

CAMBRIDGE TECHNICALS LEVEL 3 (2016)

Moderators' report

# APPLIED SCIENCE

05847–05849, 05879, 05874

**Summer 2022 series**

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## Introduction

Our Lead Moderators' reports are produced to offer constructive feedback on centres' assessment of moderated work, based on what has been observed by the moderation team. These reports include a general commentary of accuracy of internal assessment judgements; identify good practice in relation to evidence collation and presentation and comments on the quality of centre assessment decisions against individual Learning Objectives. This report also highlights areas where requirements have been misinterpreted and provides guidance to centre assessors on requirements for accessing higher mark bands. Where appropriate, the report will also signpost to other sources of information that centre assessors will find helpful.

OCR completes moderation of centre-assessed work in order to quality assure the internal assessment judgements made by assessors within a centre. Where OCR cannot confirm the centre's marks, we may adjust them in order to align them to the national standard. Any adjustments to centre marks are detailed on the Moderation Adjustments report, which can be downloaded from Interchange when results are issued. Centres should also refer to their individual centre report provided after moderation has been completed. In combination, these centre-specific documents and this overall report should help to support centres' internal assessment and moderation practice for future series.

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## General overview

Although the past year has been problematic due to the pandemic, teachers and candidates have made great progress and achieved some excellent grades on this qualification. Centres are becoming more confident on unit content and moderators are seeing much more consistent assessment.

Evidence produced has become more varied allowing candidates to demonstrate a range of abilities and skills.

### OCR support



It is important that centres have reference to both the [Centre Handbook](#) and [Administration Guides](#) for successful qualification delivery.

By liaising with their moderator early in the year, any issues can be averted as well as discussing potential visit dates and agreeing deadlines for work to be completed.

Centres should arrange moderation visit details before submitting claims on OCR Interchange.

For each moderation visit, centres are required to provide a complete Unit Recording Sheet (URS) for each candidate that clearly shows where the candidate has gained each grading criteria along with the final grade that is entered on Interchange. The URS should also include clear page referencing to show where work against the particular grading criteria has been given. This can be supported with suitable annotation in the candidate's portfolio.

It is important that each candidate provides a completed authentication statement for their work and understand the importance of authenticity in the evidence they are presenting. This process should reduce malpractice as defined within OCR Regulations. Centres only need to supply one authentication statement per candidate covering all units they are submitting.

All candidates must be encouraged to reference their work. This could be as simple as footnotes on each page showing the source material used along with numbered annotation within the work or follow a standard referencing procedure.

## Comments on individual units

### Unit 4 – Human physiology

Centres have a good understanding of this unit.

LO1: Candidates had a sound understanding of the structure of digestive system which was well supported with labelled diagrams. They also had good understanding of a common disorder related to the digestive system that could be diagnosed if a patient presented with the symptoms.

LO2: Candidates had a good understanding of the role of the musculoskeletal system in maintaining the structure and movement of the body. They were able to explain the importance of the role of bone marrow to both the skeletal and immune system.

Candidates tended to present evidence within a PowerPoint presentation so that it was concise but detailed.

LO3: Candidates were able to take basic cardiovascular measurements. Evidence tended to be presented as results supported by photographs of the candidates taking measurements or, in a small number of cases, candidates recording their spoken actions while taking measurements. Teachers further supported the activities of their candidates with witness statements.

LO4: To show the practical nature of the learning objective, centres presented evidence for taking measurements related to the respiratory system in a number of ways, such as a sequence of photographs, storyboarding, PowerPoint presentation or even video. Some centres had a limited number of different populations when investigating effects on the respiratory system.

LO5: Centres tended to produce a straightforward “texted” approach on why it is important to regulate body fluids. This was balanced by the wide range of evidence formats used throughout the whole unit.

LO6: Candidates used detailed examples to explain how the immune system functions when a vaccine is administered, thereby preventing infection by certain diseases.

### Unit 5 – Genetics

Centres tended to use only a limited range of evidence formats, such as text and images for this unit.

LO1: Candidates did provide coverage of the criteria but detail for M1 was lacking. Candidates should appreciate the importance in halving the chromosome number in gamete formation and that it leads to genetic variation in sexual reproduction. The principles of random distribution of chromosomes and therefore independent assortment of genes in gamete formation should be addressed, along with crossing over of homologous chromosomes during prophase I of meiosis as sources of genetic variation. These explanations will require the use of some extended prose to provide sufficient detail.

LO2: Candidates do not always consider the relationship between genotypes and phenotypes at molecular or biochemical levels.

Candidates should appreciate Mendel's Second Law, of independent assortment, i.e. that allele pairs separate independently during the formation of gametes.

