Royal Society of Chemistry

Mastership in Chemical Analysis (MChemA)

Assessors' Report 2024

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Introduction

This is the annual report of the Assessors for the Mastership in Chemical Analysis for the year 2024. These comments are intended for candidates and their counsellors only, to help them to understand the expectations of the examiners and to aid their preparations for the MChemA.

The MChemA Regulations, Syllabus and Guidance Notes can be found on the RSC website at http://rsc.li/mchema.

Part A

Three candidates took the Part A examination on the 17 April 2024.

Previously we had met on-line for a discussion on how to tackle examination questions, mark breakdown (and its importance), and a 'live' session on answering the previous examination paper.

All three students have passed (an average >50%). Questions 1, 3 and 5 were attempted by all 3 candidates, probably reflecting either their job roles or past degree subjects (or combination thereof). For one candidate, part questions were all over the examination paper, requiring a check to ensure that I had marked all parts, even when they appeared on different pages. All parts, per question, were accounted for. The questions attempted where as follows:

Question 1

Attempted by all three candidates. A statistics-based question, around a scenario of glyphosate in an agricultural bean crop, that had mainly numerical answers. Two candidates did particularly well (20/20 and 18/20) on the statistics data interpretation. Full marks for latter candidate were not awarded because of the uncertainty in the answer to the numerical part using the F-test. They had changed their mind on what the answer was, so while getting the number part correct, they then failed to change the wording on the written part.

Question 2

A calculation question involving determination of benzo(a)pyrene as part of a sampling numerical question, smoked fish (a descriptive answer), and a numerical calculation based on determination of the limit of quantitation. Only one person did this question (18/20), with an error in the initial calculation preventing them from getting full marks.

Question 3

Attempted by all three candidates on what was a "pure" chromatography question. It involved a question on how to introduce a sample in GC, detectors for different GC scenarios, and a theoretical chromatography calculation. One person got full marks (20/20) while the other two got 12/20. The latter both struggled with the choice of detectors (mainly).

Question 4

A descriptive chromatography question attempted by both two people. Ionization methods was followed by MS detection approaches, HPLC terms (RP versus NP) and UV as a detector. One (12/12) scored parts marks across all aspects of the question, whereas another (12/20) was confused on the RP HPLC versus NP HPLC (mainly).

Question 5

This question was attempted by all three candidates. A spectroscopy question centred around ICP-AES (mainly descriptive). One candidate lost marks on all parts of the question (14/20), another (mainly) got confused between FAAS and ICP-AES (on the nebulizer part) (16/20). While the third (16/20) just omitted a few points in the ICP description and nebulizer parts.

Question 6

A flame atomic absorption spectroscopy question with three descriptive parts was attempted by two candidates (12/20 and 20/20). The full mark answer was text book perfect, while the former was uncertain on the types of interferences in FAAS.

Question 7

All avoided question 7 on X-ray fluorescence.

Question 8

A sample preparation questions for organic molecules was attempted by one candidate only (11/20) on what a mixture of graph was plotting with a calculation on concentration against descriptions for SPE, SPME and scenarios. No attempt was made on the scenarios which was the main reason for the loss of marks on this question.

Part B

The two Part B exams were held in person at Burlington House, London on the 24th and 25th April 2024. The chief assessor was present as one of the invigilators on both days. This was the first year of the Part B in the changed format of a partially open book exam, with access being given to two websites for UK and EU legislation which removed the onerous task of reciting legislation from memory previously placed upon a candidate in the closed book format. Upon completion of the examination, candidates were required to show their internet history covering the examination period which was evidenced by and satisfied the chief assessor. All three candidates brought a limited range of original/unedited (downloaded) unwritten paper copies of common legislation with them to the examination as permitted. These are required to be checked before the examination and this was performed to the satisfaction of the chief assessor.

The change of format allows the assessors to get a better insight as to a candidate's knowledge/experience, thought processes and ability to give opinions with rationale. In the previous fully open book exam format these insights may have been masked by an ability to use search engines.

