



**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**(MAIN CAMPUS)**

**UNIVERSITY EXAMINATIONS  
2022/2023 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER MAIN EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF MEDICAL LABORATORY SCIENCES AND  
TECHNOLOGY**

**COURSE CODE: BML 322**

**COURSE TITLE: SYSTEMIC CLINICAL CHEMISTRY**

**DATE: 18TH APRIL 2023**

**TIME: 8.00 – 10.00AM**

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**INSTRUCTIONS TO CANDIDATES**

This paper is divided into three sections, **A**, **B** and **C**, carrying respectively: Multiple Choice Questions (**MCQs**), Short Answer Questions (**SAQs**) and Long Answer Questions (**LAQs**). **Answer all questions. DO NOT WRITE ON THE QUESTION PAPER.**

**TIME: 2 Hours**

MMUST observes ZERO tolerance to examination  
cheating

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This Paper Consists of 5 Printed Pages. Please Turn Over

**SECTION A: Multiple Choice Questions (20 Marks)**

1. Specific gravity of urine less than 1.010 indicates:
  - a. Diabetes mellitus
  - b. Diabetes insipidus
  - c. Diabetic ketoacidosis
  - d. None of the above
2. Which of the following is not a renal function test?
  - a. Serum urea
  - b. Serum creatinine
  - c. Cystatin – C
  - d. Total cholesterol
3. Van – den – Bergh reaction is used to detect:
  - a. Serum creatinine
  - b. Serum urea
  - c. Serum bilirubin
  - d. Blood glucose
4. The enzyme estimation done for the diagnosis of pancreatitis
  - a. Acid phosphatase
  - b. Amylase
  - c. Alkaline phosphatase
  - d. Creatinine kinase
5. The following are the endocrine function of the kidney, EXCEPT:
  - a. Erythropoietin secretion
  - b. Synthesis of Vit D3
  - c. Synthesis of prostaglandins
  - d. Synthesis of angiotensin
6. The rate of filtration in the kidney depends on .....
  - a. Glomerular permeability
  - b. Capillary hydrostatic pressure
  - c. Oncotic pressure
  - d. All of the above
7. Under the normal condition, the glomerular filtrate in the Bowman's capsule of nephron consists of the following, EXCEPT: (5)
  - a. Proteins such as albumin and globulin
  - b. Metabolic waste products such as urea, creatinine
  - c. Amino acids, glucose, organic acids
  - d. Major electrolytes such as sodium, chloride, potassium, bicarbonate
8. A patient presents with elevation of unconjugated bilirubin, normal serum alkaline phosphatase, normal liver enzyme levels and no bilirubin in the urine. This combination would suggest:
  - a. Viral infection of liver
  - b. Chemical damage to liver
  - c. Increased rate of hemolysis
  - d. Obstruction of common bile duct
9. The most active form of vitamin D is 1, 25 dihydroxycholecalciferol, and this final hydroxylation takes place in:
  - a. Skin
  - b. Liver
  - c. Kidney
  - d. Skin and liver

10. Which of the following changes in serum analytes are associated with rickets and vitamin D deficiency?
- Low calcium, and low phosphorus
  - Low calcium, and high phosphorus
  - High calcium, and low phosphorous
  - High calcium, and high phosphorous
11. The best biochemical marker of bone turnover is:
- Urine hydroxyproline
  - Serum osteocalcin
  - Serum bone alkaline phosphatase
  - Urine N – terminal teleopeptides
12. The major buffer of blood is hemoglobin because:
- It has a heme group
  - It binds O<sub>2</sub>
  - It has large numbers of histidine residues with an effective pK<sub>a</sub> of 7.3
  - It binds CO<sub>2</sub>
13. Respiratory alkalosis can be seen in patients with:
- Severe diarrhea
  - Pneumonia
  - Hysterical hyperventilation
  - Hyperkalemia
14. The most efficient marker for the diagnosis of acute pancreatitis is:
- Amylase in serum
  - Amylase in urine
  - Pancreatic amylase isoenzyme
  - Trypsinogen (immunoreactive trypsin)
15. Factors associated with poor prognosis in acute pancreatitis include all of the following EXCEPT:
- Amylase over 10 times the upper reference limit
  - Calcium decrease to less than 80 mg/L (2 mmol/L) over the first 48 hours
  - Glucose over 2000 mg/dL at the time of admission
  - Hematocrit decrease over 10% over the first 48 hours
16. The most sensitive test of pancreatic insufficiency is:
- Amylase
  - Bicarbonate level in duodenal fluid after secretin administration (secretin test)
  - Fecal fat excretion
  - Immunoreactive trypsin in serum
17. Type 1 diabetes is defined as:
- Secondary to certain conditions and syndromes
  - Insulin dependent
  - Impaired glucose tolerance test
  - Glucose intolerance during pregnancy
18. In the fasting state, diabetes may be tentatively considered as the differential diagnosis if the glucose level is greater than:
- 1100 mg/L
  - 1260 mg/L
  - 1600 mg/L
  - 2000 mg/L
19. Type II diabetes is defined as:
- Secondary to certain conditions and syndromes
  - Impaired glucose tolerance test

