

P0114



RAN - 2506000101032701

RAN-2506000101032701/2406000101030701

First Year M.B.B.S. Examination September - 2025

Biochemistry (Paper - I) Level - 3

Time: 3 Hours]

[Total Marks: 100

સૂચના : / Instructions

(1)

નીચે દર્શાવેલ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.

Fill up strictly the details of signs on your answer book

Name of the Examination:

First Year M.B.B.S.

Name of the Subject :

Biochemistry (Paper - I) Level - 3

Subject Code No.: 2506000101032701/2406000101030701

Seat No.:

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Student's Signature

Instructions for Section A:

- (2) All questions are compulsory.
- (3) Each MCQ has only one correct answer.
- (4) One Mark for correct answer. No negative marking.

SECTION : A

(1 × 20 = 20)

1. If blood for glucose estimation is collected in a tube without fluoride, what error may occur?
 - a. Falsely high glucose due to hemolysis
 - b. Falsely low glucose due to ongoing glycolysis
 - c. No change in glucose level
 - d. Falsely elevated sodium level
2. A 7-day-old male neonate is brought to the emergency room with bleeding from the umbilical stump and fresh blood in stools. There is no family history of bleeding disorders. On examination, the baby is pale, irritable, and has mild hepatomegaly. Laboratory findings reveal Prolonged prothrombin time and, low levels of clotting factors II, VII, IX, and X. Which of the following deficiency leads to this condition?
 - a. Vitamin A
 - b. Vitamin D
 - c. Vitamin E
 - d. Vitamin K

3. Gaucher's disease is due to deficiency of the enzyme:
 - a. Sphingomyelinase
 - b. Glucocerebrosidase
 - c. α -Galactosidase
 - d. β -Galactosidase
4. A 32-year-old female working in a laboratory accidentally ingests cyanide and is rushed to the hospital. She is declared dead upon reaching the hospital. Which complex of the electron transport chain is most likely inhibited by cyanide?
 - a. Complex I (NADH dehydrogenase)
 - b. Complex II (Succinate dehydrogenase)
 - c. Complex III (Cytochrome bc_1 complex)
 - d. Complex IV (Cytochrome c oxidase)
5. Which one of the following molecules act as a donor in detoxification by Conjugation.
 - a. S-Adenosine Methionine (SAM)
 - b. Glutathione (GSH)
 - c. Phospho-adenosine phosphosulphate (PAPS)
 - d. All the above
6. All the following are detoxifying agents except:
 - a. Glycine
 - b. Glutathione
 - c. Glucuronic Acid
 - d. Glycogen
7. Which vitamin is required for transamination reactions?
 - a. Biotin
 - b. Pyridoxine (Vitamin B6)
 - c. Vitamin K
 - d. Thiamine (Vitamin B1)
8. The most important extracellular buffer is:
 - a. Carbonic acid-bicarbonate buffer
 - b. Phosphate buffer
 - c. Haemoglobin buffer
 - d. None of the above

9. A 15-year-old girl from a hilly village presents with a gradually enlarging swelling in the front of her neck over the past year. On examination, the thyroid is diffusely enlarged but non-tender. She has no signs of hyperthyroidism or hypothyroidism. Her diet mainly consists of locally grown vegetables and has limited access to iodized salt. Which of the following mineral deficiency is associated with this condition?
- Iodine
 - Iron
 - Zinc
 - Magnesium
10. A 28-year-old woman with a history of chronic vomiting due to a gastric outlet obstruction presents with weakness and muscle cramps. ABG reveals: pH = 7.50, $\text{HCO}_3^- = 32 \text{ mEq/L}$, $\text{PaCO}_2 = 48 \text{ mmHg}$, $\text{K}^+ = 2.9 \text{ mEq/L}$, $\text{Cl}^- = 91 \text{ mEq/L}$. What is the most likely acid-base disorder?
- Respiratory acidosis
 - Metabolic acidosis with respiratory compensation
 - Metabolic alkalosis with respiratory compensation
 - Mixed acid-base disorder
11. A 35-year male was brought to emergency in an unconscious state. He was a habitual drinker. When his blood sample was analyzed, blood glucose levels were found to be low (48 mg/dL). Blood glucose levels were low due to:
- Increase in the catabolism of blood glucose
 - Increased availability of NAD^+
 - Decreased availability of pyruvate and oxaloacetate
 - Increased availability of NADPH
12. Which of the following amino acids can act as anaplerotic sources by conversion into TCA cycle intermediates?
- Leucine and lysine
 - Glutamate and aspartate
 - Tyrosine and phenylalanine
 - Tryptophan and histidine
13. A medical student has been studying for exams, and neglects to eat anything for 12 hours. At this point, the student opens a large packet of potato chips and eats every one of them in a short period. Which one of the following is elevated in his plasma?
- Chylomicrons
 - Glucagon
 - Acetolactate
 - Free fatty acids

