

Mastership in Chemical Analysis

Part B Examination

Paper 1

Burlington House

Wednesday 24th April 2024

1200 – 1600

Plus 10 minutes reading time

Instructions

Answer **four** questions out of the six questions.

The answers to each question must be returned at the end of the examination. Please also provide any question notes you have prepared which could demonstrate your thinking.

Please read through the questions carefully. You are advised to take approximately equal time on each question.

This is a partially open book examination. You will be allowed access to legislation only. You will not be allowed to communicate with third parties during the examination or freely search online for information. You can use any resources on the following two websites only, for the UK ([Legislation.gov.uk](http://legislation.gov.uk)) and EU (<https://eur-lex.europa.eu/homepage.html?locale=en>) legislation. You will be required at the end of the examination to show your internet history covering the duration of the examination.

Where appropriate, please reference the relevant resources used for each question.

The marks allocated to each question are given.

Unless otherwise stated, references to Statutes in England include the equivalent alternatives for Scotland, Wales, and Northern Ireland. Where appropriate specify which Statutes you are using.

Unless otherwise stated, any reference to Statutes includes the EU regulations that they enforce.

Food Analysis/Composition/Labelling

Question 1

- (a) 200 barrels of “reservoir fluid” have leaked from a pipeline into an area where there were shellfish beds being reared for human consumption. Due to the nature of this leak and the potential impact on the environment, the local authority as well as the Scottish Environment Protection Agency (SEPA) and Food Standards Scotland (FSS) are also involved. Your laboratory has been asked to test 20 samples of cockles and mussels for polycyclic aromatic hydrocarbon (PAHs) Benzo[a]anthracene, Benzo[b]fluoranthene, Chrysene and Benzo[a]pyrene.

Detail your analytical approach and interpretation of your results to determine compliance.

(15 marks)

- (b) A trading standards officer has concerns over the quality and processes that a small local dairy is applying to bottled drinking milk. They have approached you as their public analyst to have the bottled milk tested. Discuss the parameters that you would assess to confirm the standards of the milk are satisfactory and meet the required regulatory requirements.

(10 marks)

Question 2

- (a) United Kingdom Accreditation Service (UKAS) accreditation requires an investigation into Proficiency Testing (PT) when there is an unsatisfactory z-score.

Explain with reasoning how you would conduct this investigation and assess the impact.

(4 marks)

- (b) Your laboratory has returned the following performance scores.

For EACH discuss the principle analytical issues that may have resulted in these z-scores.

- (i) Peroxide value in an olive oil with a z-score of +3.68

(3 marks)

- (ii) Misidentification on one of three fish flesh samples in which *Gadus macrocephalus* (pacific cod) was reported but *Gadus chalcogrammus* (Alaska pollock) was assigned

(3 marks)

- (iii) Citric acid in a soft drink with a z-score of +4.02

(2 marks)

- (c) A PT scheme organiser has assigned a z'-score (z-prime) instead of a z-score for titratable acidity in a milk analysis. In what circumstances is a z-prime score performance score issued and how is it interpreted?

(3 marks)

- (d) What specific analyses and particular calculations are required in order to assess whether a product labelled as 'Milk Chocolate' complies with compositional legislation?

(10 marks)

Question 3

- (a) A food business operator (FBO) wishes to place non-alcoholic energy drinks for sportsmen on the market.

The operator wants to make two drink ranges with the following mixtures of colours:

- (i) Riboflavin (E 101) 150 mg/l; Tartrazine (E 102) 100 mg/l; Ponceau 4R (E 124) 100 mg/l
- (ii) Sunset Yellow (E 110) 55 mg/l; Lutein (E 161b) 35 mg/l; Lycopene (E 160 d) 15 mg/l

Explain if the FBO can use these colours with the quantities indicated.

(4 marks)

- (b) A food business operator (FBO) has started to produce mayonnaise. In order to produce a batch of 304 kg of mayonnaise, the FBO uses 300 g potassium sorbate and 160 g sodium benzoate.

Are the amounts of sorbate and benzoate used in compliance with legislation?

Potassium Sorbate	M_w 150.22 g/mol
Sodium Benzoate	M_w 144.10 g/mol
Sorbic Acid	M_w 112.13 g/mol
Benzoic Acid	M_w 122.12 g/mol

(3 marks)

- (c) According to an analytical report of a chocolate confectionery product taken by the control local authority, the results found 500 mg/kg E 1520, 20 mg/kg E 210 and 200 mg/kg E 1519. State whether these amounts can be justified as carry over and provide an explanation as to your conclusion?

(4 marks)

- (d) A sample of an iced children's birthday cake has been submitted for the quantification of colours and for compliance. Outline your analytical approach with this sample and how would interpret the results.

