



(University of Choice)

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

(MAIN CAMPUS)

**UNIVERSITY EXAMINATIONS (MAIN PAPER)
2023/2024 ACADEMIC YEAR**

THIRD YEAR FIRST SEMESTER EXAMINATIONS

**FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN MEDICAL LABORATORY
SCIENCES**

COURSE CODE: BML 312

**COURSE TITLE: INTRODUCTION TO CLINICAL
CHEMISTRY**

DATE: 8TH DECEMBER 2023

TIME: 2.00-4.00PM

INSTRUCTIONS TO CANDIDATES

This paper is divided into three sections, A B and C, 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

This Paper Consists of 5 Printed Pages. Please Turn Over

SECTION A (Multiple Choice Questions) (20 marks)

1. The liquid portion of blood remaining after a clot has formed is called:-----
 - A. The buffy coat
 - B. Serum
 - C. Plasma
 - D. Tissue fluid
2. Glucose results are correctly reported in:-----
 - A. g/mmol
 - B. mmol/L
 - C. g/L
 - D. g/ml
3. If a patients refuses to have a venipuncture done:-----
 - A. Tear up the requisition paper
 - B. Collect urine sample
 - C. Notify the patient's physician
 - D. Politely ask a patient to come back next week
4. Which statement is false when performing a venipuncture?
 - A. The vein is puncture at a 15 – 20 degree angle
 - B. The patients arm is cleansed before palpating the vein
 - C. The bevel of the needle is pointed up when entering the vein
 - D. The tourniquet is removed before withdrawing the needle
5. A biohazardous container is used to discard:-----
 - A. Lancets
 - B. Needles
 - C. Band aid wrappers
 - D. A & B
6. If a lavender top, plain red top, grey top, and light blue top tubes are collected, what is the order of draw?
 - A. Plain red top, light blue, lavender, grey
 - B. Grey, blue, lavender, plain red top
 - C. Blue, plain red top, grey lavender
 - D. They can be collected in any order
7. The tourniquet is:-----
 - A. Applied very tightly to the arm
 - B. Used to increase venous fill
 - C. Released after the needle is withdrawn
 - D. Tied in a knot to keep it on securely
8. A blood specimen collected in a heparinized tube is centrifuged. It will separate into:--
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 - A. Serum and clot
 - B. Plasma and clot
 - C. Serum and plasma
 - D. Plasma buffy coat, RBC
9. Hemolysis may result from:-----
 - A. Vigorously shaking the blood specimen
 - B. Refrigerating the vacutainer before use
 - C. Leaving the tourniquet on for more than three minutes
 - D. All of the above

10. The first drop of blood is wiped away after performing a skin puncture to:-----
- A. Increase blood flow to the area
 - B. Remove the last traces of alcohol
 - C. Remove any excess tissue fluid
 - D. Remove the last traces of alcohol and any excess tissue fluid
11. Separated serum that is dark yellow to amber in color is termed:-----
- A. Icteric
 - B. Jaundiced
 - C. Hemolyzed
 - D. Lipemic
12. Moderate levels of hemoglobin can cause methodological interference in which of the following analytical procedures?
- A. Cholesterol
 - B. Albumin
 - C. Triglycerides
 - D. Iron
13. The information on a chain of custody document includes:-----
- A. Subject name
 - B. Person sending specimen
 - C. Person receiving specimen
 - D. Condition of seals
14. The purpose of a chain of custody document is to:-----
- A. Ensure that no tampering of the sample occurred
 - B. Ensure that the specimen is derived from the appropriate individual
 - C. Ensure that the reported results are correct for the appropriate individual
 - D. Ensure that quality control was performed
15. Which one of the following patient variables can affect measured analyte concentrations?
- A. Diurnal variation
 - B. Education
 - C. Religion
 - D. Height
16. All of the following are higher in the morning than the afternoon or evening (in persons with a normal wake:sleep cycle) except:-----
- A. ACTH
 - B. Cortisol
 - C. Prolactin
 - D. Renin/aldosterone
17. Which one of the following is typically decreased after meals?
- A. Chloride
 - B. Gastrin
 - C. Growth hormone
 - D. Insulin
18. EDTA contamination will decrease all of the following analytes except:-----
- A. Alkaline phosphatase
 - A. Creatine kinase