14. All of the following serve as cofactors for enzymes of TCA cycle, except:
- a. Biotin
 - b. Pantothenic Acid
 - c. Riboflavin
 - d. Niacin
15. A hypochromic microcytic anemia with increased iron stores in the bone marrow may be
- a. Iron responsive
 - b. Pyridoxine responsive
 - c. Vitamin B12 responsive
 - d. Folate responsive
16. A person with Type 1 diabetes went on a trip and ran out of insulin, after 4 days she felt lethargic, nauseous, and had difficulty standing. After appropriate treatment, which one of the following liver enzymes would be reduced in activity as compared to before treatment?
- a. Phosphofructokinase - 2
 - b. Pyruvate dehydrogenase
 - c. Pyruvate kinase
 - d. Fructose 1, 6 - bisphosphatase
17. Ribosomes are primarily involved in which of the following processes?
- a. Lipid synthesis
 - b. Protein synthesis
 - c. DNA replication
 - d. Detoxification
18. A 3-month-old girl is developing cataracts. Other than not having a social smile or being able to track objects visually, all other aspects of the girl's examination are normal. Tests on the baby's urine are positive for reducing sugar but negative for glucose, which enzyme is most likely deficient in this girl?
- a. Aldolase B
 - b. Fructokinase
 - c. Galactokinase
 - d. Galactose 1-phosphate uridylyltransferase
19. Superoxide dismutase protects the cell by converting superoxide radicals into:
- a. Oxygen and water
 - b. Nitric oxide
 - c. Hydrogen peroxide
 - d. Hydroxyl radicals

20. A 32-year-old poorly controlled diabetic pregnant lady is undergoing amniocentesis at 36 weeks for fetal lung maturity prior to having a caesarean delivery. Which of the following laboratory tests results on the amniotic fluid would best indicate that the Fetal lungs are mature?
- Phosphatidylglycerol is present
 - Lecithin/sphingomyelin (L/S) ratio of 1:1
 - Cephalin is present
 - Phosphatidylinositol is present

Instructions for Section B and C:

- 1) Use Blue/Black Ball-point pen only.
- 2) The numbers on the right indicates full marks.
- 3) Draw Labelled diagrams wherever necessary.

SECTION: B

Q. 2. Long Question-Answers. (1 out of 2) (1×10 =10)

1. What is glycolysis? What is the importance of glycolysis? Describe the pathway of Glycolysis including energetics and Regulation (1+2+5+1+1)
2. Describe at least six risk factors for Atherosclerosis. Describe LDL-cholesterol metabolism. Describe the causes of primary familial hypercholesterolemia. Explain the basis of using the 'Statin' group of drugs to reduce cholesterol levels. (3+3+2+2)

Q. 3. Justification Questions. (5 out of 6) (5×3 =15)

1. Biotin is known as Anti-egg white injury factor
2. Septic shock leads to metabolic acidosis.
3. Liver the primary site for xenobiotic metabolism.
4. Acute respiratory distress syndrome is seen more frequently in premature infants
5. Calcium level in blood is increased by parathyroid hormone. Explain.
6. Eating raw fish causes thiamine deficiency, Explain.

Q. 4. Short Notes. (3 out of 4)

(3×5=15)

1. Describe Protein Energy Malnutrition.
2. Pentose Phosphate Pathway
3. Ketone bodies - synthesis, breakdown and regulation.
4. Describe the sources, requirement and deficiency manifestation of Vitamin A.