(5 marks)

- (e) A complaint sample of chicken tikka curry (40% chicken) was submitted as it was alleged to be too strongly coloured. How would you approach the analysis?

Results of analysis found the following colours: Tartrazine, Allura Red and Ponceau 4R at the concentrations of 203mg/kg, 86mg/kg and 67mg/kg respectively. Assess whether the levels are compliant.

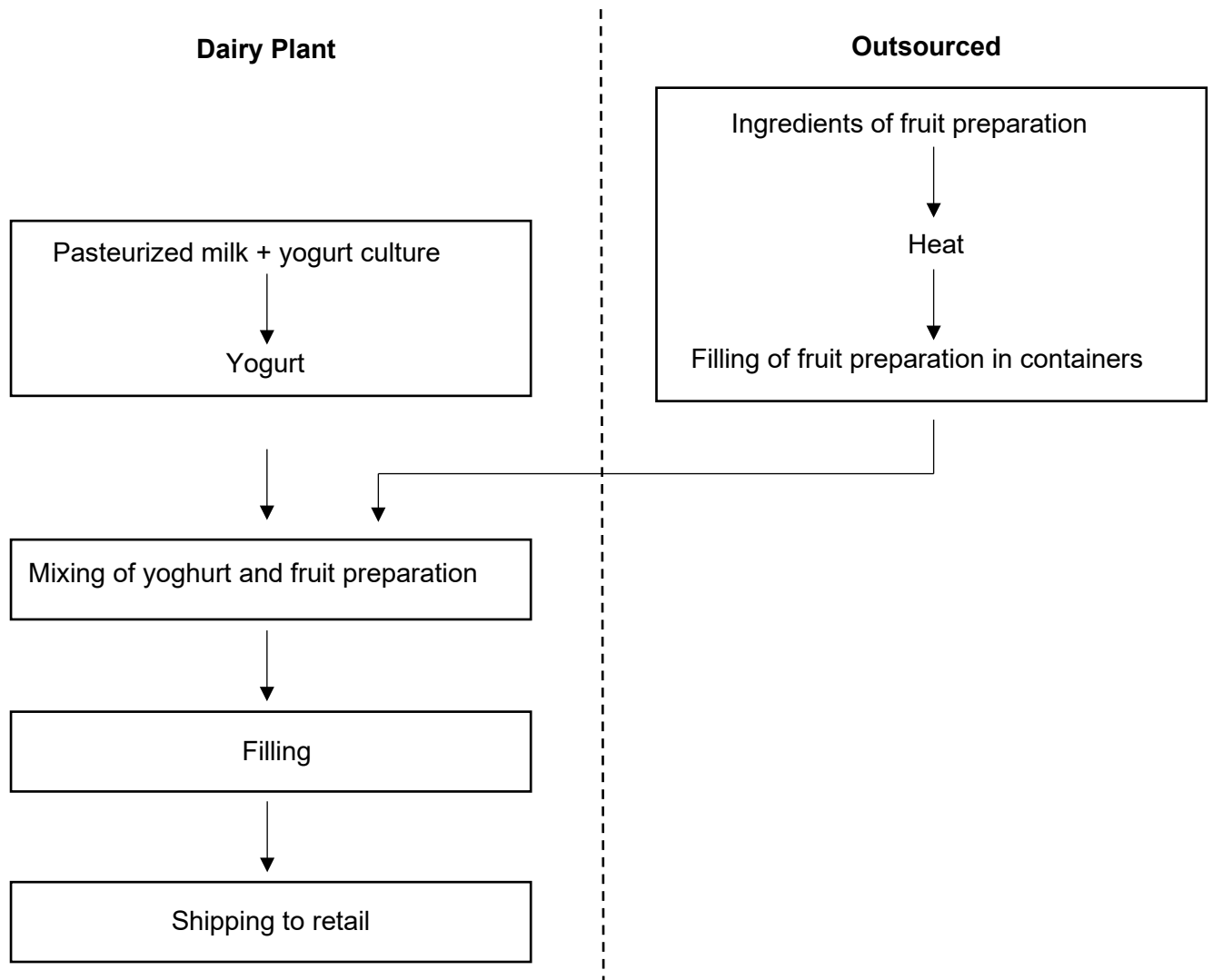
(6 marks)

(Question 3 continues on the next page)

- (f) A food business operator (FBO) wants to produce a dairy product with 10% of added fruit preparation according to the production flow chart below. The final product is heat-treated.

Which food additives are permitted? Could the presence of sorbates be justified in the final product and up to what level?

(3 marks)



Question 4

(a) For EACH of the following, outline the analytical methods that you would use to demonstrate the quality/authenticity of each of the following products including all rationale and subsequent criteria behind your choices.

