
LEVEL 3

APPLIED GENERAL SCIENCE

ASC6

Report on the Examination

1775

January 2020

Version: 1.0

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General

For the entries seen, marking by centre assessors showed a good level of understanding of the standards expected at Pass and Merit levels. Distinction level portfolios were relatively scarce this may have been due to time pressures. Previous reports for this unit have also mentioned time issues, mostly relating to PO4, and relatively sparse coverage of the criteria for this performance outcome was in evidence again.

ASC6a requires a number of experimentally based approaches which can be integrated with the theory-based aspects, and centres find that a degree of pre-planning pays dividends and ensures a more coherent experience for learners.

Once completed, it is important for the centre to support/comment on learner achievement, and supporting materials to be supplied by the centre should include the following:

- Observation Records (to support learner achievement and to provide the evidence that the learner has completed the experiment, followed the standard procedures, applied the risk assessment, used aseptic technique, recorded results correctly, etc.)
 - if the learner has not provided, for instance, photographic evidence to support results (eg images of plates), then the Observation Record may do that, again supporting learner achievement and the award of centre marks
- USF signatures of both the learner and the teacher must be present to confirm that the work submitted is that learner's own independent work
- A completed Centre Declaration sheet

PO1: Identify the main groups of microorganisms in terms of their structure

P1, M1

The requirements are clearly described in the Unit Content and also the Performance Outcomes (Grading Criteria). All three types of microorganism should be covered with the same degree of detail.

P1 and M1 were covered well by many learners, and good portfolios had the following content for all three types of microorganism, all research based, and with good diagrammatic support and well adapted source material:

- characteristic structures and features
- labelled diagrams
- functions of the key features

P2, M2, D1

P2 should describe the methods listed in the Unit Content used to identify microorganisms:

- Gram staining
- microscopy (to include both light and electron microscopy)

- colony characteristics

As with many areas of this Unit, good responses have relevant diagrams and images, obtained from research, to add to the descriptions.

M2 continues from P2 and explains how the techniques are used and what information each can provide concerning structures of microorganisms:

- how differences in structure for different types of bacteria enable them to be identified by Gram staining
- how colony characteristics (morphology) enable microorganisms to be identified
- how light microscopy and electron microscopy are used and how their usefulness is related to resolution and magnification and the structural features of the microorganism

D1 expands the information established in M2 and, using good levels of research, compares the use of different identification techniques in biotechnological industries. This was a much weaker area in virtually all portfolios seen in this series, and may be another time related issue.

P3 is a practically based criterion and it would be sensible to integrate this with the relevant content relating to Gram staining in P2 and M2. The evidence that allows this to be awarded consists of the following:

- standard procedure and risk assessment followed (both issued by centre)
- Observation Record supporting safe working and successful outcomes
- individual learner results (eg photographic images)

It is also important that the portfolio evidence goes on to use the results obtained to identify microorganisms.

PO2: Use aseptic techniques to safely cultivate microorganisms

PO2 (based on cultivation techniques) leads directly on to other related aspects of study assessed in PO3 and which feature later in portfolios (ie “Use of practical techniques to investigate various relevant factors affecting growth of microorganisms”). When learners are reviewing portfolios, it would be good practice to include links on the relevant pages or an indication that “this technique, pour plates, is later used for the investigation of the effects of temperature on bacterial growth on page”

P4, M3

P4: Risk assessments are prepared by each learner for the safe cultivation of microorganisms and should include full reference to the following aspects of practical work:

- preparation of sterile growth media
- specific names (and types) of microorganisms used and correct identification of the associated hazard
- cultivation of microorganisms

- aseptic techniques
- safe disposal

Centres should note that without specific identification of the microorganisms used and full risk assessments associated with them, the RA will be considered to have significant omissions and should not be awarded.

Learners will find the CLEAPSS Student Safety Sheets useful when compiling their RAs.
[<http://science.cleapss.org.uk/Resources/Student-Safety-Sheets/>]

M3: Explanations of control measures used can be incorporated into the RA table or considered separately. This should include explanations of how aseptic techniques are applied and how they contribute to the control measures. Details of aseptic techniques themselves do need to be evident.