SECTION: C

Q. 5. Clinical Aspects/Cases.

(4×5 =20)

1. A 10-year-old girl presented with excessive tiredness, poor appetite, inability to concentrate and tingling sensations. On examination, there was pallor. Laboratory examination revealed a decrease in hemoglobin, ferritin, and MCV. Total iron-binding capacity (TIBC), transferrin, and Red Cell Distribution Width (RDW) were increased. She was diagnosed with iron deficiency anemia.
 - a. Explain how iron is conserved in our body. (2)
 - b. Explain the role of various proteins in iron absorption. (3)
2. A 4-year-old boy is brought to the paediatric outpatient department by his mother with complaints of bowing of the legs and delayed walking. The child appears underweight for his age. On examination, there is frontal bossing, widening of the wrists, and a "rachitic rosary" along the rib cage. His diet mainly consists of cereal-based meals, and he rarely plays outside. A chest X-ray reveals cupping and fraying at the metaphyseal ends of long bones. Blood tests report was as below,
Serum Calcium: 7.5 mg/dl (Reference range 8.5 – 10.5 mg/dl)
Serum Phosphate: 2.7 mg/dl (Reference range: 3.5 – 4.5 mg/dl)
Vitamin D3: 20 ng/ml (Reference range: 30-50 ng/ml)
 - a. What is the most likely diagnosis and which clinical signs point towards it? (2)
 - b. Explain the role of Vitamin D in calcium and phosphate metabolism. (2)
 - c. What are the dietary and non-dietary measures to prevent Vitamin D deficiency in children? (1)

3. A 65-year-old man was brought to the hospital in a semiconscious state. The patient displayed a typical hyper ventilatory breathing pattern with fruity smell in his breath. The pulse was feeble and hypotension was noted. The laboratory reports were ordered and were as below:
- | | |
|--|---------------------------------------|
| pH: 7.10 | Serum Na ⁺ : 135.5 mmol/L, |
| pCO ₂ :39.0 mm of Hg | Serum K ⁺ : 6.5mmol/L |
| HCO ₃ ⁻ :14.0 mmol/L | Serum Cl ⁻ : 90mmol/L |
| Random Blood Sugar: 451 mg/dl. | |
- Identify the acid base disorder in above case with justification. (1)
 - Calculate Anion Gap. (1)
 - Give any 2 causes of High Anion Gap Metabolic Acidosis. (1)
 - Explain the basis of hyperkalemia in this case. (2)
4. 45-year-old female with Body Mass Index (BMI) of 35 kg/m² and diagnosis of diabetes mellitus (DM) for 7 years came to Medicine OPD for increased frequency of micturition, tingling and numbness in bilateral palm and soles, diarrhea and history of not taking any treatment for DM for last 3 months. Clinician advised report of random plasma glucose; the result was 332 mg/dl. The clinician advised report of fasting and post prandial plasma glucose; the result was 276 mg/dl and 567 mg/dl respectively.
- What is a diagnostic criterion for diagnosis of DM based on plasma glucose concentration (WHO criteria)? (2)
 - Why uncontrolled diabetes mellitus leads to ketosis? (1)
 - Write acute and chronic complication of Diabetes mellitus. (2)

Q. 6. Short Notes.

(4×5=20)

- Describe and discuss commitment to lifelong learning as an important part of physician's life.
- Free radical scavenging system.
- Inhibitors of Electron Transport Chain.
- Clinical significance of Phospholipids

P0116



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First Year M.B.B.S. Examination September - 2025

Biochemistry (Paper - II) Level - 3

Time: 3 Hours]

[Total Marks: 100

સૂચના : / Instructions

- (1) નીચે દર્શાવેલ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the details of signs on your answer book
- Name of the Examination:
First Year M.B.B.S.
- Name of the Subject :
Biochemistry (Paper - II) Level - 3
- Subject Code No.: 2506000101032702 /2406000101030702

Seat No.:

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Student's Signature

Instructions for Section A:

- (2) All questions are compulsory.
- (3) Each MCQ has only one correct answer.
- (4) One Mark for correct answer. No negative marking.

SECTION: A

Q. I. Multiple Choice Question.

(1 × 20 =20)

1. A 26-year-old woman is brought to the emergency department with complaints of severe lower abdominal pain, anxiety, muscle weakness, and tingling in her hands and feet. She reports no fever, vomiting, or diarrhea. She mentions starting a new weight-loss diet and took over-the-counter herbal supplements for the past week. She had a similar episode six months ago after recovering from a viral illness. Physical examination reveals mild tachycardia but a soft, non-tender abdomen. Her urine is reddish-brown and turns dark purple upon standing in light. No signs of infection or inflammation are noted. Which of the following is the most likely diagnosis?
 - a. Lead poisoning
 - b. Acute intermittent porphyria
 - c. Crohn's disease
 - d. Renal colic

