UNIVERSITI KUALA LUMPUR
INSTITUTE OF MEDICAL SCIENCE TECHNOLOGY

FINAL EXAMINATION

OCTOBER 2025 SEMESTER

COURSE CODE	:	HDD20603
COURSE TITLE	:	CLINICAL CHEMISTRY 1
PROGRAMME NAME	:	DIPLOMA OF MEDICAL LABORATORY TECHNOLOGY
DATE	:	23 JANUARY 2026
TIME	:	9:00AM - 12:00PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of TWO sections.
4. Section A consist 25 MCQ or EMQ questions. Answer ALL questions.
5. Section B consist of four questions. Answer THREE (3) questions only.
6. Please write your answer on the answer booklet provided.
7. Please answer all questions in English only.
8. Please answer MCQ/EMQ questions using OMR sheet. ☐ *Tick if applicable*
9. Refer to the attached Formula/ Appendies. ☐ *Tick if applicable*

THERE ARE 12 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 25 marks)

Answer ALL questions.

Please use the objective answer sheet provided.

1. The circulating marker currently used for the diagnosis and monitoring of hepatocellular carcinoma is _____.

   A. Carcinoembryonic antigen (CEA)

   B. Alpha-fetoprotein (AFP)

   C. Human chorionic gonadotropin (hCG)

   D. Cancer antigen 125 (CA-125)

2. Which plasma protein indicator has a half-life of 18–20 days?

   A. Transferrin

   B. Transthyretin

   C. Retinol-binding protein

   D. Albumin

3. Low total serum protein levels can be a sign of _____.

   A. dehydration

   B. chronic infection

   C. liver or kidney disorders

   D. bone marrow tumors

4. Which of the following describes "Metastasis"?

   A. Programmed cell death.

   B. The formation of a primary tumor.

   C. The development of new blood vessels.

   D. The spreading of tumors to other areas of the body.

5. Therapeutic Drug Monitoring (TDM) is used to _____.

   A. test for illegal drug use only

   B. measure the nutritional value of food

   C. increase the drug dose until side effects appear

   D. ensure drug levels remain within a therapeutic range

6. To which type of proteins do immunoglobulins, such as IgG and IgM, belong?

   A. Alpha-2 globulins

   B. Alpha-1 globulins

   C. Gamma globulins

   D. Beta globulins

7. The primary clinical use of Prostate Specific Antigen (PSA) testing is _____.

   A. screening and monitoring for prostate cancer

   B. diagnosing kidney failure

   C. monitoring liver function

   D. testing for diabetes

8. Bicarbonate deficit (blood concentrations below 22 mEq/L) leads to _____.

   A. respiratory acidosis

   B. metabolic alkalosis

   C. metabolic acidosis

   D. respiratory alkalosis

9. The "Hook Effect" in immunoassays refer to _____.

   A. false positive results due to lipemia

   B. interference from heterophile antibodies

   C. false low results due to excessively high marker concentrations

   D. high sensitivity at low analyte levels

10. Which tumor marker is the only clinically accepted serologic marker for ovarian cancer?

   A. PSA

   B. AFP

   C. CA-125

   D. CEA

11. Which organ is the primary site for the synthesis of most plasma proteins?

   A. Pancreas

   B. Kidneys

   C. Spleen

   D. Liver

12. A pH value of less than 7.35 in the blood is defined as _____.

   A. acidosis

   B. homeostasis

   C. neutrality

   D. alkalosis

13. In the Henderson-Hasselbalch equation, which component represents the "respiratory" variable?

    A. Sodium

    B. Bicarbonate

    C. Hemoglobin

    D. Carbonic acid

14. A primary function of albumin in the circulation is to _____.

    A. act as a primary immune defense

    B. initiate the blood clotting cascade

    C. maintain colloidal osmotic pressure

    D. transport oxygen to tissues

15. The most abundant protein found in human blood plasma is _____.

    A. Globulin

    B. Fibrinogen

    C. Albumin

    D. Transferrin

16. Which hormone is primarily responsible for lowering blood glucose levels?

    A. Insulin

    B. Cortisol

    C. Thyroxine

    D. Glucagon

17. Hemoglobin A1c (HbA1c) is used to monitor average blood sugar levels over _____.

    A. 6 months

    B. 120 days

    C. 1 week

    D. 24 hours

18. The clinical term for the yellowing of skin and eyes caused by excess bilirubin is called _____.

    A. hematuria

    B. hemolysis

    C. jaundice

    D. proteinuria

19. Which laboratory test is used specifically to evaluate the body's iron stores?

    A. Serum ferritin

    B. Total iron-binding capacity

    C. Serum iron

    D. Transferrin saturation

20. According to Beer's Law, how does the concentration of an analyte relate to light absorption?

    A. Concentration is unrelated to color intensity.

    B. Lower concentration results in higher absorption.

    C. Higher concentration results in more light transmitted.

    D. Higher concentration results in higher absorption.

21. Which electrolyte is primarily regulated by the hormone aldosterone?

A. Calcium (Ca^{2+})

B. Sodium (Na+)

C. Chloride (Cl^-)

D. Magnesium (Mg^{2+})

22. Which condition is characterized by high levels of ketones in the blood and urine due to inadequate insulin?

