



UNIVERSITY OF
BIRMINGHAM

STUDENT BOOKLET

Name: _____

ID No: _____

College of Medical and Dental Sciences

MSc in Clinical Biochemistry
Course Code 5602
Year 1&2

SHORT ANSWER PAPER

Friday 3rd July 2009

Room WF15
Medical School
University of Birmingham

Enter your name and student ID number in the space provided on this answer booklet

Answer all Questions

Time Allowed: 2 hours (1315 - 1515)

You will need to pass each module

Please write final answers to calculations in the boxes provided below the question

For examiners use only

Module 3		Module 7		Module 8		Module 9	
Question	Mark	Question	Mark	Question	Mark	Question	Mark
1				1		1	
2				2		2	
3				3		3	
4				4		4	
5				5		5	

Module 3

1. 65 year old man presented with fever, dyspnoea and oliguria. Biochemical investigation revealed:

Serum	Sodium	132 mmol/L
	Potassium	6.9 mmol/L
	Urea	42 mmol/L
	Glucose	12 mmol/L
	Creatinine	608 μ mol/L
Urine	Osmolality	290 mmol/kg
	Sodium	55 mmol/L

- a) Is the patient more likely to have pre-renal or established renal failure?
(4 marks)

- b) Give three reasons to support your answer. (2 marks each)

2. A two year old boy was admitted to Accident and Emergency unconscious and hyperventilating. He had been perfectly well until 2 hours previously when he started vomiting. He had the following biochemistry results:

Serum	Sodium	130 mmol/L
	Potassium	3.3 mmol/L
	Chloride	94 mmol/L
	Urea	3.1 mmol/L
	Glucose	9.0 mmol/L
	Creatinine	40 μ mol/L

Arterial Blood	pH	7.20
	H ⁺	63 nmol/L
	pO ₂	14.0 kPa
	pCO ₂	2.0 kPa
	HCO ₃ ⁻	10 mmol/L

Urine	glucose +
Ketones	trace

a) What is the acid base disturbance? (4 marks)

b) What is the likeliest cause? (4 marks)

c) What further investigation is required? (2 marks)

3. Table 2 gives the cortisol results from a batch of samples. The assay has been performed using a new lot of calibrators. The tube number corresponds to the position of the sample in the run. Patients A, C and D had short Synacthen tests performed and cortisol collected 0, 30 and 60 minutes post synacthen, the times given in the table were those recorded on the samples. Patient B had an overnight Dexamethasone suppression test. No clinical details were provided on the request form for Patients E, F and G. Table 1 gives the target, mean and standard deviation (sd) for the internal quality control samples (IQC).

Table 1

IQC Level	Mean	1 sd
Low	15	0.8
Medium	300	8.9
High	750	15

Table 2

Tube	Name	Sample number	Cortisol
1	LOW QC		13.5
2	MEDIUM QC		310
3	HIGH QC		778
4	Patient A 0	1	335
5	Patient A 30	2	642
6	Patient A 60	3	753
7	Patient B	1	<0.5
8	Patient C 0	1	>1750
9	Patient C 30	2	>1750
10	Patient C 60	3	>1750
11	Patient D 0	1	563
12	Patient D 30	2	210
13	Patient D 60	3	798
14	Patient E	1	370
15	Patient E	2	712
16	Patient F	1	12
17	Patient G	1	500
18	LOW QC		12.1
19	MEDIUM QC		294
20	HIGH QC		745

a) Assuming that acceptable limits for the internal quality control (IQC) were mean \pm 2SD state, giving your reasons, which samples if any should be authorised?

(3 marks)

b) How would you deal with the remaining samples?

(3 marks)

c) What would you like to know in order to optimise the quality control in this assay?

(3 marks)

d) Comment on the results from patient D assuming the analysis has been performed correctly.

(1 mark)

4. Calculate the number of grams of lactic acid that must be added to 5g of sodium hydroxide to give a litre of solution with a pH of 5.0 (pKa of lactic acid = 3.86. molecular weight of sodium hydroxide = 40 and molecular weight of lactic acid = 90). (10 marks)

Weight of lactic acid required

5. Calculate the Creatinine Clearance in a 65 year old man with the following results:

Serum Creatinine 150 $\mu\text{mol/L}$

24 hour Urine Creatinine 10 mmol/L
 Volume 2010mL

(10 marks)

Creatinine Clearance

4. Calculate the probability that medium chain CoA dehydrogenase deficiency is present when the test for it is positive, if the sensitivity is 0.95 and the specificity is 0.98 and the prevalence of disease is 1 in 10000. (10 marks)

Predictive value of a positive result =

5. A child is receiving 10g nitrogen per day as amino acids but no other nitrogen input. Urinary urea excretion is 500 mmol/24 hours. Calculate whether he is in positive or negative nitrogen balance. State what assumptions you make (10 marks)