- (i) Tea (Black)
- (ii) Tomato Puree
- (iii) Mayonnaise
- (iv) Flax Seed Oil
- (v) Fresh raw chicken skewers

(3 marks each = 15 marks)

(b) Explain EACH of the following and how they are applied in food analyses.

- (i) Veith's Ratio
- (ii) Stubbs and More
- (iii) Extraneous water
- (iv) Spirit Obscuration
- (v) Water activity

(2 marks each = 10 marks)

Question 5

An inexperienced Trading Standards Officer (TSO) has been passed the following label designs from local businesses relating to products to be launched in the near future. For EACH of the four labels below, discuss any concerns that you may have with legislative compliance giving full reasoning and rationale to back up your opinions.

[Note: A full label assessment is NOT required]

(Question 5 continues on the next page)

(a)



HOT HONEY

The Honey you love but with a twist. Liven up your dishes with Hilltop Hot Honey. Add sweet heat to ice-cream, pizzas, marinade meats and more.

100% Pure and Natural
Store at room temperature.
Crystallisation may naturally occur. If this happens, place the bottle in warm water.
Blend of Non-EU Honeys

Warning: Unsuitable for infants under 12 months of age. Suitable for vegetarians.

Ingredients: Honey (99.98%), Chilli Extract (0.02%)

Nutritional Values: Typical values per 100g:
Energy 1306kJ/307kcal; Fat<0.5g of which saturates <0.1g; Carbohydrate 76g of which sugars 76g; Fibre <0.5g; Protein <0.5g; Salt 0.03g

Pack contains approx 16 servings

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REUSE & RECYCLE

Hilltop Honey Ltd
UK: Newtown, Powys, SY16 3BD. Ireland: Office 128, 3 Lombard Street East, Dublin 2, D02 HC78

info@lovehilltop.com
lovehilltop.com

250ge **K**_{LBD}

Best Before End:

5 060298 573872

(4 marks)

(Question 5 continues on the next page)

(b)

Hemp it up![®]

Member of
SCOTTISH HEMP GROWERS



Hemp it up!
Barns of Airlie Farm,
Angus, DD8 5NJ

 [hempitup_](#)
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5 070000 851198

 **VEGAN FRIENDLY**
 **PESTICIDE FREE**

HIGH IN OMEGA-3

**COLD PRESSED
EXTRA VIRGIN
HEMP SEED OIL**

A deliciously nutty table oil perfect
for adding to salads, dressings, dips,
soup, vegetables, pasta...

Dip, drizzle & cartwheel

SCOTTISH AND SUSTAINABLE

INGREDIENTS:
Cold pressed extra virgin hemp seed oil.

Nutritional information:
Typical values per 100g

Energy	3700kJ/900kcal
Fat	100 g
of which saturates	8.5 g
of which monounsaturates	8.9 g
of which polyunsaturates	78.1 g
Carbohydrates	0 g
of which sugars	0 g
Fibre	0 g
Protein	0 g
Salt	0 g
Omega-3	19.4 g
Omega-6	57.1 g
Omega-9	8.4 g

10 g (1 dessert spoon) taken daily delivers 2 g of Omega-3, daily recommendation for maintaining normal blood cholesterol.

BEST BEFORE END See Bottle
BATCH NUMBER See Bottle

Store in a cool dark place.

230ml

(6 marks)

(Question 5 continues on the next page)

(c)



[With this product, the FBO is using a patented protease enzyme product Brewers Clarex® at the start of the barley fermentation process and an analytical result provided by the business stated a gluten level less than 10 mg/kg.]

(4 marks)

(d)



(5 marks)

(Question 5 continues on the next page)

- (e) A formal cooked pie sample containing chunks of both steak & kidney sold loose from a family run butcher's shop in a small local authority has failed a meat content analysis when compared to the verbal quantitative ingredient declaration (QUID). Given various production factors can affect such a declaration, explain what advice you would give to an inexperienced qualified Trading Standards Officer on how to obtain a defensible follow-up formal sample for analysis and the rationale behind all your advice?

(6 marks)

Question 6

- (a) Your local Council is concerned about the nutritional value of meals served at its secondary schools and have asked you to design a practical protocol to be used to assess their nutritional value against relevant national standards.

Outline the protocol that you have recommended. Discuss the parameters and the different approaches to sampling and analysis that you have considered when designing the protocol, giving the reasoning behind your decisions.

(10 marks)

- (b) Fat is a mandatory declared nutrient on the nutrition panel on pre-packed foods.

Using examples of different types of foods, describe the most appropriate technique that should be used for that food type to obtain the most accurate result.

(15 marks)

END OF PAPER