

MSc in Clinical Biochemistry

West Midlands Training Course in Clinical Biochemistry & The University of Birmingham.

Short Answer Paper June 29th 2007

Answer all Questions

Time Allowed 1 hour 30 minutes

You will need to pass each module

Module 1

1. A 35 year old man has persistent hypertension and hypokalaemia. Following withdrawal of medication and correction of the hypokalaemia, plasma investigations were as follows:

	0800h Recumbent	1200h Ambulant
Aldosterone pmol/L	720 (Ref Range 100-450)	1270 (Ref Range 200 – 800)
Renin nmol/L/hr	0.1 (Ref Range 1.1-2.7)	0.3 (Ref Range 2.8 – 4.5)
Cortisol nmol/L	700	300

- a. What is the likely diagnosis? 4 marks
- b. What is the underlying cause? 4 marks
- c. Explain why the serum cortisol is measured? 2 marks
2. A 10 year old boy was investigated for short stature and found to be hypocalcaemic. Further serum investigations showed:
- | | |
|----------------------------|------------------------------|
| Calcium (mmol/L) | 1.81 |
| Phosphate (mmol/L) | 1.95 |
| Alkaline Phosphatase(IU/L) | 160 (Adult ref range 30-130) |
| Albumin (g/L) | 40 |
| Creatinine (umol/L) | 60 |

Discuss these results and the likely differential diagnosis. 5 marks
Suggest further investigations required for clarification of the diagnosis and indicate what results you would expect for the **two** likeliest diagnoses. 5 marks

3. List 5 causes of hypophosphataemia. 2 marks each

4. A laboratory wishes to check that its equation for adjusting calcium for albumin is correct for its current methods. A large dataset of paired calcium and albumin results is obtained from the laboratory computer, and a scatter plot of calcium (y-axis) versus albumin (x-axis) is graphed. The linear correlation is confirmed with an equation (in the form of $y = mx+c$):

$$\text{Calcium} = 0.016 \times \text{Albumin} + 1.698$$

a. Using the equation and the desired reference range of 2.10 – 2.60 mmol/L, calculate the adjustment equation for this laboratory, expressed in the form:

$$\text{Adjusted calcium} = \text{calcium} + A (B - \text{albumin}) \quad \text{5 marks}$$

What assumptions about the dataset do you need to make for the equation to be valid? 1 mark

b. The equation previously used by the laboratory was

$$\text{Adjusted calcium} = \text{calcium} + 0.025(40 - \text{albumin}).$$

A patient had the results: Adjusted Ca 2.42 mmol/L, Albumin 25g/L. What would the new adjusted calcium result now be for the same patient? 4 marks

5. Parathyroid hormone has a plasma half life of 3 minutes. A patient undergoing a parathyroidectomy had an initial plasma value of 60 pmol/L. What was the level 20 minutes after isolation of the gland? 5 marks

How long until the PTH level was undetectable? (Limit of detection = 0.2pmol/L) 5 marks

Module 2

6. List 5 differences between type 1 and type 2 diabetes mellitus **2 marks each**

7. A 70 year old man with back-pain was referred to a Haematologist because of a low haemoglobin of 10.2 g/dL (ref range 12.5-16.5) and a very high ESR of >100mm/hr (ref range <7). His serum biochemistry is detailed below:

Calcium (mmol/L)	3.16
Alkaline Phosphatase (IU/L)	110 (Ref Range 30-130)
Protein (g/L)	116
Albumin(g/L)	30
Creatinine (umol/L)	160
Parathyroid hormone (pmol/L)	0.2(Ref Range 0.5-5.5)

- a. Discuss the results and suggest the likely cause of the abnormalities shown. **6 marks**
- b. What additional investigations should be undertaken to determine the diagnosis? **4 marks**
8. The following plasma glucose results (mmol/L) were obtained on venous samples taken during a 75g oral glucose tolerance test. Interpret the results in the light of the WHO criteria.

	Fasting	2 hour	Symptoms
Case 1	6.0	7.7	None
Case 2	6.5	11.1	None
Case 3	6.3	7.5	None
Case 4	6.9	15.0	Polyuria/Polydipsia
Case 5	6.4	7.9	None

2 marks each

9. Calculate the LDL concentration in a male patient with the following serum lipid concentrations:

Total Cholesterol (mmol/L) 5.8
Triglycerides (mmol/L) 2.6
HDL Cholesterol (mmol/L) 1.3

8 marks

Briefly discuss the conditions under which LDL cholesterol calculations are invalid.

2 marks

10. A new screening test for diabetic nephropathy is positive in 97% of patients with the disease and 1% of patients without it. Calculate the probability that a patient with a positive test has the disease if the prevalence of the disease in those tested is
- 1 in 3
 - 1 in 100

5 marks

5 marks

Module 3

11. The following results were obtained in a 50 year old diabetic with oedema after a 12 hour fast.

Serum	Sodium (mmol/L)	138
	Potassium (mmol/L)	3.6
	Urea (mmol/L)	7.1
	Creatinine (umol/L)	125
	Albumin (g/L)	18
	Glucose (mmol/L)	7.3
	Cholesterol (mmol/L)	12
	Triglycerides (mmol/L)	3.6
Urine Dipstick	Protein	+++
	Glucose	-ve

- What is the most likely diagnosis? 5 marks
- What test would help confirm the diagnosis? 3 marks
- Name the likely underlying cause 2 marks

12. A 40 yr old man with a long history of indigestion was admitted with a three day history of projectile vomiting. Investigations revealed:

pH	7.52	(7.36-7.44)
pO ₂	7.9 kPa	(9-13)
pCO ₂	8.5 kPa	(4-6)
HCO ₃	42	(22-29)

- What is the underlying acid-base disorder?
 - Explain the PO₂ and PCO₂ results
 - What would you expect the plasma potassium concentration to be?
 - What are the expected urine pH and potassium levels?
 - What is the likeliest cause for the underlying acid-base disorder?
- 2 marks each**
13. Briefly describe the features of the refeeding syndrome
- 10 marks**
14. A diabetic has a 24 hour urine output of 2L, a serum creatinine of 200 umol/L and a urine creatinine of 10mmol/L. Calculate the creatinine clearance.
- 10 marks**
15. Calculate the pH of a solution formed by mixing 8mL of KH₂PO₄ (0.06M) and 12mL Na₂HPO₄ (0.06M). The pK for the $\text{H}_2\text{PO}_4^- \rightleftharpoons \text{H}^+ + \text{HPO}_4^{2-}$ is 6.8.
- 10 marks**