Higher Specialist Diploma

Clinical Chemistry

Examination - September 2022

Short Answer Questions

60 minutes

Attempt all four questions

<u>Instructions to candidates</u>

1. Record your candidate number and HSD discipline on the front sheet of the answer booklet

2. Record your candidate number, the question number and the page number in the spaces provided on the answer sheets

3. Each question is worth 25 marks.

1. You have been approached by a consultant in the accident and Emergency department to consider expanding on their biochemistry POCT offering within the department.

    a. State two tests that are currently available as POCT options and the clinical situations where they are useful. (6 marks)

    b. If implementing a new POCT piece of equipment, what are the key considerations. (9 marks)

    c. What steps would need to be taken to ensure the quality of results. (10 marks)

2. A recent TSH result has been reported incorrectly and it has been determined that the cause was assay interference. You have been asked to provide a training session to staff on immunoassay interferences.

    a. Name two different types of immunoassays in automation and provide examples of analytes which use each method. (5 marks)

    b. Provide an overview of the benefits of immunoassay. (10 marks)

    c. Provide a brief description of the limitations of automated immunoassay, including different types of immunoassay interference. (10 marks)

3. A myeloma patient with a serum sodium level of 145mmol / l and a total protein of 94 g / l has been held in the queue for validation. Describe your actions in terms of investigating this result prior to its release.

    a. Identify why this result might have been held for validation. (10 marks)

    b. Considering the analysis methods potentially involved, what implications might the limitation of the assays have on the results produced? (8 marks)

    c. Describe the actions you would take to investigate these results to confirm their validity prior to their release. (7 marks)

4. You are putting some notes together for a tutorial on Blood Gas Analysis:

a. Describe the typical arterial blood gas results in patients with the following:

(3 marks each)
   i. respiratory acidosis
   ii. metabolic acidosis

b. What is meant by 'compensation' when discussing blood gas results?   (5 marks)

c. Briefly describe the anion gap and provide an example of a condition where this is used to interpret acid-based disorders.   (6 marks)

d. Explain why the Calcium results from blood gas analysers may differ to those produced by the laboratory for the same patient.   (8 marks)

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Essay Paper

120 minutes

Attempt 2 out of 5 questions

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1. Record your candidate number and HSD discipline on the front sheet of the answer booklet

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3. Begin each new answer on a new page

4. Each question is worth 100 marks

1. Critically discuss the requirements and considerations of implementing a new assay into the biochemistry department repertoire.

2. Critically discuss the role of evidence-based practice within clinical chemistry laboratory practice in terms of (a) reducing unnecessary testing (b) procurement (c) service improvement.

3. Critically review the role of bilirubin and ALP as diagnostic tests for liver associated conditions.

4. Provide a detailed account of the clinical laboratory's role in the diagnosis and monitoring of chronic conditions of diabetes mellitus, with consideration to the methods employed, potential limitations and reference ranges.

5. Critically discuss the role of the laboratory in female pituitary dysfunction with regards to infertility investigation and treatment.

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Case studies

120 minutes

Attempt all case studies

<u>Instructions to candidates</u>

1. Record your candidate number and HSD discipline on the front sheet of the answer booklet.

2. Record your candidate number, the question number and the page number in the spaces provided on the answer sheets.

3. Begin each new case study on a new page.

4. Each question is worth 100 marks.

5. For these case study questions you are strongly advised to answer the questions as they arise during the case study to avoid later information impacting adversely on your answers to the earlier questions by presuming an "outcome".

SEEN CASE STUDY

1.

A 24-year-old man was admitted to the coronary care unit through emergency. He had been suffering from abdominal pain, reduced urine output, loss of appetite, loss of weight, and constipation for the past 1 week. He was also suffering from excessive cough and severe dyspnoea. After admission, on the 6th day, he developed visual disturbance and delirium. On examination, he was found to have AF with a pulse rate of 72 beats per minute (irregular). His laboratory results were as follows:

Sodium	114	132-144	Mmol / L
Potassium	6.2	3.2-4.8	Mmol / L
Urea	56	3.0-8.0	Mmol / L
Creatinine	170	60-120	µmol / L
Total Bilirubin	6.4	<25	µmol / L
Direct Bilirubin	1.5	<2	µmol / L

a. Calculate the eGFR for this patient, providing the full calculation you have used.