Nitrogen balance

Module 8

1. Match the following disease states with the most likely biochemical/clinical characteristics

(2 marks each)

- a) Neuroblastoma
 - b) Insulinoma
 - c) Glucagonoma
 - d) Carcinoid Disease
 - e) Somatostatinoma
-
- i. Elevated urine 5-hydroxyindole acetic acid (5HIAA) output and raised plasma chromogranin A in a 65 year old man.
 - ii. Abdominal distension and raised urine 3-hydroxy 4 methoxy mandelic acid (HMMA) output in an 18 month old child.
 - iii. 61 year old man with a history of headaches and confusion with plasma glucose <2.0 mmol/L.
 - iv. 55 year old woman with necrolytic migratory erythema and diabetes mellitus
 - v. Fasting blood sugar > 9mmol/L on two occasions with steatorrhoea

2. An 84 year old man with progressive weakness has difficulty in walking. His serum biochemistry results are:

Calcium	1.81 mmol/L	
Phosphate	0.80 mmol/L	
Alkaline Phosphatase	900 IU/ L	(30 –130)
Albumin	40 g/L	
Creatinine	80 μ mol/L	

- a) What's the diagnosis? (4 marks)
- b) Give two other biochemical investigations which may help in the management of the patient. (4 marks)
- c) Why does the patient have difficulty walking? (2 marks)

3. A patient on the Intensive Care Unit has the following results:

Serum Sodium	132	mmol/L
Potassium	7.2	mmol/L
Urea	8.4	mmol/L
Creatinine	95	μ mol/L
Calcium	1.12	mmol/L
Bilirubin	19	μ mol/L
Alkaline Phosphatase	20	IU/L
Alanine aminotransferase	101	IU/L
Protein	80	g/L
Albumin	29	g/L

a) What is the most likely reason why the serum potassium is raised?
(4 marks)

b) Give two other reasons to support your explanation (4 marks)

c) What would you tell the clinician? (2 marks)

4. Prostate Specific Antigen (PSA) has a physiological half life of 3 days in plasma. What plasma level would you expect 1 week after radical prostatectomy if the pre op concentration was 12 $\mu\text{g/L}$? (10marks)

PSA concentration =

5. A HPLC assay of an extract of a catecholamine standard mixture and an extract of an identical volume of a 24 hour urine collection, each containing an equivalent mass of DHBA as internal standard, gave the following detector responses in peak height units:

Standard	Noradrenaline (300 nmol/L)	60
	Adrenaline (50 nmol/L)	25
	DHBA	100
	Dopamine (1500 nmol/L)	150
Urine	Noradrenaline	15
	Adrenaline	39
	DHBA	110
	Dopamine	55

Given that the volume of the urine collection was 1500 mL, calculate the patient's 24h urinary output of noradrenaline, adrenaline and dopamine. (10 marks)

24 hr urine output:

Noradrenaline

Adrenaline

Dopamine

Module 9

1. A 16 year old girl with increasing weight and thinning hair has a 3 month history of amenorrhoea. Her serum biochemistry shows:

Prolactin	2, 520 mU/L	(25-625)
FSH	<1.0 IU/L	
LH	<2.0 IU/L	
Testosterone	5.7 nmol/L	(0.22 – 2.9)
TSH	0.93 mU/L	(0.27 – 4.2)

- a) Give one explanation for the clinical and biochemical features
(5 marks)

- b) Give one diagnostic test. (5 marks)

2. a) Give three enzymes that protect against free radical damage and outline the reactions that they catalyse. (3 marks each)

- b) Which free radical is formed by the Fenton reaction? (1 mark)

3. A 26 year old obese woman visits her GP with a 5 month history of oligomenorrhoea. The results of the biochemical investigations performed by the GP are:

Prolactin	600	mU/L	(25-625)
FSH	4.8	IU/L	
LH	12.0	IU/L	
Testosterone	3.5	nmol/L	(0.22 – 2.9)
TSH	2.7	mU/L	(0.27 – 4.2)

a) What is the most likely diagnosis? (2 marks)

b) What are the diagnostic criteria for this disorder? (8 marks)

4. A paper on ectopic pregnancy from the USA gives serum progesterone results in $\mu\text{g/L}$. If the conversion factor for progesterone is $\text{nmol/L} \times 0.314 = \text{ng/mL}$. What is a progesterone concentration of $8\mu\text{g/L}$ when expressed in SI units? (10 marks)

Progesterone concentration

5. A point of care testing analyser with one channel for human chorionic gonadotrophin (hCG) fails on average once in every 100 working days. More tests on different channels are added to the repertoire of the analyser. Assuming the same failure rate for the other channels, what is the probability that all channels will work on any one working day :

- a) on a five channel analyser?
- b) on a ten channel analyser?

(5 marks)
(5 marks)

Probabililty
On a five channel analyser
On a ten channel analyser