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QUALIFICATION: BACHELOR of MEDICAL LABORATORY SCIENCES	
QUALIFICATION CODE: 08BMLS	**LEVEL: 6**
COURSE: CLINICAL CHEMISTRY 2B	**COURSE CODE: CLC621S**
DATE: NOVEMBER 2024	**SESSION: 1**
DURATION: 3 HOURS	**MARKS: 100**

FIRST 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 [TOTAL MARKS: 10]

QUESTION 1 [10 MARKS]

Please read each question carefully and select the appropriate letter that corresponds to your understanding. Each of the questions below individually have a grading of one mark.

1.1) Select the lipoprotein fraction that carries most of the endogenous triglycerides. (1)

A. VLDL
B. LDL
C. HDL
D. Chylomicrons

1.2) Which of the following enzymes is a transferase? (1)

A. Alkaline Phosphatase (ALP)
B. Creatine Kinase (CK)
C. Amylase
D. Lactate Dehydrogenase (LD)

1.3) In which type of liver disease would you expect the greatest elevation of Lactate Dehydrogenase (LD)? (1)

A. Toxic hepatitis
B. Alcoholic hepatitis
C. Cirrhosis
D. Acute viral hepatitis

1.4) In a non-myocardial cause, as opposed to a myocardial cause, of an increased serum or plasma Creatine Kinase-MB (CK-MB), which of the following would be expected? (1)

A. A persistent increase in CK-MB
B. An increase in both the percentage and concentration of CK-MB
C. The presence of increased Troponin I (TnI)
D. A more modest increase in total Creatine Kinase (CK) than CK-MB

1.5) Which of the following cardiac markers is consistently increased in individuals who exhibit unstable angina? (1)

A. Troponin C
B. Troponin T
C. Creatine Kinase-MB (CK-MB)
D. Myoglobin

1.6) Select the most sensitive marker for alcoholic liver disease? (1)

A. GLD
B. ALT
C. AST
D. γ-Glutamyl transferase (GGT)

1.7) Which enzyme is measured in whole blood? (1)

A. Chymotrypsin
B. Glucose-6-phosphate dehydrogenase
C. Glycogen phosphorylase
D. Lipase

1.8) Which of the statements below about serum urea is true? (1)

A. Levels are independent of diet.
B. Urea is not reabsorbed by the renal tubules.
C. High blood urea nitrogen (BUN) levels can result from necrotic liver disease.
D. BUN is elevated in prerenal as well as renal failure.

1.9) Blood ammonia levels are usually measured to evaluate: (1)

A. Renal failure
B. Acid–base status
C. Hepatic coma
D. Gastrointestinal malabsorption

1.10) Hyperalbuminemia is caused by: (1)

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

SECTION B: SHORT AND STRUCTURED QUESTIONS — TOTAL MARKS: 50

QUESTION 2 — [10 MARKS]

A 46-year-old man visited his general practitioner for a consultation, during which a random lipogram panel was requested. Blood samples were collected immediately after the appointment for the following tests: total cholesterol, triglycerides, and high-density lipoprotein (HDL) cholesterol, using a random blood collection method. The following results were obtained:

- Total cholesterol = 14.9 mmol/L
- HDL cholesterol = 0.98 mmol/L
- Triglycerides = 6.81 mmol/L
-

2.1) Calculate the patients Low-Density Lipoprotein and interpret the results? (3)

2.2) State the name of the formula used to determine the Low-Density Lipoprotein (LDL) cholesterol level based on the results provided in question 2.1. (1)

2.3) With reference to the results, describe why a direct measurement for LDL cholesterol is preferred over the calculation method. (4)

2.4) A state-of-the-art laboratory has started offering non-fasting lipid profile to facilitate the patients. Which of the following cholesterol cannot be determined in non-fasting state, without significant error? (2)

QUESTION 3 **[10 MARKS]**

34-year-old women was admitted to the intensive care unit of the Windhoek Central Hospital as she had suffered from severe burns. Arterial blood gas analysis was performed to assess for any acid-base disturbance. Her biochemical findings are shown below in Table 1.

Analytes	Results	Reference Ranges
pH	7.56	7.35 – 7.45
Partial pressure of Carbon Dioxide	3.3 kPa	4.65 – 6.00 kPa
Partial pressure of Oxygen	13.3 kPa	10.5 – 13.2 kPa
Bicarbonate	22 mmol/L	22 – 28 mmol/L

Table 1. Laboratory findings

3.1) What the likely diagnosis, briefly explain your reasoning, and state whether compensation has started. (3)

3.2) Justify why the following arterial blood gas analysis findings would be consistent with partially compensated respiratory acidosis? (3)

- pH: Decreased
- Partial pressure of Carbon Dioxide: Increased
- Bicarbonate: Increased

3.3) State the factors, other than renal function, that affect serum urea levels? (4)

