UNIVERSITI KUALA LUMPUR
INSTITUTE OF MEDICAL SCIENCE TECHNOLOGY

FINAL EXAMINATION

OCTOBER 2025 SEMESTER

COURSE CODE	:	HDB30404
COURSE TITLE	:	CLINICAL BIOCHEMISTRY
PROGRAMME NAME	:	BACHELOR OF BIOMEDICAL SCIENCE (HONOURS)
DATE	:	28 JANUARY 2026
TIME	:	2:00PM - 5:00PM
DURATION	:	3 HOURS

Universiti Kuala Lumpur
ACADEMIC DEPT
MESTECH

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. Answer ALL questions for Section A.
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 16 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 40 marks)

Answer ALL questions.

Please use the answer booklet provided.

1. Which sampling error occurs when a tourniquet is left on the arm too long during venipuncture?

   A. Incorrect container

   B. Prolonged stasis

   C. Timing error

   D. Insufficient sample

2. Which of the following is frequently associated with a low Albumin/Globulin (A/G) ratio?

   A. Liver cirrhosis or chronic hepatitis.

   B. Excessive production of immunoglobulins (e.g., Multiple Myeloma).

   C. Nephrotic syndrome (protein loss through kidneys).

   D. All of the above.

3. Which receptor is tested in breast cancer patients to determine their response to Herceptin therapy?

   A. Vanillylmandelic acid (VMA)

   B. Human epidermal growth factor receptor 2 (Her-2)

   C. Cancer antigen 19-9 (CA 19-9)

   D. Prostate specific antigen (PSA)

4. Which of the following is an oncofetal antigen?

   A. Alkaline phosphatase

   B. Prostate specific antigen

   C. Alpha fetoprotein

   D. Cancer antigen 125

5. The basic functional unit of the kidney is the _____.

   A. nephron

   B. ureter

   C. bladder

   D. pelvis

6. Which type of Acute Renal Failure (ARF) is caused by an obstruction in the urinary tract after the kidney?

   A. Chronic

   B. Intrarenal

   C. Post-renal

   D. Pre-renal

7. Choose the correct name of the supernatant fluid obtained when blood is allowed to clot?

   A. Whole blood

   B. Serum

   C. Plasma

   D. Fibrinogen

8. Which specific diagnostic test is utilized to measure the production of hydrogen (H^+) by bacterial fermentation in the colon?

   A. D-xylose test

   B. Shilling test

   C. Fecal fat analysis

   D. Lactose breath test

9. Which method is most commonly used for the detection of tumor markers in the laboratory?

   A. Gel electrophoresis

   B. Immunoassay

   C. High performance liquid chromatography

   D. Microscopy

10. Which drug group is commonly monitored via therapeutic drug monitoring (TDM) to prevent toxicity while ensuring efficacy?

    A. Antibiotics

    B. Vitamins

    C. Antacids

    D. Carbohydrates

11. Which plasma protein is an acute-phase protein involved in the innate immune response?

    A. Albumin

    B. C-reactive protein

    C. Insulin

    D. Hemoglobin

12. Prediabetes is typically characterized by _____.

    A. low blood pressure

    B. decreased insulin sensitivity

    C. complete lack of insulin production

    D. high levels of hemoglobin

13. Which specific plasma protein's deficiency is most likely to lead to the development of edema?

    A. Fibrinogen

    B. Gamma globulin

    C. Albumin

    D. Alpha-fetoprotein

14. Which tumor marker is commonly used to monitor gestational trophoblastic diseases like choriocarcinoma?

    A. Alpha feto protein (AFP)

    B. Carcinoembryonic antigen (CEA)

    C. Human chorionic gonadotrophin (hCG)

    D. Prostate specific antigen (PSA)

15. Which system is activated as a compensating mechanism for the body's response to an underlying respiratory cause of acid-base imbalance?

