



**NAMIBIA UNIVERSITY  
OF SCIENCE AND TECHNOLOGY**

**FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES**

**DEPARTMENT OF CLINICAL HEALTH SCIENCES**

<b>QUALIFICATION : BACHELOR OF MEDICAL LABORATORY SCIENCES</b>	
<b>QUALIFICATION CODE: 08BMLS</b>	<b>LEVEL: 6</b>
<b>COURSE CODE: CLC621S</b>	<b>COURSE NAME: CLINICAL CHEMISTRY 2B</b>
<b>SESSION: OCTOBER 2025</b>	<b>PAPER: FIRST OPPORTUNITY</b>
<b>DURATION: 3 HOURS</b>	<b>MARKS: 100</b>

<b>FIRST OPPORTUNITY EXAMINATION PAPER</b>	
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<b>INSTRUCTIONS</b>
<b>ANSWER ALL THE QUESTIONS</b>
<b>PERMISSIBLE MATERIALS</b>
<b>CALCULATOR</b>

**THIS QUESTION PAPER CONSISTS OF 10 PAGES (Including this front page)**

**SECTION A**

**[60 MARKS]**

**QUESTION 1**

**[30]**

**Choose the correct answer and report only the suitable letter next to the relevant question number.**

- 1.1 Which of the following best describes a buffer system? (1)
- A. A strong acid and its conjugate base
  - B. Water and its conjugate salt
  - C. A strong base and its conjugate acid
  - D. A weak acid and its conjugate base
- 1.2 Which of the following would best differentiate pre-renal from post-renal azotemia? (1)
- A. Serum sodium
  - B. BUN/Creatinine ratio
  - C. Urine pH
  - D. Specific gravity
- 1.3 Which organ is primarily responsible for excreting non-volatile acids? (1)
- A. Liver
  - B. Kidneys
  - C. Lungs
  - D. Pancreas
- 1.4 What is the role of carbonic anhydrase in acid-base balance? (1)
- A. Converts bicarbonate to CO<sub>2</sub>
  - B. Catalyzes the conversion of CO<sub>2</sub> and H<sub>2</sub>O to carbonic acid
  - C. Buffers hydrogen ions
  - D. Reabsorbs sodium

- 1.5 Which bile pigment gives stool its brown color? (1)
- A. Bilirubin
  - B. Urobilinogen
  - C. Stercobilin
  - D. Conjugated bilirubin
- 1.6 Which of the following diseases results from a familial absence of HDL? (1)
- A. Krabbe disease
  - B. Gaucher disease
  - C. Tangier disease
  - D. Tay-Sachs disease
- 1.7 Turbidity in serum throughout, left undisturbed for 16 hrs at 4<sup>0</sup>C suggests elevation of: (1)
- A. Chylomicrons
  - B. Cholesterol
  - C. Total protein
  - D. IDL
- 1.8 Which hormone lowers blood glucose levels? (1)
- A. Cortisol
  - B. Adrenaline
  - C. Glucagon
  - D. Insulin
- 1.9 Which ion is exchanged for hydrogen in renal tubular cells? (1)
- A. Potassium
  - B. Sodium
  - C. Calcium
  - D. Chloride