NB: M3 cannot be considered for credit if P4 is not awarded.

P5, M4, D2

The choice of which three cultivation techniques of those listed (Unit Content p96) to carry out is a matter for the centre, but there must be at least two different types of microorganism used as indicated in the Delivery Guidance in the Specification p101.

To award P5, the following are required:

- standard procedure(s) for the preparation of the growth media (SPs issued by centre)
- standard procedures for all three techniques including incubation (SPs issued by centre)
- observations (eg photographic evidence, suitably annotated)
- observation record supporting the completion of all three techniques including evidence of following aseptic technique

M4 requires:

- an explanation of the underlying principles for each of the three cultivation techniques
 - usually by separate clear accounts for each cultivation technique and associated evidence

This was found to be a difficult area for many learners, also impacting on D2, which includes the evaluation of the techniques used and justified suggestions for improvement.

PO3: Use practical techniques to investigate the factors that affect the growth of microorganisms

P6, M5, D3

The Specification Unit Content lists 10 different factors which promote or inhibit growth of microorganisms, and P6 requires a selected range to be described. Weaker portfolios tend not to describe sufficient factors and/or provide little detail of the few that are considered. Learners should be advised that P6 requires them to consider a range, not just the three factors investigated experimentally for M5.

M5 requires practical work investigating three factors that affect growth. The expected approaches to this work include the following (but see, also, Delivery Guidance - Specification p101):

- use of a range of cultivation techniques, typically following on from those used for P5
 - use at least two types of microorganism if carrying on from P5
 - use a range of counting or measuring techniques to include measuring clear zones and viable counts
 - use serial dilutions in one of the practical techniques* (so meeting P8)
 - standard procedures, RAs (centre issued)
 - Observation Records, evidence for completion of all 3 practicals including use of aseptic technique
 - recorded results, images, photographic evidence
- * Alternatively, serial dilutions can be used in a separate activity, for instance with a haemocytometer based investigation (as explained in the Delivery Guidance p102)

Portfolio evidence was but was very well done in some cases where all candidates sampled at moderation successfully met P6/M5.

D3 follows directly on from M5 and draws conclusions concerning the effects on growth of microorganisms by the three factors investigated. This may have been affected by time issues, but very few examples of D3 being properly and completely met were seen this Series.

P7, M6, D4

P7 requires the use of one suitable technique to count/measure microorganisms. This was most commonly a haemocytometer based technique. Previously, success rates have varied with the learner's levels of understanding, although P7 is generally met if supported by the Observation Record and recorded results.

M6 continues to be a difficult area for many, and learners generally found it difficult to explain the use of this (haemocytometer) technique correctly or in full, and this impacted on their calculations that followed.

It would also be appropriate to record all 'raw' data, rather than just state the number of live cells. P102 of the Specification indicates that the total count should include viable and non viable cells.

As levels of understanding were not strong, this then affected D4, and few learners met the levels of detail expected for this evaluation of effectiveness of the counting and measuring techniques.

PO4: Identify the use of microorganisms in biotechnological industries

PO4 requires independent learner research, suitably referenced, and (very importantly) targeting the relevant sections of the Unit Content and the PO grid. This was a weaker area for nearly all learners.

Overall, PO4 can generate 6 “marks” and sufficient time for research, coupled with a firm understanding of the requirements of the criteria, are essential.

It is important that the research and portfolio content target:

- biotechnological industries (and not, for instance, the Haber process or other inorganic industrial reactions) for P9
- named microorganisms and specific biotech industries for D5
- named micro-organisms again in P10 and M9 (which may be different from those stated in D5)
- relevant processes or techniques in two different biotech industries for P10 and M9
- genetic engineering of micro-organisms in one biotech industry for D6 (which may be a different industry again)

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the [Results Statistics](#) page of the AQA Website.