

Royal Society of Chemistry

Mastership in Chemical Analysis (MChemA)

Examiners' Report 2007

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Introduction

This is the annual report of the Examiners for the Mastership in Chemical Analysis for the year ending 31 December 2007. 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 www.rsc.org/mchema.

Part A (25 April 2007, Burlington House)

Three candidates sat the Part A examination. Of these, one produced an excellent performance, one a satisfactory performance, and one failed the examination. Of the eight questions in the examination paper, Q1 on general analytical terminology, Q5 on atomic spectrometry, and Q8 on statistics/data handling were attempted by all candidates (although only one proved able to tackle the statistical calculation with competence). Question 2, on spectrophotometry, Q3 on sample preparation/analyte extraction, and Q6 on mass spectrometry were attempted by only two candidates. Perhaps surprisingly, none of the candidates attempted Q4, on chromatography, nor (less surprisingly!) Q7, on radioanalytical chemistry.

Part B (30-31 October 2007, Burlington House)

One candidate sat both papers, one Paper 2 only.

Paper 1

Question 1 on a Hazard Analysis Critical Control Point (HACCP) evaluation of a bacon manufacturer. One candidate was able to demonstrate a clear and full understanding of HACCP and the microbiological hazards associated with a plant of this type, the other was not.

Question 2, attempted by one candidate, was on legislation and analysis relating to chocolate. The second part aimed to test the candidates' understanding of chocolate ingredients and although the answer showed that the candidate was familiar with the analysis and calculations, a critical understanding of the effect of the natural variability in the theobromine and butyric acid content of the ingredients was not evident in the answer.

Neither candidate answered question 3 on modified atmosphere packaging; a widely used method of food preservation.

Question 4, on the Food Supplements Regulations 2003 and the difficulties in quantifying vitamin levels in supplements was competently tackled by the candidate who answered it who

was able to demonstrate a good understanding of the practical difficulties in obtaining accurate results in vitamin assays.

In setting question five the examiners were trying to assess candidates' familiarity with that most common set of determinations in many official control laboratories – proximate analysis of meat products to estimate the allowable meat content. It was disappointing that neither candidate ventured to answer the question and the examiners are concerned that it may have been because they lacked hands-on knowledge of performing the arithmetic themselves rather than relying on their LIMS or a spreadsheet.

In question 6 we were seeking on to test the candidates understanding of carbohydrates in a legislative, chemical and nutritional context. The question was not answered well: Glycaemic index was not mentioned, fibre was wrongly classed as a carbohydrate, and the statement “carbohydrate is usually analysed by difference” failed to convey sufficient knowledge of carbohydrate analysis.

Question 7 sought to assess breadth rather than depth of knowledge in relation to food additives. One candidate was not able to answer all parts, perhaps due to lack of time.

Question 8. Food authenticity is very topical at the moment and reassuringly both candidates presented good answers to this question, though the technique for the presence of antibiotic residues in organic pork bones was not mentioned, and one candidate was not aware that oil of bergamot gave Earl Grey Tea its characteristic aroma.

Paper 2

This Paper includes questions on food policy and law, agriculture, and water. It is often perceived as being more difficult, perhaps because, due to the way the paper is divided into three sections, there is less choice, and not all laboratories conduct agricultural and water analysis. Policy is also a difficult area, but candidates, once qualified, will be expected to contribute to consultations and comment on new policy areas. The food policy and law section usually includes one “essay” type question to allow candidates to demonstrate that they can construct a reasoned and balanced argument.

As only one candidate sat this paper, I will not discuss the specific answers given but restrict my comments to what the examiners were looking for in each of the questions. I will say the Examiners were pleased with the manner in which the paper was addressed by the candidate.

The Contaminants in Food Regulations mark changes in the way foods are sampled and analysed. We sought to test candidates' knowledge of these important Regulations. Question 3 addressed a similar topic in agriculture. Legislation in the area of nutritional and health claims is in a state of transition and the question was set to test candidates' general awareness. Questions 4 and 5 were designed to test candidates' knowledge of animal nutrition and fertilizer analysis.

The limited scope of the syllabus in the area of water can make it difficult for the examiners to set relevant questions that differ from previous papers, however the well defined areas that can be covered in questions should allow potential candidates to focus their studies and become familiar with the topics which are likely to be covered.

This year the questions covered water treatment, legislation and different aspects of water analysis and quality control.

Portfolios for Part C (June 2007)

As both candidates had already submitted portfolios in 2006 re-submission was not required in 2007.

Part C practical examination (4 September 2007, University of Reading)

Two candidates presented themselves for the examination, who were both resitting from the previous year.

Candidates were presented with the three certificate questions, the three microscopy questions and one of the interactive questions when the exam started at 9am. The other interactive question was presented later in the morning. Although the one day format of the part C does not allow for the flow of the interactive part to proceed in real time, candidates must be able to demonstrate good time management and task allocation skills to reach their full potential marks during the day.

Communication in the form of formal certificates

The examination packs include certificates as they are prescribed in the relevant legislation. Candidates need to be able to select the appropriate form of certificate and complete it in every detail. This aspect is becoming more relevant as many of us now rely on software of one form or another to put certificates together. It is pleasing to note that both candidates were able to distinguish between the different wordings required for a certificate of analysis and one of examination. Since the 1990 Act there has been debate as to whether all results should be presented on a certificate or only those which are pertinent to establishing an offence. The examiners do not presume to know which of these approaches is "correct" and candidates are not penalised for either approach. One candidate favoured brevity, the other completeness. However, candidates are reminded of the need for clarity of presentation and expression which is of benefit to the client and the court.

