Introduction

This is the annual report of the Examiners for the Mastership in Chemical Analysis for the year ending 31 December 2020. These general comments are intended for candidates and their counsellors, to help them 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

This was a first-class performance from the one candidate who sat the paper. All the more noteworthy given the circumstances of the past year, not least the postponement of the original exam and rescheduling to approximately 5 months later.

The candidate answered questions 2, 3, 4, 6 and 7 and scored 71% for the paper.

Question 2 covered 6 different terms associated with separation techniques. Full or almost full marks obtained for answers for Solid phase extraction; Gradient elution in HPLC; WCOT and SCOT GC columns; temperature programming in GC.
Normal and reverse phase HPLC – lacked detail in elution order.
Splitless injection in GC – answer for split rather than splitless was given. 14/20.

Question 3 focused on atomic spectroscopy with an emphasis on graphite furnace AAS. The answer demonstrated basic understanding of the instrumentation just lacking detail on matrix modifiers and advantages technique offered over flame AAS - 10/16.
t-test calculation 4/4 giving total of 14/20

Question 4 looked for definitions/explanations of 4 of 5 common terms. The candidate chose Beer Lambert Law; LOD; Sensitivity, Linear Dynamic Range (LDR) scoring 9/12 with reasonably complete answers to all except sensitivity.

The 2nd part of the question requirement Beer Lambert calculation but applying simultaneous equations, which, unfortunately, the candidate missed. This was the only major slip up in an otherwise exemplary paper. 9/20
Question 6 tested knowledge of HPLC theory and application for which the candidate demonstrated thorough understanding - 20/20

Question 7 covered ICP-MS instrumentation; sample digestion methods and recovery study calculation.

The candidate demonstrated an above average understanding of each area scoring 14/20.

Part B


One candidate passed the B1 paper

Paper B1

Of the eight questions set, all questions were attempted.

Question 1 was split into 3 parts.
  a) The first part asked the candidate to define meat within a legal context.
  b) The second part asked what analysis was required to determine a meat content. The candidate was expected to discuss the methods required to determine the meat content. This should have included moisture, ash, fat, protein and hydroxyproline. The candidate could also reference other protein sources and may have included soya etc.
  c) The third part of the question look at calculating the meat content. The candidate was expected to outline the calculation and discuss any assumptions made. This should have included the use of nitrogen factors, the permitted fat and collagen levels for different meat types and the correction for other nitrogen sources. The candidate could also discuss the presence of excess fat and collagen. There is guidance available that outlines this calculation.

Question 2 asked the candidate to discuss the different techniques used to preserve food and discuss their merits. The candidate were expected to discuss the techniques and use examples to exemplify the point.

The candidate could have discussed refrigeration, freezing, heating, canning and bottling, acidification, use of different types of preservatives, irradiation, curing, etc.

Question 3 asked the candidate to describe the testing required for a formal sample of a lamb curry and pilau rice meal for permitted artificial colours and peanut protein. The candidate should have discussed the analysis required, how the sample would be split, which parts of the sample would be analysed, the legislation that would apply, how the analytical results should be assessed. This may have included of the sample ie the sauce, meat and the rice would be analysed separately for colours. The sauce would have a limit under the regulations however rice and meat should not have colours unless from carry over from another ingredient. Therefore had the meat been in a marinade? Can you obtain a sample of the marinade to assess the level of colour? They may also have discussed that colour maybe present if it was there as decoration but not throughout the whole product.
The candidate should also have described the prep required for allergen analysis. How the results would be be interpreted. This may have included reference to VITAL or if the officer had asked for a nut free meal then this may be a safety issue

**Question 3b** asked the candidate to discuss how a formal tuna sample should be analysed. The requirements for Tuna are in The Microbiological Criteria of Food Regulations are:

<table>
<thead>
<tr>
<th>Food category</th>
<th>Sampling plan(^1)</th>
<th>Histamine limits</th>
<th>Analytical reference method</th>
<th>Stage where criterion applies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.26 Fishery products from fish species associated with a high amount of histidine(^2)</td>
<td>n: 9(^{(18)})</td>
<td>c: 2</td>
<td>m: 100 mg/kg</td>
<td>M: 200 mg/kg</td>
</tr>
</tbody>
</table>

Therefore, using Food category 1.26 as an example for interpretation of results:
- A batch would be designated **Satisfactory** if 9 sample units were taken (n=9) and all 9 units were below 100 mg/kg
- A batch would be designated **Acceptable** if 9 sample units (n=9) were taken and a maximum of 2 (e.g. c=1 or 2) of those units were between 100 mg/kg and 200 mg/kg
- A batch would be designated **Unsatisfactory** if:
  - 9 sample units (n=9) were taken and more than 2 (e.g. c=3) of those units were between 100 mg/kg and 200 mg/kg
  - Any (n=1) of the 9 total sample units (n=9) exceeds the maximum upper limit M of 200 mg/kg.

