



All India Institute of Medical Sciences, Bhubaneswar

1st Professional MBBS Examination 2019

Time: 3 Hrs

Biochemistry (Paper - I)

Max. Marks: 100

INSTRUCTIONS:

- Answer all questions.
- Answer Sections A and B in separate answer booklets.
- Write answers in sequence.
- Strike off all blank pages.
- On additional answer sheets, do not write your Roll number.
- Mention the number of additional answer sheets used and the sheet number on page one of the main answer booklets.

SECTION A (50 marks)

1. Study the clinical features of the case that is narrated below and answer the following questions related to the case: (5+5=10) 17-10-19

A 24-year-old call-centre employee who was otherwise healthy decided to take part in a marathon race. He never had regular physical exercise. He developed shallow breathing, severe muscle cramps, weakness and abdominal pain after a marathon race. His arterial blood pH was 7.0, HCO_3^- was 20 ml/dl and pCO_2 was 34 ml/dl. The physician explained that it is due to lack of oxygen supply during strenuous ^{unaccustomed} exercise and the accumulation of a metabolic end product in the muscles. 90-97

- a. Name the metabolic end product that has led to this clinical condition. Mention the metabolic pathway(s) that produce this metabolic end product. What is/are the metabolic fate(s) of this end product? How has that end product produced in excess amount in this case?
- b. Write the reference/normal range of arterial blood pH, bicarbonate and pCO_2 levels. Comment on the acid base status and its compensation, if any in the patient with justification.
2. Write short notes on the following (the aspects to be addressed are given in bracket): (4 x 2.5=10)
- a. Active transport across plasma membrane (definition, write two characteristics and cite an example).
- b. Secondary structures of proteins (list four names of different secondary structures and name the chemical bond(s) responsible for the formation these structures).
- c. Uncouplers of oxidative phosphorylation (definition, two examples and mechanism of action).
- d. Dietary fibre: (Definition, example of one soluble and one insoluble dietary fibre, one therapeutic indication and one therapeutic contraindication).



3. (2x5=10)
- Draw a flowchart to explain/ describe the flow of electrons through respiratory chain present in inner membrane of mitochondria and site of action of its inhibitors
 - Draw a labelled diagram of fatty acid synthase complex showing its quaternary structure, functional units, domains and location of enzymes in those domains.
4. **Compare and contrast:** (2x5=10)
- Diabetic ketosis and starvation ketosis
 - Hepatic porphyria and erythropoietic porphyria
5. **Explain why/how:** (4x2.5=10)
- Phenylketonuria is associated with hypopigmentation of skin.
 - Patients with galactosemia are susceptible to develop cataract.
 - Fetal Hemoglobin draws oxygen from maternal blood
 - Histidine load test (HGU excretion) is positive in folic acid deficiency.

SECTION B (50 marks)

6. **Study the clinical features of the case that is narrated below and answer the following questions related to the case:** (3+3+3+1=10)
- A 10yr old boy attended a primary health centre with weakness and lethargy. He was anaemic, given treatment for tape worm and oral iron therapy for 6wks. His anaemia did not improve. A blood smear examination ruled out megaloblastic anaemia but showed features suggestive of chronic haemolytic anaemia. His other blood investigation report was as given below:
- Serum ferritin level: high
 - Serum transferrin level: low
 - Transferrin saturation: very high
 - Total iron binding capacity (TIBC): low
 - Serum haptoglobin level: very low.
- He was treated with blood transfusion, iron chelating agent and was advised to take folic acid tablet regularly with significant improvement.
- Name an enzymatic defect of carbohydrate metabolism that can ^{cause} such haemolytic anaemia? Explain how this defect leads to anaemia.
 - Comment on iron status of the patient and justify your answer from the above investigation report.
 - Write the function of serum haptoglobin. Why was its level so low in this case?
 - Although megaloblastic anaemia was ruled out, why was the patient advised to take folic acid? Name another vitamin the deficiency of which can cause megaloblastic anaemia.



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Time: 3 Hrs Biochemistry (Paper-II) Max. Marks: 100

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SECTION A (50 marks)

1. Study the clinical features of the case that is narrated below and answer the following questions related to the case: (4+2+4=10)

A 3 months old male had repeated episodes of tetany and low serum parathyroid hormone (PTH) level. He had multiple congenital defects of body parts that develop from 3rd and 4th pharyngeal pouches. He had repeated viral and fungal infections since birth. His thymus was hypoplastic. There was depletion of T-cells in lymph nodes. Serum immunoglobulin level was normal.

- What is the most likely diagnosis in this condition? Justify your answer.
- How can low PTH level explained in this condition?
- Comment on B-cell function in this case. Name a primary immunodeficiency disease in which both cellular and humoral immune functions are impaired.

2. Write short notes on the following (the aspects to be addressed are given in bracket):

(2x 5=10)

- Free radicles (definition, list two free radicles generated by immunocytes, write two physiological functions and two pathological effects of free radicles, depict how vitamin C can neutralise free radicles).
- Obesity (Definition, two causes, two complications and its biochemical basis, two interventions used to treat obesity and their biochemical basis.)



(2x 5=10)

- 3.
- With the help of a flowchart describe the metabolism of ethanol. Indicate which step can be inhibited by methanol.
 - Draw a labelled diagram to show T_H -cell and macrophage interaction while presenting antigen. Indicate MHC restriction in that diagram.

4. Compare and contrast: (2x5=10)

- Metabolic acidosis and respiratory acidosis.
- Ionizing and non-ionizing radiations.