    A. Hepatic mechanisms

    B. Cardiovascular mechanisms

    C. Renal mechanisms

    D. Endocrine mechanisms

16. A patient's blood pH level below 7.35 indicates _____.

    A. acidosis

    B. alkalosis

    C. complete compensation

    D. hyperkalemia

17. The term "hyperglycemia" refers to _____.

    A. low levels of ketones

    B. high levels of glucose in the blood

    C. high levels of insulin

    D. low levels of sodium

18. Which term is defined as the volume of plasma from which a substance is completely removed into the urine per unit of time?

    A. Osmolality

    B. Filtration

    C. Specific gravity

    D. Renal clearance

19. Which safety equipment is specifically used for the disposal of chemical leaks?

    A. Spill kits

    B. Eye washer

    C. Fume hood

    D. Fire extinguisher

20. Which specific test is used to assess mucosal absorption of the small intestine?

A. Amylase test

B. Fecal fat analysis

C. D-Xylose test

D. Gastrin analysis

21. The primary purpose of performing a nutritional assessment is to investigate _____.

A. the cause of malabsorption and maldigestion

B. the individual's socioeconomic background and clinical data

C. the drug-nutrient interactions in the individual's medical history

D. whether an individual's physiologic need is met by their individual nutrient status

22. For which clinical application are tumor markers considered most useful?

A. Routine screening of the general healthy population.

B. Monitoring treatment efficacy and detecting recurrence.

C. Definitive diagnosis of cancer in the early stages.

D. Replacing medical imaging like CT scans.

23. Total protein measurement in clinical chemistry is typically used to assess _____.

A. bone density

B. liver and kidney function

C. nerve conduction

D. lung capacity

24. Which condition results in "Respiratory Alkalosis"?

A. Kidney failure

B. Hyperventilation

C. Obstructive emphysema

D. Severe diarrhea

25. Metabolic compensation for a respiratory acid-base imbalance is mostly performed by the _____.

A. kidneys

B. heart

C. intestine

D. liver

26. Which protein carries iron in the plasma?

A. Transferrin

B. Ceruloplasmin

C. Haptoglobin

D. Albumin

27. The important clinical application of Carcinoembryonic Antigen (CEA) is _____.

A. monitoring colorectal cancer response to therapy

B. diagnosing acute pancreatitis

C. monitoring pregnancy

D. screening for prostate cancer

28. Which of the following causes metabolic alkalosis?

A. Excessive vomiting

B. Hyperventilation

C. Accumulation of lactic acid

D. Keto acid accumulation

29. Which test is traditionally used to differentiate between the three main causes of vitamin B_{12} deficiency?

A. Gastrin analysis

B. Sudan III stain

C. Folate analysis

D. Shilling test

30. Which plasma bilirubin concentration typically leads to the yellow color of the skin and eyes, known as jaundice?

A. 50 mg/dL

B. 1.0 mg/dL

C. 5.2 mg/dL

D. 0.2 mg/dL

31. Which major anion maintains the dominant buffering system of plasma?

A. Phosphate

B. Bicarbonate ion

C. Sulfate

D. Chloride

32. Which hormone is secreted by the posterior pituitary in response to increased plasma osmolality, leading to increased water reabsorption by the renal collecting ducts?

A. Aldosterone

B. Renin

C. Natriuretic peptides

D. Arginine vasopressin

33. The protein that strongly attracts and retains water within the vascular system, providing oncotic pressure is _____.