**Question 4** was split into 3 parts. Two candidates attempted this question

The first part of the question asked the candidate to discuss the meanings of ‘nature’, ‘substance’ and ‘quality’ using examples to illustrate their answer.

The second part of the question asked the candidate to discuss the meaning of unsafe within the context of food safety. The candidates should have made reference to the criteria outlined in Article 14 of regulation EC178/2002.

The third part of the question asked candidate to give two of the main compositional requirements in legislation for a spirit drink described/sold as the following?
- I. Vodka
- II. Brandy
- III. Whisky
The candidate should have stipulated the legislations they were referencing and the compositional requirement of the product.

**Question 5a** asked candidate to discuss the assessment of their compliance against regulatory requirements using an analytical strategy from sample receipt to final reporting for a formal samples of dried vine fruit for aflatoxins.

**Question 5b** asked the candidate to discuss the assessment of their compliance against regulatory requirements using an analytical strategy from sample receipt to final reporting for a formal samples of Smoked salmon for polycyclic aromatic hydrocarbons.

**Question 6a** asked the candidates to outline the provisions of The Food Supplement (England) Regulations 2003. The candidates were expected to give a brief overview of the main aspects of the regulations including defining what a Food Supplement is as well as the labelling requirements the restrictions of materials that can be used to manufacturer.

**Question 6b** asked the candidate to discuss any compositional and/or labelling requirements for a sports supplement that makes a:

1. Generic health claim
2. High fibre claim
3. Good source of vitamin B1 claim
4. Magnesium improves heart function claim
5. Vegan claim

The candidate should discuss each of the above claims using the permitted nutritional claims, the health claims guidance and the candidate should discuss their opinion on what should constitute a definition for vegan.

**Question 7a** asked the candidate to outline the technical guidance on nutrition labelling of food published by the Department of Health. The candidates were expected to discuss the main aspects to the guidance including mandatory back of pack labelling, optional front of pack, non-prepacked, Alcohol, reference values, tolerances, negligible amounts etc.

**Question 7b** asked the candidate to give the conditions laid down in law for use of each of the following nutrition claims:

1. Low fat
2. High polyunsaturated fat
3. Source of fibre
4. Low energy
5. With no added sugars
Question 8 asked the candidate to discuss the risks for each of the following microorganisms in ready to eat (RTE) foods and how they behave under different conditions in the food. Describe their effects if ingested, including symptoms of infection, incubation time and any maximum permitted limits.

I. Campylobacter
II. Listeria monocytogenes
III. Bacillus cereus
IV. Staphylococcus aureus

The candidate should have made reference to the situations where the organisms are found and their preferred growing condition. They should also have considered food at the end of manufacture as well as for sale at retail. They should have referenced HPE guidance and EU regulations where applicable.

Paper B2

Two candidates attempted paper B2. Two questions were not attempted and method/s against the performance criteria identified. One of the questions was a policy question asking the candidate to discuss both the microbiological and chemical risks, including the current organisations who carry this out and the evaluation processes in place. Give examples of particular areas where risk assessments are applied to food. This may have include emerging risks, EFSA, WHO, VITAL and risk assessments carried out but FSS/FSA.

The other question that was not answered was question 6 which asked the candidate to discuss the growing trend for pet owners to feed raw food to their pets. The candidates could discuss the belief that raw improve gut bacteria, are closer to the natural foods consumed by the animal. The candidate could discuss the possible nutritional deficiencies of such diets, the risks to human and animal health from raw meats.

Question 1 (Policy) asked the candidate to discuss the growing consumer trend towards vegan, vegetarian and plant-based foods. The candidate was asked to consider how produces should be named, consumer perceptions of the terms, any health-related or other regulatory issues. As the terms are not defined in law we were looking for the candidates to from an opinion on how they thought the terms should be defined. The discussion may include their definition, with a rational for the definition. They may have defined vegetarian product as a product that does not include any meat or meat products. This would include meat, fat, rennet gelatine etc. The vegan product would not contain any products of animal origin. Therefore it should not include eggs, milk or other dairy products. The plant based was open to their interpretation.