A. Diabetic retinopathy

B. Diabetic ketoacidosis

C. Hypoglycemia

D. Hyperglycemia

23. Respiratory compensation for a metabolic acid-base problem involves _____.

A. renal excretion of bicarbonate

B. increasing heart rate

C. hyper or hypoventilation

D. activation of the liver

24. Which enzyme is the more specific marker for acute pancreatitis?

A. Alanine aminotransferase

B. Lipase

C. Amylase

D. Lactate dehydrogenase

25. Select the sentence that best describes the primary objective of an audit in a clinical biochemistry laboratory.

A. Ensuring patient confidentiality.

B. Identifying areas for improvement and compliance with standards.

C. Implementing new testing methods.

D. Reducing workload for laboratory staff.

SECTION B (Total: 75 marks)

Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 1

Answer **ALL** the following questions:

(a) State the tube top color based on its content and purpose of keeping the blood in the tube.

i. Contains a clot activator and gel and used to obtain serum for chemistry and immunology.

(2 marks)

ii. Contains EDTA and used for CBC/hematology.

(2 marks)

iii. Contains sodium fluoride and potassium oxalate, which are used for glucose measurements.

(2 marks)

(b) Define the following terms and give appropriate example:

i. Pre-analytical variables

(3 marks)

ii. Post-analytical variables

(3 marks)

(c) A laboratory technologist notices that a serum sample is hemolyzed. The reported potassium (K^+) is 8.5 mmol/L (noted as high).

i. State the major site of potassium (K^+) in the body and its ionic charge.

(3 marks)

ii. If the laboratory performed a dilution on the sample with a dilution factor of 2, calculate the actual potassium concentration.

(3 marks)

iii. Discuss the pre-analytical errors during or after sample collection that can lead to hemolysis.

(7 marks)

Question 2

Answer **ALL** the following questions:

(a) Identify the primary organ source for the following enzymes:

i. Alanine Aminotransferase (ALT)

(2 marks)

ii. Lipase

(2 marks)

(b) The following questions are related to the enzyme creatine kinase (CK):

i. Creatine Kinase (CK) is a dimeric enzyme. Name its **TWO (2)** subunits and the **THREE (3)** resulting isoenzymes.

(5 marks)

ii. For each CK isoenzyme identified above, state its primary tissue of origin and clinical significance.

(6 marks)

(c) The following questions relate to a patient experiencing an episode of myocardial infarction.

i. Discuss the temporal pattern graph (rise, peak, and return to normal) of CK-MB and LDH following an Acute Myocardial Infarction (AMI).

(8 marks)

ii. Explain why LDH is considered a non-specific marker for myocardial infarction.

(2 marks)

Question 3

Answer **ALL** the following questions:

(a) The following question is related to Lipoproteins.

i. With the aid of a diagram highlight **FOUR (4)** components that make up the structure of a typical lipoprotein particle.

(8 marks)

ii. Identify the specific apolipoprotein found on the surface of LDL that acts as a ligand for the LDL receptor.

(2 marks)

iii. Explain how density and apolipoproteins contents are used to classify lipoproteins.

(4 marks)

(b) Mr. Johan, a 42-year-old male with poorly controlled Type 2 Diabetes, presents for a lipid screening. During the laboratory process, the technologist observes that the plasma sample has a creamy, milky layer floating on top after being refrigerated overnight. The laboratory results show a Triglyceride level of 650 mg/dL (Ref: <150 mg/dL).

i. Identify the specific Lipoprotein responsible for the creamy layer observed in the refrigerated plasma.

(2 marks)

ii. Define Secondary Dyslipedemia and discuss how Mr. Johan's Type 2 Diabetes contributes to his elevated lipid levels.

(5 marks)

iii. State sample condition that must be fulfilled to ensure the Friedewald formula provides a valid estimation of cholesterols (LDL, VLDL, HDL and Total Cholesterol).

(4 marks)

Question 4

Answer **ALL** the following questions:

(a) Briefly explain the following:

i. Type 1 Diabetes Mellitus.

(3 marks)

ii. Type 2 Diabetes Mellitus.

(3 marks)

(b) State **TWO (2)** reasons why the grey-top tube is used in glucose measurement.

(4 marks)

(c) Mr. Kumar, a 55-year-old male with a BMI of 32 kg/m^2 (Obesity Class I), presents for a routine check-up. He reports persistent thirst and frequent urination. His laboratory results show a Fasting Plasma Glucose of 8.05 mmol/L and an HbA_{1c} of 8.2 %.

i. Identify the most likely type of Diabetes Mellitus and justify your answer.

(3 marks)

ii. Explain why HbA1c is a superior marker for monitoring this patient's long-term control compared to a single fasting glucose measurement.

(4 marks)

iii. Suggest a lifestyle modifications that Mr. Kumar can implement to help manage or potentially reverse his hyperglycemia.

(2 marks)

iv. Define polydipsia, polyphagia, and polyuria as symptoms associated with hyperglycemia that Mr. Kumar might be experiencing.

(6 marks)

END OF EXAMINATION PAPER