Question 1: a bottle of drinking water which was contaminated with sewerage. A full suite of chemical and microbiological parameters was presented, and the examiners expect candidates to have an awareness of what constitutes a normal or abnormal result and draw conclusions as appropriate. The questions are framed, where possible, to allow a variety of outcomes and it is hoped that candidates chose the most appropriate. With the bottled drinking water a conclusion that the sample was unsafe, rather than simply exceeding certain limits in the Regulations, was the outcome that the examiners were expecting.

Question 2: a sample of smoked salmon. A requirement to consider recovery and measurement uncertainty is now made in certain regulations and both candidates were able to deal with this in presenting their results. However neither candidate considered moisture loss during processing and the effect that this had on the concentration in muscle tissue. The results included a histamine content of 25mg/100g, a level that the examiners considered not to be of concern. However one candidate quoted the limit 20mg/100g contained in the now revoked Food Safety (Fishery Products and Live Shellfish) (Hygiene) Regulations 1998. Candidates must be au fait with the current status of legislation. They are provided with an up to date edition of Butterworths to refer to. In the examiners' experience it is advisable to refer to legislation when drafting certificates to ensure that they are correct.

Question 3: a fertiliser. With the decline in the number of fertiliser plants fewer Agricultural Analysts see fertilisers on a regular basis, however candidates are expected to be familiar with agriculture legislation. The sample referred to in the question was incorrectly named, used the wrong units and was deficient in iron. One candidate failed to recognise that the moss killer referred to in the product name was iron, which was declared, and commented adversely on the absence of a declaration of the presence of a herbicide in the particulars.

The absence of such basic knowledge in an aspiring Agricultural Analyst is of considerable concern to the examiners.

The sample was not correctly named and one candidate used the correct wording as required by the notes on completion of the certificate. One candidate was unsure as to whether the sample was deficient in iron and drafted an observation that it was before crossing it out. This lack of decisiveness and understanding is, again, of concern.

Neither candidate commented on the wording of the declarations which showed lack of attention to detail as well as lack of familiarity with the requirements of the Regulations.

Microscopy and identification

The performance of candidates in the microscopy part of the exam has been disappointing in recent years. Future candidates are referred to the Guidance Notes published by the RSC and also the excellent training aids produced by the Training Committee of the Association of Public Analysts. At the risk of repeating the comments in previous examiners' reports it is essential that candidates adopt a systematic approach and make use of all of their senses and simple tests. Candidates are also urged to develop their skills in drawing what they see. The examiners can award marks if candidates draw and label what they have seen even if they are not able to identify a substance. An idea of scale is also beneficial.

Question 4: the first microscopy sample was compressed pollen grains containing a few debris such as bee hairs. Both candidates correctly identified the presence of pollen but neither gave any more specific identifications. Honey quality has enjoyed a relatively high profile in the last few years and a greater knowledge of pollen would have been expected. One candidate produced clear drawings of a variety of grains which the examiners appreciated. However one candidate, having identified the presence of pollen drew an incorrect conclusion at the end of the question.

Although candidates are encouraged to use senses other than sight in the examination, the characteristic smell of some spices can reduce the need for competent microscopy. The sample for question 5 was deodorised nutmeg which both candidates correctly identified.

Not surprisingly, candidates successfully identified wheat starch in wholemeal organic flour from a small mill but neither identified the oak sawdust and ground stone present. Additional simple tests such as the use of phloroglucinol and igniting a small part of the sample would have been useful tools in reaching a fuller identification.

Problem solving

Question 7: the sample for this question, which was available to candidates at 9 am, was an informal one consisting of a Christmas pudding. It was in an aluminium foil container which was perforated and stained with small pieces of foil adhering to the pudding. The letter accompanying the sample stated "Enclosed is an informal sample from a batch of Christmas puddings. I think that you will find the problem with them self-evident. The manufacturer is at his wits end. Please have a look at the sample and let me know your findings".

This problem required a combination of careful visual examination, a series of requests for information and just a little chemical analysis to establish that the perforations were forming from the outside, and were due to salt attack on the aluminium foil caused by a build up of salts in the steamer as water was being re-used.

One candidate explored the possibility of corrosion from the inside but failed to explore the other possibility when this line of enquiry did not yield an answer.

Question 8: Work was prompted on this question by receipt of a phone message at 9.20 a.m. from a trainee Environmental Health Officer working on her own due to staff shortages. She requested help to investigate a possible food poisoning incident. As the day wore on more information about the unfortunate guests at a Club Annual Lunch on the previous Sunday trickled in: reports of blurred vision experienced by two people at noon, and others being rushed to hospital at 15.20 with breathing difficulties. The examiners were expecting candidates to enquire about what food had been available and the nature and onset of symptoms. As more tests were requested the sample was used up so a scatter-gun approach resulted in the available material running out.

The examiners were disappointed that despite the classic symptoms presented, only one of the candidates managed to attribute the cause of the illness to *Clostridium botulinum* in the Bigos (Pork with Sauerkraut Stew).

It is very important to communicate clearly and frequently with the examiners during the interactive questions. The examiners are able to give credit for the whole thought process, including consideration of the initial lines of enquiry and reasons why particular lines of enquiry are rejected, if these lines of enquiry are duly communicated either in initial interchanges or in the final write up.

Award of MChemA

Michelle Evans successfully completed the Part C and was awarded the Mastership in Chemical Analysis. Her certificate was presented by Alan Richards, former Chief Examiner and President of the Association of Public Analysts at the Association's Annual Conference in Durham.

Thanks

The examiners would like to thank Dr Jane McLauchlin and her colleagues at the Royal Society of Chemistry for their support and competent administration of the examination process. Mr Chris Humphreys at the Food Biosciences Department in Reading as always helped to make the Part C Interactive run smoothly.

Dr Duncan Campbell
Chief Examiner 2007