Paper 1 contained a wide variety of different question types (reflecting common public analyst work) covering direct application of accessible legislation, calculations, proficiency testing, problematic labels, analysis of common food matrices, meanings of terms encountered in food analyses, sampling advice, contamination, composition and nutrition.

Paper 2 is much more limited as to its content. These papers should provide plenty of opportunity for all candidates to demonstrate sufficient knowledge.

The format for the papers requires answering four questions in four hours, equating to one hour per question and there was a first time change of aiding candidates with 10 minutes reading time (immediately prior to the examination starting). The basis of this reading was due to observations made over previous years regarding concerns that candidates were spending insufficient time reading over the questions at the initial start of the four hours to get an understanding of them.

It should be noted that the assessors are trying to understand a candidate's thinking/rationale in answering, so it is advisable for a candidate to include details of all their thinking (whether eliminating or justifying) as any opinion/answer can be valid or partially valid with the correct justification and relevant evidence.

Candidates should be familiar with guidance documents (from FSA or Trade bodies, etc) as well as having experience in reading scientific opinion papers including consulting/visiting trusted websites dealing with as many differing topics/issues in a wide range of food and feed.

There were three candidates in total. Three candidates sat Paper 1; one for the third time, one for the second time and one for the first time. Two candidates sat Paper 2; one for the second time and one for the first time.

All candidates had access to a calculator.

Four blank booklets were provided to each candidate and the candidates were asked to use a separate booklet for each question (with additional paper available should the booklet be filled). This had the desired effect of all the answered parts to a specific question being in the one place and also in making it easier for comparison of each candidate's answers attempting particular questions. However, the legibility of handwriting of two candidates posed a challenge at times for all three assessors.

One candidate asked for clarification on one specific question part in Paper 1 (Q5d) and the response (to the candidate's satisfaction) was also verbally relayed to the two others shortly afterwards.

Overall, answers to the questions were not particularly in-depth, despite the amount of time given and accessibility to legislation. It was clear from the candidates' answers which subjects they had knowledge and/or experience of and which ones they did not.

Detailed comments on the papers are as follows.

Paper 1

Candidates were required to answer any four of the six questions set. All questions were attempted by one candidate whilst the other two only partially attempted questions which equated to a reduction of either 8 or 9 available marks.

Question 1

None of the candidates attempted this question.

The first part (a) dealt with analytical testing approach of a processing contaminant with a maximum level set in legislation and the subsequent interpretation of findings/results to assess compliance.

The second part (b) dealt with a discussion on parameters that need to be assessed in order to ensure legislative compositional standards for drinking milk are being met.

Question 2

All three candidates attempted this question.

The first part (a) was looking for an understanding of the general approach to investigating an unsatisfactory z-score within an accredited laboratory, such as trend analysis, repeating analysis by another trained analyst, comparison of the method used with others participating in the round, etc.

The second part (b) was looking for a candidate to discuss the possible causes or issues surrounding each of the three 'real' encountered scenarios with the stated PT z-scores, in regard to the following

(i)   How is the difficulty in obtaining an in-house reference overcome and is the titrant volume satisfactorily large enough, in which case, does the lab's method allow for an increase in weight of oil to be used, correct storage of the PT sample prior to analysis, etc was expected to be discussed.
(ii)   It was expected for a candidate to discuss whether the enzymes have worked properly (including in-house controls), manual checking of the database being used for interpretation, contamination or mix-up as to whether routine samples were run alongside the PT samples in a batch, etc.
(iii)   It was expected for a candidate to discuss the salt form used for the calibration namely hydrate or anhydrous, possibility of co-elution with other peaks, how did the other participants perform who used HPLC, etc.

In the third part (c), it was expected that a candidate would identify that a z-prime score replaces a z-score when the standard uncertainty (SU) of the assigned value is not negligible in relation to the standard deviation for proficiency assessment (SDPA) i.e.

SU > 0.3 times the SDPA in this case. It was also expected a candidate to state that a z-prime score is interpreted in exactly the same way as a z-score i.e. ≤2 is satisfactory, >2 but <3 is questionable and ≥3 is unsatisfactory.