(10 marks)

b. What does the eGFR and the above U&E results tell us about the patient?   (10 marks)

Mr. X was on the following medications: • Digoxin 0.25 mg OD • Furosemide 20 mg BD • Seroflo inhaler 2 puffs TDS

c. What are the contraindications for these three drugs and how would these relate to results seen in this patient?   (15 marks)

d. What role does the laboratory typically play in the routine measurement of Digoxin and why is this important for this group of drugs?   (25 marks)

e. What are the limitations and specifications of Digoxin measurement?

(15 marks)

The patient's Digoxin level was found to be

Digoxin	3.6	0.8–2.0	Ng / ml

The patient began to develop visual disturbances and delirium.

f. What is the most likely cause of this patient's symptoms and how can this be treated?

(10 marks)

g. Provide an overview of Digoxin pharmacokinetics and describe how these relate to the significance of Albumin concentration.   (15 marks)

UNSEEN CASE STUDIES

2.

A 45-year-old obese (BMI 41 kg / m2) hypertensive woman is reviewed by her GP, who thinks her face looks a bit rounder/puffier than usual and wonders if she might be Cushingoid.

a. What is meant by the term 'Cushingoid' and what are the typical characteristics of a patent with Cushing's syndrome? (10 marks)

Initial investigations include serum urea and electrolytes, random plasma cortisol and thyroid function tests, the results of which are shown below.

Sodium	143	132-144	Mmol / L
Potassium	3.1	3.2-4.8	Mmol / L
Urea	6.1	3.0-8.0	Mmol / L
Creatinine	88	60-120	μmol / L
Cortisol	479	240-720 (8-10am)	Nmol / L
TSH	1.5	0.4-4	mU / L
fT4	14.5	9-22	Pmol / L

b. How are cortisol levels regulated and influenced in health? (15 marks)

c. What do these results suggest and what are the possible causes? (20 marks)

d. Why is the cortisol level unhelpful and what further investigations could be carried out to help confirm diagnosis? (20 marks)

e. What typical findings of the dexamethasone suppression test for the different causes of raised cortisol would you expect to see? (15 marks)

f. How is cortisol typically measured in the laboratory and what are the limitations of these methods? (10 marks)

g. What are the typical treatments for the different causes of Cushing's syndrome? (10 marks)

3.

A 45-year-old woman is admitted to A&E after collapsing outside the local primary school. On questioning she says that she has been tired a lot lately and has not been eating much because of feeling sick. She had a mastectomy some five years previously for breast cancer. Blood tests are sent to the laboratory for routine urea and electrolytes and for CEA, CA153 and CA125.

Parameter	Result	Range	
Sodium	129	132-144	Mmol / L
Potassium	4.5	3.2-4.8	Mmol / L
Chloride	89	96-106	Mmol / L
Bicarbonate	21	22-29	Mmol / L
Urea	14.5	3.0-8.0	Mmol / L
Creatinine	186	60-120	µmol / L
eGFR	27	➢ 60	mL / min / 1.73 m²
Glucose	4.8	3.9-5.6	Mmol / L

a. Given the clinical history, briefly discuss whether you think the request for CEA, CA153 and CA125 is justified. Is this appropriate use of tumour markers?   (15 marks)

b. Explain the urea and electrolyte results above and suggest what further tests may help in the differential diagnosis.   (15 marks)

The patient is admitted to a general medicine ward and her condition continues to deteriorate despite fluid replacement. Her temperature is elevated and based on this a request is sent to the laboratory for lactate analysis and liver function tests.

c. Is the request for lactate justified? What is the clinician looking for?   (20 marks)

d. The laboratory reports that the sample for lactate was not collected appropriately. Give advice as to the correct sample requirements.   (15 marks)

Liver function results reveal the following:

Parameter	Result	Range	
Total protein	84	60 to 83	G / L
Albumin	41	35 to 50	G / L
Bilirubin	154	<21	Mmol / L
ALP	985	30 to 129	IU / L
ALT	300	<41	IU / L
GGT	234	<61	IU / L

e. Comment on the above results.   (20 marks)

The laboratory is contacted to "add on" a calcium and phosphate level.

Parameter	Result
Cor. Calcium	3.2 mmol / L
Phosphate	2.5 mmol / L

f.   What do you think the biochemical results are indicating for this patient as your overall diagnosis and what tests could be useful?   (15 marks)