Candidates should be introduced to the chi-squared test ( $\chi^2$ -squared test) to compare expected and observed progeny in a cross.

Candidates could discuss how genes influence each other, or are physically coupled or linked in some way on the chromosome. They should also identify another type of gene interaction called epistasis, where two or more genes at different loci interact.

To fulfil M3, candidates should be conversant with DNA recombination – the exchange of genetic material that occurs between homologous chromosomes during meiosis.

Candidates should also be aware that with advances in DNA sequencing and having produced genomes for many species, it is now possible to produce physical maps of the genome.

LO3: Candidates were able to give good descriptions of the principles and advantages of DNA sequencing and the principles of genetic profiling but were less successful when evaluating the significance and limitations of genetic profiling techniques. Candidates could consider the benefits and drawbacks of using mitochondrial DNA, which is better preserved in old samples and is particularly useful in historical or archaeological cases.

LO4: Candidates could assess the impact and implications of a DNA sequencing project and its impact, such as the Human Genome Project and then produce a report in terms the public will understand.

## Unit 6 – Control of hazards in the laboratory

Most centres have a good understanding of the requirements of this unit. There are some misunderstandings that do arise, particularly with grade criteria D1 and D2.

Most centres followed the bio-laboratory model assignment; OCR has produced a range of other model assignments for this unit.

Consider the order of delivering LOs/criteria. If candidates first have to consider designing a biological laboratory, LO3 then LO2 and LO1 will be brought into focus in the design brief.

Candidates should specify the containment level of their laboratory design.

LO3: Candidates will be used to working in a centre laboratory but not realise the detailed procedures required when handling very contagious microorganisms. There are different laboratories designed for different levels of biohazards - there are 4 levels of containment laboratories to work with different levels of biohazards.

When planning a laboratory candidates could consider information provided by the A.S.E. as well as relevant health and safety legislation affecting the control of diseases in a laboratory.

An initial introduction examining the different level of containment laboratory might enhance candidates' approach to compiling evidence.

### OCR support



Candidates' experience of science laboratories that has been limited to a centre laboratory can be enhanced by the use of video in [OCR's Wellcome Sanger Institute Project](#), which will allow candidates to "visit/see/experience" a range of bio-laboratories.

The laboratory designs varied, with some tending to be general and lacking detail as well as explanation. There needs to be more detail of the materials that would be used for the furniture, flooring, work benches, etc. and how the design could minimise risks.

Other designs were more detailed, as a scenario had been set so the laboratory was designed with a specific purpose.

Make sure assessment of P4 evidence includes comments relating to the design specification of the equipment/materials used in construction to control risks, i.e. does the candidate's design control risks, which then leads onto procedures needed to reduce risks.

For D3, listing containment control regulations and control of diseases in a laboratory legislation will introduce candidates to the idea that in most career situations there are relevant regulations and legislation.

It is best that candidates decide on a specific containment level laboratory to design.

LO2: A risk assessment is simply a means of determining the risk associated with work with a particular hazard. In the workplace, this is most often broken down into five steps.

The methods chosen to control the risks identified by the risk assessment should follow the hierarchical approach which is common to both MHSWR and COSHH.

Candidates should consider how laboratory acquired infections can be prevented, as well as legislation and guidance for working with biological agents and how it influences procedures and practices.

D1, D2: When evaluating the effectiveness of current legislation and procedures, candidates could analyse data from infection in various types of laboratories rather than use examples outside of the laboratory.

Candidates do not always produce the detail required for a Level 3 qualification evaluation and produce evidence at a Level 2. Extra tips to improve the depth would be to use examples of incidents in laboratories of poor procedures and practices and their effects on individuals and the environment.

An approach might be to research the accident incidents before 2011 (regulation change due to the Pirbright foot and mouth incident) and those after. Candidates could use examples to support their evidence.

For P2, develop the approach to risk assessing so that it could be applied to a broad range of circumstance, i.e. COSHH 5 Steps to risk assessment; hierarchical approach to eliminating and controlling risk so candidates could assess risk in any situation.

Candidates need to broaden the range of risk assessments to disposal of waste and the actual chemicals used. Candidates might view a procedure following good practice and another following bad. Notice simple things such as space/set up of equipment so it is safe and easy to reach as well as "protecting" the environment. This should introduce candidates to real life bio-hazard level laboratories.

Make sure the risk assessments are carried out using a formal risk assessment document which is then checked and signed off.

LO1: Candidates will need to know how organisms cause disease and how pathogens are transmitted to be able to reduce risks in a laboratory as well as to categorise hazard substances.

For M1 expand the detail of the transmission of pathogens. This could be done with examples which in turn will give candidates a broader understanding for possible situations in the future.