The fourth part (d) dealt with the analysis calculations necessary for determination of Total Dry Cocoa Solids and Dry Milk Solids in a milk chocolate for assessment of legislative compliance.

One candidate performed adequately well overall relative to the other two and hence experience in PT & investigations and chocolate analysis was apparent. Regarding the other two candidates, it was apparent that one did not have much experience in PT & investigations including not attempting part (c) but had some experience in chocolate analysis. The remaining candidate had mixed success with signs of PT experience but not much in chocolate analysis.

Question 3

All three candidates attempted this question.

The question dealt with six scenarios involving food additives in different matrices and required a candidate to answer a range of different things such as compliance with legislation, calculations, carry-over principle, sampling considerations and components of a compound food.

One candidate performed well relative to the other two and demonstrated experience with food additives and its legislation. One candidate did not perform well including not attempting part (b). The remaining candidate was undistinguished including not attempting part (f).

Question 4

All three candidates attempted this question.

The first part (a) was looking for outlines of the most appropriate analytical methods that would demonstrate quality/authenticity of five different food matrices, including rationale for their choice of methods.

The second part (b) was looking for a candidate to provide an explanation of five terms encountered with food analyses testing and how they subsequently are applicable.

One candidate performed well relative to the other two although a better depth of answers in (a) could have been given by that candidate. The other two candidates were undistinguished in both parts and one of these candidates did not attempt part b(ii) whilst the other did not attempt part b(iv).

Question 5

All three candidates attempted this question.

The first four parts (a-d) dealt with 'real' labels submitted by a relatively new inexperienced Trading Standards Officer (TSO) who was looking for advice on their compliance with relevant legislation. These labels were for new products to be launched and placed on the market. The candidate acting as a public analyst was expected to identify all possible concerns and discuss these with full reasoning so that the TSO could deal with the business. The candidates had access to all necessary legislation

 (a) Dealt with the name of the food, presentation of the reserved description term and the use of the claim statement "100% Pure and Natural"
 (b) Dealt with allergenic ingredient information

(c) Dealt with a nutrition and health claim and as to whether the corresponding compositional requirements would be fulfilled

(d) Dealt with the defining of this food category and whether the listed additive ingredients are permitted in such a category

The fifth part (e) dealt with a meat and offal pie and involved definitions, meaning of QUID, recording component weights and their variation effects, fat migration and the expectation for the candidate to deal with all of the variables that need to be considered (along with rationale).

This question was not attempted well by any of the candidates which was very disappointing considering the foods are commonly encountered in public analyst work. With regards to the label assessments, given that two candidates have already submitted partial portfolios for assessment which includes labelling, the standard of answers was disappointing. One candidate did not attempt part (c) and one candidate gave a fuller labelling assessment in part (d) despite the question stating not to.

Question 6

None of the candidates attempted this question.

The first part (a) dealt with designing and outlining a practical protocol including sampling and analysis considerations to compare any local authority's secondary school meals against relevant national standards.

The second part (b) expected a candidate to highlight all of the possible analytical techniques that could be used to determine the mandatory declared 'fat' nutrient content including giving examples of the food matrices that each technique is most applicable to obtain the best accurate result.

Paper 2

Candidates were required to answer three questions from four in Section 1 (Food), and one question from two in Section 2 (Agriculture).

Section 1: Food

Question 1

Both candidates attempted this question.

The first part (a) dealt with the topical issue of 'rare' or 'pink' or 'lightly cooked' beef burgers (i.e. Less Than Thoroughly Cooked) served in catering establishments/ restaurants. The question required a detailed discussion on the aspects that a food business operator must consider to ensure 'safe' food is served. This should have included discussion on HACCP, testing requirements and applicable legislation, etc. The topic is discussed on a government website (https://www.legislation.gov.uk/) and specific guidance was produced following issues/outbreaks relating to this type of food.

The second part (b) expected a discussion on the use of currently available DNA analysis techniques that could be applied to the microbiological safety of foods including appropriate examples with their advantages and limitations.