- c. Glucose intolerance during pregnancy
  - d. Non – insulin dependent
20. The most useful analyte for monitoring long – term (6 – 8 weeks) stability of blood glucose is:
- a. Lactic acid
  - b. Urinary ketone bodies
  - c. Insulin
  - d. Glycosylated hemoglobin

**SECTION B: Short Answer Questions (40 Marks)**

1. Briefly discuss the criteria for the diagnosis of diabetes mellitus (8 marks).
2. What is the anion gap given the following laboratory results (shown as mmol/L? Na = 125; K = 4.5; Cl = 100; tCO<sub>2</sub> = 10) (8 marks).
3. The following liver enzyme results are obtained from an adult male patient: ALT = 280 U/L (reference range = 0 – 45 U/L), AST = 300 U/L (reference range = 0 – 35 U/L), ALP = 150 U/L (reference range = 53 – 128 U/L). Comparing with the reference ranges for adult males, what might account for these results? (6 marks).
4. Differentiate primary and secondary thyroid hormonal disorders in terms of causes and typical laboratory results (6 marks).
5. What are three (3) preanalytical sources of error that need to be avoided in order to provide accurate plasma ammonia values (6 marks).
6. Given a laboratory result following a blood gas analysis of a patient suffering from respiratory system related disease is: pH = 7.33, pCO<sub>2</sub> = 54, and pO<sub>2</sub> = 88,
  - a. Calculate carbonic acid and bicarbonate results using the Henderson – Hasselbalch equation (4 marks).
  - b. Given the results obtained from above question, classify the acid base status of the patient (2 marks).

**SECTION C: Long Answer Questions (60 Marks)**

1. A 48 year old black male was brought to the emergency room, semicomatose. His initial blood chemistries were as follows: PH 7.25, PCO<sub>2</sub> 21, PO<sub>2</sub> 94, bicarbonate 18, base deficit 17 mmol/L, glucose 6857 mg/L (glucose oxidase), BUN 190 mg/L (enzymatic, urease/GLDH), creatinine (alkaline picrate) 21 mg/L, ketones (> 1600 mg/L), electrolytes within normal range. The patient was treated intravenously with isotonic saline, insulin, potassium, chloride, and 50 g/L dextrose. The patient improved rapidly, and his blood glucose decreased. Twenty – four hours after entering the hospital, the following results were obtained on a renal profile: glucose 2050mg/L, BUN 180 mg/L, creatinine 9.5 mg/L, electrolytes within normal range, ketones negative. The physician in charge of the patient does not believe the patient was in renal failure. Since the creatinine result is now only slightly elevated while the BUN result is within the reference range, the physician questions the initial creatinine value.
  - a. What is the reason for the discrepancy in creatinine values? (3 marks).
  - b. How does a serum urea and creatinine concentration change in renal failure and in dehydration? (2 marks).
  - c. What methods are available for the measurement of creatinine? (5 marks).
  - d. Are there any advantages or disadvantages for measurement of creatinine by the alkaline picrate reaction versus the enzymatic methods? (6 marks).
  - e. How is BUN measured? Are there any major interferants of BUN assays? (4 marks).
2. Describe testing for cardiac function, such as troponin T and I, CK – MB, LD isoenzymes, hs-CRP and homocysteine (20 marks).
3. Categorize tumor markers based on a logical classification system, relating to chemical makeup and general methodology of analysis (20 marks).