## Unit 7 – Human nutrition

Centres have a very good understanding of this unit and used a wide variety of formats when presenting evidence.

LO1: Candidates had a sound understanding of the components of a healthy balanced diet and produced a variety of formats that would appeal to the public.

LO2: Candidates understood that energy expenditure is the sum of the basal metabolic rate, the thermic effect of food and the energy expended in physical activity. That metabolic processes require energy and the minimum amount of energy your body requires to carry out these chemical processes is called the basal metabolic rate (BMR).

Both practical investigations; finding energy content of a carbohydrate food and calculating the BMR of groups of people were supported by tabulated results, photographs of candidates undertaking investigations and witness statements.

LO3: Candidates produced a wide range evidence and detailed examples of conditions relating to dietary needs.

A number of candidates produced booklets and leaflets targeting the public which demonstrated a detailed and sympathetic understanding of the subject.

D1 required candidates to recommend and justify nutritional requirements for a specific group of people; some candidates drew on their understanding of prior criteria and created a summary based on it.

LO4: A number of centres approached this as a practical investigative activity collecting, analysing, and then evaluating food labelling. Some centres also produced and justified labelling for a food product the targeted a specific group of people which summaries the whole unit.

## Unit 13 – Environmental surveying & Unit 14 – Environmental management

Centres could combine these units in a “project” based around an environmental practical investigation which in turn could be part of a “climate change” presentation.

The environmental investigation could be supported by the environmental model assignment from Unit 6.

## Unit 18 – Microbiology

Centres have a good understanding of this unit.

LO1: Candidates tended to give detailed descriptions with downloaded images but candidates did not always give a size or magnification of the images. A few centres approached the learning objective with a more practical approach where candidates were given a range of slides of microorganisms which they identified giving an analysis of their findings. This was linked to Unit 2 LO4 [Be able to examine and record features of biological samples] with candidates recording relevant data and making biological drawings while using a microscope. This approach gave a greater “hands-on” scientific approach as candidates would be using Gram Staining and DNA extraction methods.



LO2: Candidates gave good descriptions of the use of microorganisms in agriculture but their evaluation of the consequences of the introduction of GM crops tended to be weak in detail and quantitative data. Their approach might be that they have to: "convince a group to their held belief".

LO3: Candidates gave a general overview of the four industries given in the specifications.

The grade criteria, requires only one food to be produced– consideration could be given to linking with Unit 21 Product testing techniques. Centres produced a range of food products however some foods allowed a greater depth of knowledge to be shown this was reflected in M4 with some candidates giving little when giving evidence for biochemical processes. Candidates should test their product to see if optimum conditions have been met.

LO4. Centres were able to give detailed evidence supported with images and the use of case studies to broaden their evidence with summaries from The World Health Organisation, England, the Health and Social Care Act 2008 Code of Practice. The better distinction candidate was able to support their evidence with quantitative data.

## Unit 21- Product testing techniques & Unit 10 – Testing consumer products

Centres carried out the practical investigations within the units very well. They should remember P3 requires a range of titration techniques.

Some centres linked activities across units to produce a project approach, linking testing practicals in Unit 21 to production in unit 18. Also, the laboratory logbooks used by centres in Unit 2 linking to the other units in the qualification displayed a great understanding of a "real" scientific approach to learning.

LO1: Candidates should consider carefully which product they research to be able to obtain information so as to fully cover the grade criteria. They will need to appreciate how regulation affects the quality imposed on their product.

LO2: When candidates consider the tests in P2, they should consider the sensitivity, accuracy, and reliability of each test. This would then link into M2 as well as support the development of regulations in LO1.

Some candidates' evidence for M2 explaining how the effectiveness of consumer product evidence is established was not very detailed.

LO3: In D1 some candidates linked the results in M3 to establish the comparison of results. Again, candidates can link to P2 (test selected) when considering the accuracy of their results.

The approach should be that all measurements and observations should be recorded, in tabular form where appropriate. Measurements should be recorded to the degree of accuracy of the equipment used. Candidates should be careful in the use of significant figures and decimal places. Their evaluations need to have depth with a reasoned opinion based on the evidence collected. Candidates should look carefully at using correct science in their evaluations; some were lacking in detail and did not really show enough understanding. The evaluations should also include comments on the validity and reliability of the investigation as well as how it could be improved.

LO4: Candidates carried out the investigations well with good supporting results.

LO5: [Unit 10 only] Centres tended to test "Antimicrobial Susceptibility" using different dilutions of TCP measuring the diameter of clear zones of inhibition on an E. coli agar plate and graphically analyse and evaluate the effectiveness of different strengths of TCP.

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