NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Faculty of Health, Natural Resources and Applied Sciences

School of Health Sciences

Department of Clinical Health Sciences

13 Jackson Kaujeua Street
Private Bag 13388
Windhoek
NAMIBIA

T: +264 61 207 2970
F: +264 61 207 9970
E: dchs@nust.na
W: www.nust.na

QUALIFICATION: BACHELOR of MEDICAL LABORATORY SCIENCES	
QUALIFICATION CODE: 08BMLS	**LEVEL: 6**
COURSE: CLINICAL CHEMISTRY 2B	**COURSE CODE: CLC621S**
DATE: JANUARY 2025	**SESSION: 1**
DURATION: 3 HOURS	**MARKS: 100**

SECOND OPPORTUNITY EXAMINATION PAPER

EXAMINER: *MR. JAFET IT ILONGA*

MODERATOR: *MRS. FREDRIKA ENGELBRECHT*

INSTRUCTIONS:

1. Answer all questions on the separate answer sheet.
2. Please write neatly and legibly.
3. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
4. No books, notes and other additional aids are allowed.
5. Mark all answers clearly with their respective question numbers.

PERMISSIBLE MATERIALS:

1. Non-Programmable Calculator

This question paper consists of 8 printed pages including this front page.

SECTION A: MULTIPLE CHOICE [10 MARKS]

QUESTION 1 [10 MARKS]

Please read each question carefully and select the appropriate letter next to the corresponding question.

1.1) Kjeldahl's procedure for total protein is based upon the premise that: (1)

A. Proteins are negatively charged
B. The pKa of proteins is the same
C. The nitrogen content of proteins is constant
D. Proteins have similar tyrosine and tryptophan content

1.2) Upon which principle is the biuret method based? (1)

A. The reaction of phenolic groups with CuIISO4
B. Coordinate bonds between Cu+2 and carbonyl and imine groups of peptide bonds.
C. The protein error of indicator effect producing colour when dyes bind protein
D. The reaction of phosphomolybdic acid with protein

1.3) Hyperalbuminemia is caused by: (1)

A. Dehydration syndromes
B. Liver disease
C. Burns
D. Gastroenteropathy

1.4) Select the protein which migrates in the β region at pH 8.6 in protein electrophoresis? (1)

A. Haptoglobin
B. Orosomucoprotein
C. Antichymotrypsin
D. Transferrin

1.5) Which of the following conditions is usually associated with an acute inflammatory pattern? (1)

A. Myocardial infarction (MI)
B. Malignancy
C. Rheumatoid arthritis
D. Hepatitis

1.6) Which serum protein should be measured in a patient suspected of having Wilson's disease? (1)

A. Hemopexin
B. Alpha-1 antitrypsin
C. Haptoglobin
D. Ceruloplasmin

1.7) Which of the following affects specific gravity but not osmolality? (1)

A. Protein
B. Salt
C. Urea
D. Glucose

1.8) Urine with a specific gravity consistently between 1.002 and 1.003 suggests: (1)

A. Acute glomerulonephritis
B. Renal tubular failure
C. Diabetes insipidus
D. Addison's disease

1.9) A patient's blood gas results are as follows: pH = 7.26, CO2 = 2.0 mmol/L, HCO_3^- = 29 mmol/L. How would these results be classified? (1)

A. Metabolic acidosis
B. Metabolic alkalosis
C. Respiratory acidosis
D. Respiratory alkalosis

1.10) Which set of results is indicative of uncompensated respiratory alkalosis? (1)

A. pH 7.70; HCO_3^- 30 mmol/L; PCO_2 25 mm Hg
B. pH 7.66; HCO_3^- 22 mmol/L; PCO_2 20 mm Hg
C. pH 7.46; HCO_3^- 38 mmol/L; PCO_2 55 mm Hg
D. pH 7.36; HCO_3^- 22 mmol/L; PCO_2 38 mm Hg

SECTION B: SHORT AND STRUCTURED QUESTIONS [30 MARKS]

QUESTION 2 [13 MARKS]

56-year-old female came for a follow-up consultation with a Nephrologist at the Windhoek Central Hospital. She complained of symptoms, such as tiredness and weakness, which had developed over a long period. Several years previously she had developed backache due to lumbar disc prolapse and had habitually consumed large quantities of analgesic tablets. The patient had already seen the doctor 3 months prior where the doctor performed the tests as those presented below. Blood was collected at the initial consultation and the findings were similar 3 months previously at an outpatient clinic visit. Below are the serum and urine biochemistry results:

Serum Chemistry		
Analytes	**Results**	**Reference Ranges**
Sodium	140 mmol/L	136 – 145 mmol/L
Potassium	5.5 mmol/L	3.6 – 5.1 mmol/L
Chloride	100 mmol/L	97 – 107 mmol/L
Bicarbonate	16 mmol/L	22 – 28 mmol/L
Urea	33 mmol/L	1.7 – 6.7 mmol/L
Creatinine	900 µmol/L	75 – 115 µmol/L
Calcium	1.9 mmol/L	2.1 – 2.6 mmol/L
Phosphate	4.2 mmol/L	0.8 – 1.4 µmol/L
Urine Chemistry		
Creatinine	4.0 mmol/L	
Urine Output	3 L/24 hours	

Table 1. Laboratory findings

2.1) Calculate and interpret the creatinine clearance? Show your calculations. (5)

2.2) Calculate the patients anion gap and interpret the findings (3)