- 1.10 A 43-year-old man with a family history of CAD has the following lipid profile analysis (1) performed. Total cholesterol =280 mg/dl; triglycerides=150 mg/dl and HDL cholesterol =50 mg/dl. Using the Friedwald calculation, the LDL cholesterol for this patient is:
- A. 160 mg/dl
  - B. 200 mg/dl
  - C. 240 mg/dl
  - D. 300 mg/dl
- 1.11 Which of the following statements concerning chylomicrons is **FALSE**: (1)
- A. This lipoprotein is produced in the intestinal mucosa
  - B. The primary function is to transport dietary exogenous lipids to the liver
  - C. The major lipid transported is cholesterol
  - D. It remains at the original during lipoprotein electrophoresis
- 1.12 Which condition is associated with a pH of 7.1 and low PCO<sub>2</sub>? (1)
- A. Respiratory acidosis
  - B. Metabolic alkalosis
  - C. Metabolic acidosis with respiratory compensation
  - D. Respiratory alkalosis
- 1.13 What is the effect of aldosterone on acid-base balance? (1)
- A. Promotes bicarbonate loss
  - B. Enhances hydrogen ion excretion
  - C. Inhibits sodium reabsorption
  - D. Reduces chloride concentration
- 1.14 Given the following data, calculate the creatinine clearance: serum creatinine 2.4mg/dL; urine creatinine 120mg/dL; urine volume 1.1mL/min: (1)
- A. 50 ml/min
  - B. 291 ml/min
  - C. 55 ml/min
  - D. 106 ml/min

- 1.15 Which enzyme is elevated in acute pancreatitis? (1)
- A. ALT
  - B. Amylase
  - C. ALP
  - D. AST
- 1.16 Which enzyme is elevated in biliary obstruction? (1)
- A. ALT
  - B. AST
  - C. ALP
  - D. LDH
- 1.17 Which syndrome involves defective bilirubin conjugation due to enzyme deficiency?(1)
- A. Crigler-Najjar syndrome
  - B. Rotor syndrome
  - C. Dubin-Johnson syndrome
  - D. Gilbert's syndrome
- 1.18 Which condition is associated with unconjugated hyperbilirubinemia? (1)
- A. Dubin-Johnson syndrome
  - B. Rotor syndrome
  - C. Hemolysis
  - D. Cholestasis
- 1.19 Which isoenzyme of CK is most specific for cardiac muscle? (1)
- A. CK-MM
  - B. CK-BB
  - C. CK-MB
  - D. CK-Total

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- 1.20 Which enzyme is elevated in hemolytic anemia due to RBC breakdown? (1)
- A. LDH
  - B. ALT
  - C. CK
  - D. ALP
- 1.21 Which enzyme rises first after myocardial infarction? (1)
- A. Creatine kinase (CK)
  - B. Lactate dehydrogenase (LDH)
  - C. Aspartate transaminase (AST)
  - D. Troponin T
- 1.22 Which enzyme remains elevated the longest after myocardial infarction? (1)
- A. CK-MB
  - B. Troponin I
  - C. LDH
  - D. ALT
- 1.23 What unit is commonly used to report enzyme activity? (1)
- A. IU/L
  - B. mg/dL
  - C. mmol/L
  - D. ng/ml
- 1.24 What type of inhibition reduces both  $K_m$  and  $V_{max}$ ? (1)
- A. Competitive
  - B. Non-competitive
  - C. Uncompetitive
  - D. Irreversible
- 1.25 What does  $K_m$  represent in Michaelis-Menten kinetics? (1)
- A. Maximum velocity
  - B. Substrate concentration at half  $V_{max}$
  - C. Enzyme turnover number
  - D. Inhibitor constant

- 1.26 Which plot is used to determine  $K_m$  and  $V_{max}$  graphically? (1)
- A. Michaelis-Menten plot
  - B. Eadie-Hofstee plot
  - C. Lineweaver-Burk plot
  - D. Hanes-Woolf plot
- 1.27 Competitive inhibitors affect which parameter? (1)
- A.  $K_m$
  - B.  $V_{max}$
  - C. Turnover number
  - D. Enzyme concentration
- 1.28 Which term describes the energy needed to reach the transition state? (1)
- A. Free energy
  - B. Binding energy
  - C. Activation energy
  - D. Reaction quotient
- 1.29 What happens when substrate concentration exceeds enzyme saturation? (1)
- A. Reaction rate drops
  - B. Reaction rate plateaus
  - C.  $K_m$  increases
  - D. Enzyme is degraded
- 1.30 In the colorimetric determination of cholesterol, using the enzyme cholesterol oxidase, the agent that oxidizes the colourless organic compound 4-aminoantipyrine to a pink colour is: (1)
- A. Cholest-4-ene-3-one
  - B. NAD
  - C. Hydrogen peroxide
  - D. Phenol

**QUESTION 2**

**(30)**

Assess the following statements and decide whether they are true or false.