2. A child with short stature, brittle bone and blue sclera is found to have mutation in collagen. Which of the following is the recurring amino acid is the most likely to be altered in mutation that distort collagen molecule?
 - a. Glycine
 - b. Asine
 - c. Proline
 - d. Tryptophan
3. Which of the following is the correct sequence in the degradation of heme?
 - a. Heme → Bilirubin → Biliverdin → Urobilinogen
 - b. Heme → Biliverdin → Bilirubin → Urobilinogen
 - c. Heme → Urobilinogen → Biliverdin → Bilirubin
 - d. Heme → Bilirubin → Urobilinogen → Biliverdin
4. Enzyme A digest protein in stomach and Enzyme B digests proteins in small intestine, which of the following is not true?
 - a. Enzyme A would be denatured in the small intestine.
 - b. Enzyme A works best in acidic conditions.
 - c. Enzyme A can also work in the small intestine.
 - d. Enzyme A helps in the hydrolysis of proteins
5. A 30-year-old woman presents with low-grade fever, dry cough, and mild chest discomfort for one week. Chest X-ray reveals patchy infiltrates. Laboratory tests and clinical findings suggest atypical pneumonia, most likely due to *Mycoplasma pneumoniae*. She is started on erythromycin. Erythromycin helps treat this infection by interfering with which one of the following bacterial processes?
 - a. DNA replication
 - b. Elongation of protein synthesis
 - c. Cell wall synthesis
 - d. Folate metabolism
6. An operon is best described by:
 - a. A constitutively expressed gene system
 - b. An unregulated gene system
 - c. A co-ordinately regulated gene system
 - d. A gene that produces a monocistronic mRNA

7. The role of Taq polymerase in PCR is critical because:
- It can synthesize RNA from DNA
 - It binds to primers during denaturation
 - It is stable at high temperatures and catalyzes DNA synthesis
 - It regulates the melting temperature of the DNA template
8. Which of the following chromatographic techniques is based on molecular size?
- Gel filtration chromatography
 - Ion exchange chromatography
 - Paper chromatography
 - Affinity chromatography
9. Which specific DNA sequence does the hormone-receptor complex interact with to regulate gene transcription?
- TATA box
 - CAAT box
 - Hormone response element
 - Promoter enhancer region
10. Lesch-Nyhan syndrome is due to the lack of:
- Adenine Phosphoribosyltransferase
 - Adenosine deaminase
 - Hypoxanthine-Guanine Phosphoribosyltransferase
 - PRPP amidotransferase
11. Which of the following biomarkers is most commonly used to monitor epithelial ovarian cancer?
- Beta-human chorionic gonadotropin (β -hCG)
 - Alpha-fetoprotein (AFP)
 - Cancer antigen 125 (CA-125)
 - Carcinoembryonic antigen (CEA)
12. Anticancer drug 5' fluorouracil inhibits enzyme:
- Thymidylate synthase
 - Adenosine kinase
 - PRPP synthetase
 - Nucleoside phosphorylase

13. All are oncogene products, except
 - a. Growth factors
 - b. Tyrosine kinase
 - c. Interleukin - 2
 - d. Transcription factors
14. The human immunodeficiency virus:
 - a. Has two RNA strands as its genetic material
 - b. Infection is spread by mosquito
 - c. Is diagnosed by immune electrophoresis
 - d. Provides resistance to the patient against other viral infections
15. Which of the following enzymes is most commonly used in ELISA techniques?
 - a. Amylase
 - b. Urease
 - c. Horseradish peroxidase
 - d. DNA polymerase
16. In reversible non-competitive enzyme activity inhibition
 - a. Inhibitor bears structural resemblance to substrate
 - b. Inhibitor lowers the maximum velocity attainable with a given amount of enzyme
 - c. K_m is increased
 - d. K_m is decreased
17. HIV primarily targets which of the following cells?
 - a. B lymphocytes
 - b. CD8+T cells
 - c. CD4+ T helper cells
 - d. Natural killer cells
18. Enzyme responsible for respiratory burst is:
 - a. NADPH Oxidase
 - b. Nitric oxide synthase
 - c. Glutathione peroxidase
 - d. Catalase

19. Plasma differs from serum by the presence of:
- Albumin
 - Globulin
 - Fibrinogen
 - Immunoglobulin
20. In Maple syrup urine disease, which of the following compound is accumulated?
- Homogentisate
 - Methylmalonyl-CoA
 - Branched chain alpha keto acid
 - Homocysteine

Instructions for Section B and C:

- (1) Use Blue/Black Ball-point pen only.
- (2) The numbers on the right indicates full marks.
- (3) Draw Labelled diagrams wherever necessary.