A. globulin

B. fibrinogen

C. albumin

D. transferrin

34. Which acid-base category uses bicarbonate concentration as the primary indicator?

A. Metabolic

B. Gaseous

C. Volatile

D. Respiratory

35. An increase in both ALT and AST levels is commonly associated with _____.

A. hepatitis

B. biliary obstruction

C. kidney stone

D. bone disease

36. Which type of malnutrition involves deficiencies in carbohydrates, lipids, and proteins?

A. Mineral excess

B. Micronutrient

C. Vitamin deficiency

D. Macronutrient

37. Which condition is caused by a deficiency of Erythropoietin in renal patients?

A. Muscle cramps

B. Bloating

C. Anemia

D. Weight loss

38. Obesity increases the risk of endometrial cancer. Which hormone is thought to mediate this effect?

A. Thyroxine

B. Insulin-like growth factor-1

C. Oestrogen

D. Testosterone

39. Which of the following statements about plasma lipoproteins is correct?

A. They have a hydrophobic core of phospholipid and apolipoproteins.

B. They have a hydrophobic core of triacylglycerol and cholesterol esters.

C. They have a hydrophilic core of triacylglycerol and cholesterol esters.

D. They have a hydrophobic core of phospholipids and free cholesterol.

40. The major anion of the extracellular fluid (ECF) that passively moves with Na^+ to maintain neutral electrical charge is _____.

A. phosphate

B. sulfate

C. chloride

D. bicarbonate

SECTION B (Total: 60 marks)

Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 1

Answer **ALL** of the following questions:

(a) A 60-year-old female presents with the following lipid panel: Total Cholesterol: 240 mg/dL, Triglycerides: 180 mg/dL, and HDL: 40 mg/dL.

i. State the Friedewald formula for calculating LDL.

(2 marks)

ii. Calculate this patient's VLDL and LDL levels using the provided data.

(6 marks)

iii. Identify **ONE (1)** condition where the Friedewald formula can't be used.

(2 marks)

(b) Elaborate the purpose of Triglyceride (TG) measurement, the sample collection process, and the method of detection.

(10 marks)

Question 2

Answer **ALL** of the following questions:

(a) A 45-year-old female patient had her blood drawn for a potassium and Lactate Dehydrogenase (LDH) test. The sample was left near a direct sunlight window for three hours before being centrifuged. The resulting plasma appeared visibly pinkish color (hemolysis).

i. Outline **THREE (3)** pre-analytical contributing errors evident in this scenario.

(6 marks)

ii. Explain how these specific errors would falsely alter the results of potassium and LDH, and describe the potential danger to the patient's management.

(4 marks)

(b) Discuss the responsibilities of a laboratory scientist in relation to patient result processing, reporting, and laboratory management.

(10 marks)

Question 3

Answer **ALL** of the following questions:

(a) A 48-year-old patient presents with yellowing of the skin and sclera. Laboratory investigation reveals the following results: Total Bilirubin of 4.5 mg/dL (or 77 µmol/L), Conjugated (Direct) Bilirubin of 0.4 mg/dL, Alanine Aminotransferase (ALT) of 40 U/L, and Aspartate Aminotransferase (AST) of 45 U/L.

Reference Values: Total Bilirubin: 0.2 - 1.2 mg/dL; Conjugated Bilirubin: 0.0 - 0.3 mg/dL; Unconjugated Bilirubin: 0.2 - 0.8 mg/dL; *ALT: 7 - 55 U/L; AST: 8 - 48 U/L.*

i. Calculate the Unconjugated (Indirect) Bilirubin level.

(3 marks)

ii. Based on the normal ALT and AST levels combined with the high Unconjugated Bilirubin, determine if the jaundice is likely pre-hepatic, hepatocellular, or obstructive.

(3 marks)

iii. Explain the role of the liver in the conjugation of bilirubin.

(4 marks)

(b) Elaborate the key metabolic and physiological functions of the liver as a central organ in the human body.

(10 marks)

Question 4

Answer **ALL** of the following questions:

(a) Pharmacokinetics describes how the body affects a drug, including absorption, distribution, metabolism, and excretion.

i. Identify **THREE (3)** different drug groups that require therapeutic drug monitoring (TDM) and provide one specific drug example for each.

(6 marks)

ii. Describe the reactions involved in the hepatic metabolism of therapeutic drugs.

(4 marks)

(b) Discuss therapeutic drug monitoring (TDM) by elaborating on its purpose, goals, and the importance of drug concentration in the blood.

(10 marks)

END OF EXAMINATION PAPER