Both parts of this question were not attempted well by either of the candidates (although one was better relative to the other) and demonstrated a significant lack of microbiological knowledge in these pertinent areas. One candidate in part (a) persisted with discussing 'pre-packed' food rather than hot cooked food made to order.

Question 2

Both candidates attempted this question.

The first part (a) dealt with the 7 key principles of the internationally recognised food safety management system HACCP to ensure food is safe for consumers to eat. It was expected that each of the principles would be listed and explained including examples of how such a system would be implemented in workplaces.

The second part (b) dealt with the newsworthy topic of shelf life dates and their pivotal role to ensure both food safety and prevent safe food from going to waste. A discussion was expected on the different approaches available for a food business operator to take and it was expected that a candidate would not only discuss microbiology ('use by') but quality ('best before') considerations, including insightfulness with predictive modelling, challenge testing, 'transport packaging', food packaging atmospheres, etc.

Both candidates were undistinguished and lacked depth to the answers. One candidate performed better in part (b) than (a) whilst the other candidate performed the same for parts (a) and (b).

Question 3

Both candidates attempted this question.

The first part (a) dealt with the topic of the food fraud strategies after moving on from the infamous 'Horsegate' scandal. A discussion was expected, to include a candidate's own opinions on what developments there have been over the last ten years, the types of activity that have been identified as manifesting within food crime offences/fraud, what has/hasn't worked, other untried things that may be worthwhile considering, how effective the National Food Crime Unit (NFCU) is, etc.

The second part (b) dealt with the topical subject of UK food recalls surrounding allergens which appear to be constantly in the media. It was expected that a candidate would discuss likely causes, the two approaches (risk management and risk assessment), public expectations, whether precautionary allergen labelling (PAL) system is working (and in a consistent manner), impact of Brexit and imported goods, HACCP, mis-packings, supermarket own brands (sub-contracting factories) and their audit processes, whether consumer/patient organisations are being involved enough, etc.

A very good published article in the Journal of AOAC International by three respected authors prominent in this field in 2018 still very much applies today and for the foreseeable future.

Many possibilities exist in this question for a candidate to freely discuss and obtain marks but both candidates were undistinguished. Neither candidate stated what they regard the term 'food fraud' to even mean and they did not show great knowledge in either of these persistent topical areas and hence lacked depth to their answers.

Question 4

Neither of the candidates attempted this question dealing with water (for human consumption).

The first part (a) required a schematic diagram with explanation of the various steps in a surface/ground water treatment plant.

The second part (b) dealt with the testing of two parameters encountered in legislation.

The third part (c) dealt with two issues commonly known to be the cause of complaints and thus resulting in an investigation.

Section 2: Agriculture

Question 5

One candidate attempted this question.

The first part (a) dealt with five undesirable substances having a maximum permissible limit laid down in feed legislation, as to how their presence is likely to arise and their effects on animal health and the ramifications for the human food chain.

The second part (b) dealt with five plant nutrients applied by means of a fertiliser and which appear in legislation, as to their role in a plant's growth/existence and a typical physical sign when deficient.

The candidate did not answer the question well and illustrated a significant lack of knowledge in these areas of agriculture.

Question 6

One candidate attempted this question.

The first part (a) required detailing the parameters that a raw pet food manufacturer would need to consider in order to place 'safe' feed of this type on the retail sale market such as feed material quality, testing, transport, handling, packaging, legislative requirements and labelling. Examples of different types of raw pet food products were also expected to be given.

The second part (b) dealt with various microbial hazards in pet food types and the candidates were expected to consider the production of the three specified pet food types in order to decide their significance through reasoning.

The candidate did not answer the question well and illustrated a significant lack of microbiological knowledge in these areas of agriculture.

Portfolio of Evidence

The first-part portfolio of evidence was received on time from the candidate attempting Part B for the first time and feedback/advice was given via an (online) interview along with the provision of a brief written summary afterwards. A further candidate not re-sitting the Part B examination this year also submitted an update to their first part portfolio and again this has been reviewed by all three assessors with written collated feedback provided to that candidate.

Part C

No exam held in 2024.