Write only the number of the question and next to it **TRUE** for a true statement.

For all **FALSE statement**, indicate that it is false **and provide a rationale. (One mark allocated to calling a statement TRUE or FALSE, and one mark allocated to the rationale when calling a statement FALSE).**

- 2.1 Diabetes mellitus is caused by excess insulin.
- 2.2 The glucose oxidase test is used to measure blood glucose
- 2.3 Glycogen is stored in the liver and muscles
- 2.4 LDL cholesterol is considered "Good" cholesterol.
- 2.5 HDL cholesterol helps remove excess cholesterol from tissues.
- 2.6 Triglycerides are stored in muscle tissue.
- 2.7 Chylomicrons transport dietary lipids from the intestine.
- 2.8 Gluconeogenesis occurs primarily in the kidneys.
- 2.9 Fructose and glucose are both hexoses.
- 2.10 The pancreas produces both insulin and glucagon.
- 2.11 Porphyrins are precursors in the synthesis of heme.
- 2.12 Porphyrins are caused by enzyme deficiencies in the heme biosynthesis pathway.
- 2.13 All porphyrias present with photosensitivity.
- 2.14 Acute intermittent porphyria (AIP) is associated with decreased urinary porphobilinogen.
- 2.15 Lead poisoning affects the same enzymes as congenital porphyrias.
- 2.16 Hypokalemia can result in cardiac arrhythmias.
- 2.17 Alpha-1 antitrypsin is a clotting factor.
- 2.18 In PKU, the body fails to metabolize leucine properly.
- 2.19 Microalbuminuria is a late sign of diabetic nephropathy.
- 2.20 Inulin is reabsorbed by renal tubules.

**SECTION B**

**[20 MARKS]**

**QUESTION 3**

**(20)**

3.1 Differentiate between glycogenesis and gluconeogenesis.

(3)

3.2 Describe the clinical implications of hyperglycemia.

(4)

3.3 Describe the metabolism of bilirubin from hemoglobin breakdown to excretion.

(6)

3.4 Describe any 2 (two) factors that affect enzyme reactions.

(4)

3.5 Evaluate the significance of hypoalbuminaemia in a patient with liver disease.

(3)

**SECTION C**

**[20 MARKS]**

**QUESTION 4**

**(20)**

4.1 A 32-year-old woman presents with dizziness and sweating after skipping breakfast. Her blood glucose is 2.8 mmol/L. Insulin levels are elevated.

4.1.1 What is the likely cause of her symptoms?

(1)

4.1.2 How does insulin contribute to hypo glycaemia?

(2)

4.1.3 What two (2) diagnostic tests would you order?

(2)

4.2 A 25-year-old male presents with tendon xanthomas and a total cholesterol of 9.8 mmol/L. His father died of a heart attack at age 40 years.

4.2.1 Evaluate the results and state the possible diagnosis?

(2)

4.2.2 Briefly describe the genetic defect is involved.

(2)

4.3 A 45-year-old man reports fatigue, frequent urination, and increased thirst. His fasting blood glucose is 9.2 mmol/L and HbA1c is 8.5%.

4.3.1 Evaluate these results and state the possible diagnosis.

(1)

4.3.2 Describe what the HbA1c result indicates.

(2)

4.3.3 State the importance of measuring HbA1c in diabetic patients versus measuring fasting plasma glucose.

(3)

4.4 An old diabetic patient with renal complications has the following blood results. Given these results calculate the osmolality and comment on the results. (5)

133 mmol/L  
Glucose: 487 mg/dl  
BUN: 84 mg/dl  
Creatinine: 5 mg/dl

**End of Examination**

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