phase in (b). Candidates were very familiar with the idea of using a different solvent if one shows no results in (c). Many candidates measured the top of the relevant spot on the chromatogram to work out the Rf value for part (d); reference to the measured spot would have confirmed that spots should be measured at their midpoint. This inaccuracy meant that candidates were unable to explain that the value was between two given ones, hence the uncertainty in the given conclusion. In part (e) candidates were able to describe the basic steps in setting up chromatography apparatus but many ended their description with the paper being placed in the beaker containing solvent and few described the removal of the chromatography paper from the solvent when it had spread up the paper. Candidates need to ensure that they include the necessary detail which they would have followed in carrying out this experiment such as the fact that the solvent should be below the dye spots and show this if they use diagrams. There were very few references to how to get the food colouring from the sweet coating. Several candidates referred to the solvent with reference to putting spots of solvent on the paper rather than dye, although they had not made reference to using a solvent to get the dye sample in the first place.

Question No.2

Parts (a) and (b) were answered well with candidates confident in basic experimental procedure and able to interpret indicator test results. However, in part (ci) few were able to demonstrate an understanding that in a titration the indicator changes colour at the neutralisation point, most repeated that it shows if a solution is acid or alkali. In part (cii) fair test was a common answer with many not appreciating that repeating the titration makes results more reliable or allows calculation of mean. Many candidates stated that the titration is repeated to get an accurate value but there was little recognition that the first titration is usually used to find a rough value.

Candidates were very confident in identifying outliers (part (ciii)) but in part (civ) many gave a reason for why they had chosen that number as the outlier, rather than a reason as to why it had occurred in the experiment. In part (d) most definitions of qualitative referred to the quality of the results, candidates were more confident in defining 'quantitative'. However there were many misconceptions such as qualitative is more accurate and quantitative is just more data or a larger number of results.

Question No.3

Candidates demonstrated confidence in plotting points on a graph and the best answers showed recognition of the outlier and drew a line of best fit being aware that it would go through the origin, but a number failed to recognise the outlier and joined the points in parts (ai and aii). In parts (bi and bii) candidates showed that they are far more familiar with calculating the mean rather than the range of experimental results. Part (biii) indicated a lack of understanding regarding using the graph to find the mean concentration; many candidates simply found the mean of the concentrations in the results table. Most candidates showed an understanding of how to obtain secondary data, although some stated the need to do more experiments.

Question No.4

Parts (a) and (b) were answered well but in part (c) candidates did not seem to understand the concept of how to work out actual size from a measurement, often multiplying by the magnification rather than dividing. In part (d) most candidates could state that X was lily and Y was daisy pollen and better answers justified this; several were also able to state that Z could be either the willow herb or lily from its range of pollen diameters. Weaker answers often identified lily and daisy without explanation. A common misconception regarding the difficulty in identifying Z related to the range of diameters being greater than X and Y, rather than linking the range to the information given in the table.

Question No.5

The best answers in part (a)(i) showed that the candidates were aware that universal indicator uses an integer scale recognising that the pH could be above 6.2 within the 6 range or alternatively there was recognition of the difficulty in distinguishing between orange and yellow. Candidates recognised the greater accuracy of a pH meter but many answers related to reducing the risk of human error or being quicker or easier to use which were not creditworthy. Candidates need to be more familiar with the results of chemical identification tests as many only recognised the test for either copper or chloride with no significant indication that one was better known than the other.

R075/02

Candidates found question 1(a)a quite tricky. Some showed an understanding that using universal indicator paper is subjective, but few made reference to the values being integers or words to that effect. In part 1(a)(ii) most could score one mark for stating that an advantage of a pH meter would be that it would be more accurate. Some incorrectly thought that a pH meter would also be subjective as it would give colours. Although there was space labelled on the paper for two advantages, many candidates only wrote one. In part (b) of question 1, although the question asked candidates to circle two correct answers, many only circled one. Many candidates scored one mark here though, generally for identifying copper as one of the ions in the water.

In question 2(a), many candidates lost marks as they drew more than one line from each phase. Candidates who did score normal correctly identified the mobile phase. The stationary phase was often wrongly linked to the pencil line. In part (b), very few candidates were able to interpret the chromatogram correctly to make conclusions about the two food dyes. Many candidates made reference to the solvent rather than colour/dye. This same mistake was made in made in part (c)(i), which in general was much better answered than part (b); However, many candidates stated that the solvent did not move up the paper, which was not worthy of credit. In general candidates showed that they were able to calculate the Rf value of a substance; however some candidates lost marks as they did not read the question carefully and calculated the Rf value of the wrong spot. In part (d)(ii) many candidates did not use a ruler accurately and so were not able to make correct judgements to evaluate Peter's conclusion.

Question 3a was well answered with many candidates being able to make a valid conclusion regarding the two types of pollen. Candidates were also good at understanding how to change the magnification of the microscope. Part (a)(ii) of question 3, however, let many candidates down. Most were able to measure the length of the pollen grain, however the majority then multiplied the measured value to get the actual length rather than dividing it. Those who lost one mark generally did so as they gave their answer in centimetres rather than millimetres. Most candidates were aware how to take find the mean length of the pollen grain.