QUESTION 4 **[10 MARKS]**

4.1) What is the formula for calculating plasma osmolality, and justify the rationale behind including specific analytes in this calculation? (6)

4.2) Differentiate between the concepts of osmolality and tonicity. (4)

QUESTION 5 **[10 MARKS]**

5.1) Compare and contrast the biochemistry laboratory findings between iron deficiency anaemia and anaemia of chronic disease? (10)

QUESTION 6 **[10 MARKS]**

A 22-year-old male was attended to at the Casualty Unit of the Katutura Hospital with complaints of severe abdominal pain in the upper abdomen for the past 4 to 6 hours. The man presented with pain radiating to the back and the pain was not relieved by analgesics. He revealed the history of similar type of symptoms, few days back. He also said that he consumed alcohol and heavy oily food last night.

Analytes	Results	Reference Ranges
Serum lipase	345 IU/L	0 – 160 IU/L
Serum amylase	223 IU/L	40 – 140 IU/L
Serum alanine aminotransferase	661 IU/L	10 – 40 IU/L
Serum aspartate aminotransferase	55 IU/L	8 – 20 IU/L

Table 2. Laboratory findings

6.1) Looking at the case study presentation and laboratory findings, what is the probable diagnosis and explain the clinical utility for testing serum lipase and amylase. (8)

6.2) What other two other biochemical analytes, and their laboratory findings, that would also be affected by the condition mention in question 6.1. (2)

SECTION C: CASE STUDIES [40 MARKS]

QUESTION 7 [15 MARKS]

A 5-year-old girl was taken to the Onandjokwe Lutheran State Hospital because she was unconscious. Her mother said that about two weeks earlier, the girl had a sore throat and mild fever and started to feel unwell. In the days before going to the hospital, the girl had been very thirsty and needed to urinate a lot at night. On the day she was admitted, she started vomiting, was breathing quickly and deeply, and became very drowsy. When doctors examined her, they found she was dehydrated, had cold skin, a fruity smell on her breath, a heart rate of 120 beats per minute, and low blood pressure of 90/60 mmHg. The patient's blood and urine biochemical laboratory findings are shown in Table 3.

Analytes	**Results**	**Reference Ranges**
Plasma Glucose	28.9 mmol/L	3.9 – 5.9 mmol/L
Arterial Blood pH	7.02	7.35 – 7.45
Sodium	130 mmol/L	136 – 145 mmol/L
Potassium	5.9 mmol/L	3.5 – 5.0 mmol/L
Chloride	100 mmol/L	96 – 108 mmol/L
Urinalysis Results		
Analytes	**Results**	
Glucose	++++	
Ketone bodies	++++	

Table 3. Laboratory findings

7.1) State the most likely diagnosis (one mark), describe briefly the reasoning behind your diagnosis (three marks), and conclude by briefly stating what might be the precipitating cause of this condition (one mark)? (5)

7.2) What type of acid-base disorder is the patient experiencing (one mark)? Identify four other notable clinical conditions that could result in the same metabolic dysfunction. Lastly, explain why the patient is exhibiting rapid and deep (hyperventilated) breathing (5 marks)?

(10)

QUESTION 8 **[10 MARKS]**

A 5 -year-old boy was admitted with severe nosebleeds and abdominal swelling for two days at the Oshakati State Hospital. He had no previous history of jaundice, abdominal swelling, or a bleeding disorder. One of his siblings had died at six months of age due to severe nosebleeds and mild jaundice, with the cause unknown. Examination revealed low-grade fever, severe icterus, pedal oedema, hepatomegaly, splenomegaly with ascites, and an ophthalmic examination showed bilateral Kayser-Fleischer (KF) rings. The patient's laboratory findings are shown in Table 4.

Analytes	Results	Reference Ranges
Haemoglobin	10.8 g/dL	12 – 16 g/dL
Prothrombin time (PT)	139 seconds	9 – 12 seconds
Serum Total Bilirubin	77 µmol/L	3 – 21 µmol/L
Serum Aspartate Aminotransferase (AST)	112 IU/L	8–20 IU/L
Serum Alanine Aminotransferase (ALT)	120 IU/L	10–40 IU/L
Serum Alkaline Phosphatase	2000 IU/L	40–130 IU/L
Serum Ceruloplasmin Level	0.04 g/L	0.14 – 0.40 g/L
Urinary Copper Value	1.57 µmol/L	0.157 – 0.472 µmol/L

Table 3. Laboratory findings

8.1) What is the most probable diagnosis (one mark) and cause of this condition (three marks)? Justify your answer using the laboratory findings (six marks). (10)

QUESTION 9 **[15 MARKS]**

9.1) Compare and contrast between pre-hepatic, hepatic, and post-hepatic jaundice with reference to five laboratory findings and their expected outcomes for differential diagnosis? Please tabulate your answer. (15)

END OF EXAMINATION PAPER