- B. Magnesium (spectrophotometric methods)
 - C. Potassium
19. The mechanism of interference in hemolyzed samples is correctly matched with the test name in all of the following combinations except:-----
- A. Bilirubin – release from red blood cells
 - B. Cholesterol – interference in assay
 - C. Creatine kinase – interference in assay
 - D. Lactate dehydrogenase – release from red blood cells
20. Appropriate tests to use for delta checks, since they show low intra-individual variation, little day to day variation, but higher inter-individual variation, include:-----
- A. Alkaline phosphatase
 - B. Creatine kinase
 - C. Glucose
 - D. Lactate dehydrogenase

SECTION B: Short Answer Questions (40 Marks)

1. Explain how the concentration of analyte in a sample or a solution in a clinical chemistry laboratory can be expressed (5 marks).
2. What is the molarity of a 2.5N solution of HCl (5 marks).
3. What volume is needed to make 500 ml of a 0.1 M solution of Tris buffer from a solution of 2 M Tris buffer? (5 marks).
4. Explain the difference between precision and accuracy in clinical chemistry (5 marks).
5. Briefly explain five (5) different types of blood collection tubes used in clinical laboratories stating when appropriate to use them (5 marks).
6. The glucose level of a student was taken three months ago and the results were 6.6mmol/l. When he visited the school clinic today, the glucose levels were 5.82 mmol/l. provided that the published value for glucose is 6.0% and the analytical value is 1.6%, has the glucose levels changed to have any clinical impact? (5 marks).
7. A urea standard was prepared by mixing 2.0 mL of a 0.050 g/dL solution and 2.0 mL of a 10 mg/dl standard. What is the mg/dL concentration of the prepared urea standard. (5 marks).
8. a. A 1:10 dilution of a substance is rediluted 3:5, 2:15 and 1:2. What is the final dilution? (2.5 marks).
- b. A 10 L solution of 0.50 mol/L concentration was prepared by adding 250 mL of stock solution and adjusting the volume to 10 L. what is the concentration of the stock solution? (2.5 marks).

SECTION C: Long Answer Questions (60 Marks)

1. Blood sample was collected from fifteen student residing in Lurambi area and their serum iron level ($\mu\text{mol/L}$) was established. The results were as follows:- 20, 15, 22, 19, 27, 22, 27, 19, 20, 22, 15, 15, 27, 20 and 19.
 - i. Calculate the mean serum iron level (2 marks).
 - ii. Calculate the standard deviation for the data provided above. (4 marks).
 - iii. Calculate the standard error of the mean (4 marks).
 - iv. Establish the reference range for the student residing in Lurambi area using the data provided (5 marks).

- v. In a population of 20,000 students, the serum iron level was normally distributed with a mean of $15.5\mu\text{mol/L}$ and standard deviation of $1.85\mu\text{mol/L}$. how many students had their serum iron level ranging between $15.5 - 1.85\mu\text{mol/L}$ to $17.35 - 1.85\mu\text{mol/L}$.
(5 marks).
2. Two methods for the measurement of serum urate were evaluated. In method A, the sample is treated with compound X which reacts with urate and structurally related substances to produce a blue colored compound. The change in absorbance in the blue wavelength range is then measured. The test is performed on an automated analyser. In Method B, the sample is treated with uricase enzyme which converts urate to allantoin. Urate absorbs in the UV whereas allantoin does not. The decrease in UV absorbance is measured. The uricase is highly specific for urate as substrate. The test is manually performed. A single sample of serum was measured repeatedly by each method, with the following results in mM.
- Method A: 0.54, 0.55, 0.54, 0.56, 0.55, 0.55, 0.55 and 0.54.
Method B: 0.45, 0.41, 0.40, 0.42, 0.46, 0.43, 0.40 and 0.44
- Calculate the precision of each method in terms of coefficient of variation
(6 marks).
 - Which method has the best precision
(2 marks).
 - Provided that the true value for urate in the sample is 0.43mM , which method has the best accuracy?
(2 marks).
 - Suggest any possible reasons for the variation in results as obtained from method A and B
(4 marks).
 - What other factors would need to be considered before deciding on whether to use method A or B in a particular laboratory?
(6 marks).
3. Discuss giving relevant examples of analytes the importance of clinical chemistry laboratory in a health set up
(20 marks).