The first of the two six mark, extended writing questions was not well answered, with very few candidates scoring above Level 1. Candidates did not seem aware of what an electron microscope is, describing how lenses are changed in a way appropriate to a light microscope. A few thought they were used to see electrons. The process of use was clearly not known, many candidates simply referred to the scanning electron microscope being more accurate and stating that it can 'zoom in' rather than referring to magnification. Very few made reference to the disadvantages of the scanning electron microscope, such as the vacuum needed, the fact that it is a complex procedure or not for living organisms. Many thought that scanning electron microscopes take a quick rather than long set up time.

Question 4(a) was generally well answered, those who did not put general comments such as wear gloves or a lab coat. Some candidates simply stated ensure that the lid is sealed, which was not creditworthy. Parts (b) and (c) of question 4 was generally well answered. Part d was not so well answered; candidates did not seem well practiced in data interpretation and did not seem familiar with looking closely at an absorbance curve. Some identified lead and titanium as being close but few of these stated that the peak covered both. In part (e)(ii) the majority of candidates thought that the reason that a flame test was a qualitative test was that it was unreliable. Candidates need to know the difference between qualitative and quantitative. Many referred to the quality of the results and some linked this to quantitative being how many results have been obtained.

The second six mark question in question 5 was very poorly answered; many candidates did not make use of the full information. Very few candidates calculated a mean absorbance or concentration for the dyes and, therefore, could not make a valid conclusion. Others simply stated if the dye could be used or not but did not make any attempt to support this with any data or workings that were used to make their judgement. Parts (b) and (c) were better answered, however, with most candidates being able to correctly categorise the variables as the dependent and control variables in (b)(i) and most being able to calculate the mean volume of alkali; although many did not score full credit as they did not spot and ignore the outlier in their calculation. In the last part of question 5, candidates' maths skills let them down; it was felt that a significant majority of the candidates did not bring a calculator into the examination with them; therefore, even with the equation being given, this made the question very hard for them. Very few candidates were able to suggest a reason why the burette reading was multiplied by 2. Many candidates left these last two questions blank.

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 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.

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. 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 needed to identify the target group for their fitness programme, the model assignment referrers to 11 to 19 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 compared 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 identify eight bones labelled 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 referrer 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 and within the blood four components 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 used. 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 is 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 first 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 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.

R078 The Science of production

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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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 was helpful not only for assessment but also internal standardisation.

The model assignment groups the learning outcomes into four tasks.

Task 1

The evidence for Task 1 integrates evidence for LO1 and LO2. Candidates are expected to describe at least three commercially-important chemicals produced by neutralisation giving the relevant chemical equations, the use of balanced symbol equations and chemical nomenclature. Then produce a fertiliser by neutralisation and calculate the yield of their reaction.

A witness statement would support the independence of the candidate when carrying out the production of the fertiliser.

Task 2

The evidence for Task 2 integrates evidence for LO3 and LO4. Candidates produce a description of the factors that affect plant growth, and how they can be altered to optimise growth and they should include temperature, water, sunlight, nutrients, as well as the gases involved in photosynthesis. Candidates should give a balanced symbol equation for the photosynthesis equation.

Candidates monitor the growth of their chosen plant. It is expected that candidates will grow a batch of their chosen plant taking measurements over a period of time.

The choice of plant might be limited by the time that candidates will have on the timetable and a fast growing plant, such as cress or radish might be chosen.

Task 3

The evidence for Task 3 integrates evidence for LO5 and LO6. Candidates produce a description of the conditions required to produce a wide range of useful products by microorganisms and why conditions affect production.

Candidates then carry out an investigation monitoring the production of products by microorganisms. They may wish to produce a product such as yogurt or alcohol. To determine the optimum conditions candidates will need to carry out the production process under different conditions to determine the optimum deciding on the optimum by calculating the yield and making a qualitative statement on the yield.

Task 4

Task 4 covers LO7 and LO8. Candidates describe the purpose and structure of an organisation in the production sector and the careers roles within it.

The use of guest speakers or shadowing professionals is a possibility.

This task could be combined with work experience but it is not an essential part of the requirements for this unit.

Comments on Learning Outcomes:

Task 1 [LO1 and LO2] Candidates were able to produce a report identifying commercially important chemicals produced by neutralisation reactions. They were able to produce a fertiliser by neutralisation. Candidates were able to give the relevant balanced symbol equations and correct chemical nomenclature.

Task 2 [LO3 and LO4] Candidates were able to monitor plant growth but they should be able to choose a format to record the growth that clearly produces data from which a trend can be established. Cress tended to be the favoured plant that was monitored. Candidates could then record the range of growth for the batch of cress as it grew. This gave a more informative record.

Task 3 [LO5 and LO6] Most candidates produced a yogurt using microorganisms under optimum production conditions. There were sufficient conditions tested to give a realistic conclusion to the investigation.

Task 4 [LO7 and LO8] Most candidates produced relevant material explaining how a brewery company operates and the roles of some of the people within it.

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

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Head office
Telephone: 01223 552552
Facsimile: 01223 552553

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