SECTION- B

Q. 2. Long Question -A Answers. (1 out of 2) (1 × 10 = 10)

1. Describe the metabolism of Phenylalanine. Enumerate important biological product synthesized from tyrosine. Add a note on various inborn error of metabolism related to tyrosine (3+2+5)
2. Describe replication of DNA in prokaryotes. Add a note on inhibitors of replication in prokaryotes. (6+4)

Q. 3. Justification Questions (5 out of 6) (5 × 3 = 15)

1. Creatinine clearance is considered better than urea clearance.
2. Telomerase are involved in ageing process. Justify
3. Alpha-1 antitrypsin deficiency leads to development of emphysema.
4. Persons with sickle cell are resistant to malaria.
5. Hypoalbuminemia leads to fluid retention in interstitial space.
6. Gout cause pain in first metatarsophalangeal joint pain. Explain.

Q. 4. Short Notes. (3 out of 4)**(3 × 5 = 15)**

1. Describe Urea cycle and its regulation
2. Thyroid Function Test
3. Homocysteinuria
4. Heme Catabolism

SECTION: C**Q. 5. Short Notes & Clinical Aspects****(4 × 5 = 20)**

1. A 48-year-old male arrives to emergency room with acute-onset chest discomfort and palpitations that began 30 minutes ago while he was at rest. He has no prior cardiac history but admits to frequent fast-food meals and minimal exercise. His blood pressure is low at 90/60 mmHg. ECG shows a new onset left bundle branch block. Laboratory investigations are as given below,

Test	Result	Reference Range
CK-MB (Creatine Kinase-MB)	79 U/L	< 24 U/L
Total CK (Creatine Kinase)	410 U/L	40-200 U/L
LDH (Lactate Dehydrogenase)	730 U/L	140-280 U/L
AST (SGOT)	73 U/L	5-40 U/L
Serum Cholesterol	259 mg/dL	< 200 mg/dL
Random Blood Sugar	197 mg/dL	< 140 mg/dL

- a. What is the provisional diagnosis? (1)
 - b. Write significance of different enzymes in the diagnosis of this condition. (3)
 - c. Mention two non-enzymatic biomarkers used for detection of this disease. (1)
2. A 6-year-old boy was brought to the hospital with complaints of swelling around the eyes noticed for the past 5 days, which gradually spread to the legs and abdomen. The child also had decreased urine output and frothy urine, but no fever or signs of infection. On examination, there was periorbital edema, pitting pedal edema, and mild ascites. Blood pressure was normal. Urinalysis showed 3+ proteinuria, and blood tests revealed low serum albumin (2.0 g/dL), high serum cholesterol, and normal renal function tests.

- a. What is the most likely diagnosis? (1)
 - b. Explain the reason for edema formation in this condition. (2)
 - c. Why is serum cholesterol elevated in nephrotic syndrome? (2)
3. A 52 years old, chronic alcoholic admitted to the hospital in a serious condition. His daughter found him in an unconscious state when she had come to see him in the morning. One and a half empty bottles of alcohol were found in the room. When the alcohol was examined for its contents, it was found to be containing high amount of methanol. Doctors on duty diagnosed that it was a case of methanol intoxication and decided to start the intravenous infusion of ethanol.
- a. Why methanol is toxic? How methanol and ethanol are metabolized in the body? (2)
 - b. Write the classification of enzymes. (2)
 - c. Why ethanol is given as treatment in methanol poisoning? Write its principle and biochemical basis. (1)
4. A 4-day-old female infant is admitted with progressive yellow discoloration of her skin and sclera, noticed by her mother since the second day of life. She was born at term by vaginal delivery, birth weight 3.1 kg. There are no antenatal or perinatal complications. On examination, she is feeding well and active. Laboratory tests show:
- Serum Total Bilirubin: 13.3 mg/dL
 Direct (Conjugated) Bilirubin: 0.4 mg/dL
 Indirect (Unconjugated) Bilirubin: 12.9 mg/dL
- Phototherapy was started, and daily bilirubin monitoring was advised.
 Diagnosis: uncomplicated physiological jaundice
- a. What is the diagnosis? Why do many neonates suffer from jaundice? (1)
 - b. Enumerate the site & steps of bilirubin synthesis in the body. (3)
 - c. How is phototherapy helpful in this condition? (1)

Q.6. Short Notes.

(4 × 5 = 20)

1. Role of Physician in Healthcare
2. DNA Repair Mechanism
3. Recombinant DNA Technology
4. Enzymes inhibition