The candidate should then have discussed why individuals may be moving to this type of diet. This may be based on climate change, animal welfare, perceptions that plant based is healthier due to lower saturated fats, higher fibre etc. The candidate should present a reasoned argument for their answer.
**Question 3a (Agriculture)**

Outline the regulatory control for the use of genetically modified organisms (GMOs) as ingredients in animal feed. Describe the analytical approach from sample receipt to final reporting required for the identification of authorised GMOs in a compound feed containing soya, maize and rapeseed.

For the first part of the question the candidate should reference the relevant sections of:-

- The Genetically Modified Feed (England) Regulations 2004
- Regulation (EC) No 1829/2003, genetically modified food and feed
- Regulation (EC) No 1830/2003, traceability and labelling of genetically modified organisms and the traceability of food and feed products produced from genetically modified organisms and amending Directive 2001/18

The candidate should then describe the sampling and analysis of a feed sample for GMO. This may be by a PCR based method looking for GM events the sample may be screened to determine if the product contains GMO soya, maize and rapeseed materials. This may then be followed up with a RT quantitative analysis.

**Question 4a (Agriculture)** asked the candidate to outline the provisions of Commission Regulation (EC) No 152/2009. This should include:-

- Sampling for the official control of feed, in particular as regards the determination of constituents
- The method of sampling set out in Annex I is applicable for the control of feed as regards the determination of pesticide residues
- Preparation of samples for analysis and expression of results shall be carried out in accordance with the methods set out in Annex II.
- Methods of analysis to control the composition of feed materials and compound feed
- Methods of analysis to control the level of authorised additives in feed and determine no longer permitted additive
- Methods of analysis to control undesirable substances in feed
- Methods of analysis for the determination of constituents of animal origin for the official control of feed
- Calculation of energy for poultry.

**Question 4b** asked for the definitions of each of the following:-

I. Sampled portion
II. Incremental sample
III. Aggregate sample
IV. Final sample
**Question 4c** asked for the instructions given for an incremental sample of each of the following:

I. Non-homogenisable liquid feed  
II. Packaged feed 

**Question 4d** asked how should the quantitative result of any undesirable substance(s) in an animal feed be treated in order to establish if it is non-compliant?

**Question 5** asked the candidate to outline the labelling requirements for feed additives and how they should be labelled in a compound feed. The candidate should have identified the different categories of additives and there uses and how they should appear on the label as outlined in 1831/2003.

Eg Sensory, nutritional additives, zootechnical and coccidiostats and histomonostats  
specific name given to the additives upon authorisation, preceded by the name of the functional group as mentioned in the authorisation;  
name or business name and the address or registered place of business of the person responsible for the particulars referred to in this Article;  
net weight or, in the case of liquid additives either the net volume or the net weight;  
directions for use, and any safety recommendations regarding the use and, where applicable, the specific requirements mentioned in the authorisation, including animal species and categories for which the additive;  
the identification number; and the batch reference number and date of manufacture  
They should also outline the requirements for a compound feed as outlined in EC 767/2009 Article 17.

**Question 5b** asked the candidate to define the terms:-

I. Complementary feed  
II. Mineral feed  
III. Feed additive

**Question 7** asked the candidate to detail the compositional and labelling requirements for a bottled spring water. The candidate should reference The Natural Mineral Water, Spring Water and Bottled Drinking Water (England) Regulations 2007 and outline what constitutes a bottle water and how it should be labelled. The answer should also make clear what is not permitted ie references to mineral water or spring water unless the water meets the necessary requirements).

**Question 7b** required the candidate to outline the testing required to check the following parameters in the water:

I. Bicarbonate  
II. Sodium  
III. Chloride  
IV. Dry residue  
V. pH
Question 8a asked the candidate to outline the main provisions of the legislation governing public water supplies. The candidate should make reference to the Public Water Supply Regulation 2014 and outline the requirements of the regulations to carry out testing in different zones at specific intervals. The water must meet the requirements outlined in the regulations both from a microbiological and chemical perspective.

Question 8b required the candidate to discuss the consequences of a high level of iron in a private water supply and what could be done to rectify the adverse level. The candidate should be aware of the different types of water purification and how the high level of iron may interfere with the remediation process.

Part C

Due to COVID-19 there was no part C exam this year.