2.3) Comment on the plasma bicarbonate concentration result from the laboratory findings in Table 1? (2)

2.4) Provide three causes of heavy proteinuria? (3)

QUESTION 3 **[7 MARKS]**

3.1) A 24-year-old male is brought to the Casualty Unit of the Medi-Clinic Hospital by paramedics. The patient was found unconscious on the street and is suspected of alcohol intoxication by bystanders. Below are the chemistry results shown in Table 2. Calculate the serum osmolality, determine the osmomal gap, and explain/interpret the clinical significance of your findings? Show your calculations. (7)

Analytes	Results
Sodium	135 mmol/L
Glucose	4.0 mmol/L
Urea	6.28 mmol/L
Measured osmolality	318 mOsm/kg

Table 2. Laboratory findings

QUESTION 4 **[10 MARKS]**

A 43-year-old woman had a fall at home, multiple fractures were found on X-ray. She had a 5-month history of fatigue and bone pain; however, she did not have other comorbidities.

Chemistry		Reference Ranges
Calcium	2.90 mmol/L	2.2 – 2.6 mmol/L
Creatinine	218 µmol/L	55 – 84 µmol/L
Albumin	31 g/L	35 – 50 g/L
Haematology: Full Blood Count (Smear Examination)		
Erythrocytes: Polychromasia +, Microcytosis + Leucocytes: Reactive lymphocytes and 31 plasmacytoid cells noted. Platelets: Mild thrombocytopenia. Manuel platelet estimation: 108 x10E9/L		

Table 3. Laboratory findings

4.1) What could be the probable diagnosis (one mark) and explain the biochemical basis for the symptoms of this clinical condition (four marks)? (5)

4.2) Illustrate the serum protein electrophoretic pattern observed in the condition mentioned in 4.1. (5)

SECTION C: CASE STUDIES **[60 MARKS]**

QUESTION 5 **[20 MARKS]**

A 37-year-old woman presents with complaints of excessive thirst (polydipsia), excessive hunger (polyphagia), and frequent urination (polyuria) at the Outpatient Department of the Rundu State Hospital. Clinical manifestations include nausea, blurred vision, recurrent skin infections, numbness or tingling in the hands and feet, as well as sudden weight loss or gain. The patient's blood and urine biochemical laboratory findings are shown in Table 1.

Analytes	Results	Reference Ranges
Plasma Glucose	10.0 mmol/L	3.9 – 6.1 mmol/L
Urinalysis Results		
Analytes	**Results**	
Glucose	+	

Table 4. Laboratory findings

5.1) Taking the case and laboratory findings into consideration, what is the most likely diagnosis (one mark)? Briefly explain the pathophysiology of the condition (three marks) and conclude by stating other additional laboratory tests or investigation you would request to confirm the diagnosis (three marks). (7)

5.2) Explain the biochemical basis of polyphagia and polyuria in relation to the disease? (4)

5.3) What are the laboratory investigations of choice for diagnosing and monitoring diabetic patients? Motivate your answer. (6)

5.4) Briefly outline the patient care and management plan for individuals diagnosed with the condition mentioned in question 5.1. (3)

QUESTION 6 **[20 MARKS]**

A 61-year-old man came to the Emergency Centre of Windhoek Central Hospital with abdominal pain and vomiting that started the night before, along with constipation for the past week. During the physical examination, he showed signs of numbness and had trouble moving his arms, especially his hands. The patient's laboratory findings are shown in Table 2.

Analytes	Results	Reference Ranges
Serum Calcium	1.5 mmol/L	2.1 – 2.6 mmol/L
Serum Albumin	35 g/L	35 – 48 g/L
Serum Alkaline phosphatase	453 IU/L	40 – 130 IU/L

Table 2. Laboratory findings

6.1) What is the most probable diagnosis and list at least six common causes of such a clinical presentation? (7)

6.2) State five laboratory tests and briefly explain their clinical significance in confirming the diagnosis mentioned in question 6.1? (10)

6.3) Calculate the corrected calcium and interpret your findings? (3)

QUESTION 7 **[20 MARKS]**

A 32-year-old woman admitted at the General Ward of the Oshakati State Hospital presented with concurrent signs of tiredness and dizziness for two weeks. She was fully alert and able to speak clearly, with no signs of neurological issues. However, she had noticeable paleness in her skin and mucous membranes. Peripheral blood smear shows erythrocytes with marked microcytosis, anisocytosis, and hypochromia. The patient's laboratory findings are shown in Table 3.

Analytes	Results	Reference Ranges
Haemoglobin	4.6 g/dL	12 – 16 g/dL
Red Cell Count	2.8 x 10^{12}/L	4.0 – 5.0 10^{12}/L
Serum Iron	0.43 µmol/L	15 - 200 µg/L
Total Iron Binding Capacity (TIBC)	79.0 µmol/L	39 - 72 µmol/L
Serum Ferritin	7.0 µg/L	15 - 200 µg/L
Vitamin B12	860.0 pg/L	191 - 667 pg/L
Folic Acid	28.8 ng/L	4.6 - 18.7 ng/L

Table 3. Laboratory findings

7.1) What is the most likely diagnosis, and list five possible causes of this condition? (6)

7.2) State five biochemical tests that can help confirm the diagnosis mentioned in 7.1, along with their expected outcomes. (10)

7.3) Briefly outline the treatment and management plan for patients diagnosed with the condition mentioned in question 7.1? (4)

END OF EXAMINATION PAPER