5. Explain why/how: (4x2.5=10)

- Slow acetylators frequently develop isoniazide (INH)-induced neurotoxicity.
- Regular intake of dietary fibre can prevent gallstone formation.
- Body temperature and sweating increases during consumption of non-veg food.
- Subjects with null or inactive CYP2A6 alleles are less prone for developing tobacco-dependence.

SECTION B (50 marks)

6. Study the clinical features of the case that is narrated below and answer the following questions related to the case: (3+3+2+2=10)

A 48 yr old female patient became obese and lethargic for last 6months. Her voice became coarse. Skin became rough and dry. Her ankle jerk was delayed. Her thyroid function test report was as shown below:

- Serum free T4: low
- Serum free T3: low
- Serum TSH: very low
- Serum Cholesterol: high



- Comment on her thyroid function status with justification.
- Can it be a case of primary hypothyroidism? Recommend a thyroid function test that can confirm where lies the defect (hypothalamus, pituitary or thyroid gland).
- Explain the biochemical basis of hypercholesterolemia in this case.
- What is the cause of obesity and lethargy in this case?



7. Write short notes on the following (the aspects to be addressed are given in brackets): (2 x 5 = 10)
- Non-functional enzymes of the plasma (definition, diagnostic significance with five examples).
 - Antioxidant vitamins and pro-vitamins (examples and mechanism of their antioxidant activity).
8. (2 x 5 = 10)
- Draw a flowchart to explain/ describe the hyperpolarization of rod cells when light ray falls on retina.
 - Draw a labelled diagram of Lineweaver Burk plot showing change in K_m and V_{max} in competitive and non-competitive enzyme inhibition.
9. Compare and contrast: (2 x 5 = 10)
- Hyponatremia and hypokalaemia
 - Trace elements and ultratrace elements
10. Explain why/how: (4 x 2.5 = 10)
- Warferin treatment elevates prothrombin time.
 - Thiamin deficiency leads to heart failure.
 - Vesopressin increases water absorption from collecting duct.
 - Renal failure leads to osteodystrophy.

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SECTION A (50 marks)

1. **A three-week-old infant was brought to the OPD with complaints of excessive crying, refusal to feeds and lethargy. The mother also gave history of mousy odour of urine and laboratory tests revealed phenylketonuria. (1+1+5+3=10)**
 - a. What is the biochemical defect?
 - b. What are the products accumulated and excreted in the urine?
 - c. Discuss the metabolism of phenylalanine.
 - d. Add a note on the biochemically significant products formed in the metabolism of phenylalanine.

2. **Write briefly on (4x2.5= 10)**
 - a. Quarternary structure of proteins (Definition, Characteristic features, Example of protein, exhibiting quarternary structure)
 - b. Rapaport Leubering cycle (Site, Formation & significance of 2,3 BPG)
 - c. High density lipoproteins (Composition, functions & clinical significance)
 - d. Facilitated diffusion (Definition, salient features, two examples)

3.
 - a. With the help of a neat diagram Describe the Chemiosmoic hypothesis of oxidative phosphorylation (Diagram, explanation of chemiosmotic hypothesis, & mechanism of ATP synthesis. (5)
 - b. Describe the process of glycogenolysis and add a note on its regulation (various steps in the process & mention the role of hormones in regulation) (5)

4. **Compare and contrast: (2x5=10)**
 - a. Pre-hepatic and post hepatic jaundice
 - b. Transamination and deamination



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5. Explain why/how: (4x2.5=10)

- Porphyria presents with abdominal cramps and skin rashes.
- Metabolic disorders of Urea cycle lead to encephalopathy.
- Persons affected by G6PD deficiency are protected from malaria
- Though the liver produces ketone bodies it does not utilize them

SECTION B (50 marks)

6. A four-year child was brought to the hospital with complaints of slow growth and pain in the joints. On examination he was found to be anemic, had frontal bossing, bowing of the legs, and swelling of the costochondral junction. Laboratory results were as follows.

Serum calcium --- 8.2mg/dL
Serum Phosphorus --- 2.8 mg/dL
ALP --- 720U/L (1+1+4+2+2=10)

- What is the likely diagnosis
- Name the deficient nutrient implicated in the above case
- Describe the biochemical functions of this vitamin
- Mention normal serum total and ionized calcium level and factors that affect calcium absorption from intestine
- Give example of two Calcium regulated biochemical reactions.

7.

- Discuss the various factors affecting the absorption of iron in the body. Add a brief note on the transport of iron in the blood (3+2=5)
- With the help of a neat diagram describe the Wald's visual cycle (5)

8. Write short notes on the following (2x5=10)

- Describe effect of substrate concentration on the rate of an enzyme catalyzed reaction with the help of a neat diagram.
- Discuss the biochemical functions of vitamin C (Explain at least five important function)

9. Compare and contrast (2x5=10)

- Macrocytic anemia and megaloblastic anemia
- Competitive and noncompetitive enzyme inhibition

10. Explain why/how: (4x2.5=10)

- Prothrombin time is prolonged in Cirrhosis of liver.
- Hyperkalemia may lead to cardiac arrest.
- Neurological symptoms are quite common in vitamin B6 deficiency.
- Aldosterone insufficiency produces severe dehydration.



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SECTION A (50 marks)

- 1. Study the clinical features of the case that is narrated below and answer the following questions related to the case: (1+4+2+3=10)**

Workers of a factory were on hunger strike for more than 3 days. One of the worker fainted. The doctor on examination found he was sweating profusely, had rapid thread pulse and fruity smell breath.

Blood picture FBS-60mg/dl , pH-7.3, HCO_3^- —low, PaCO_2 -low

Urinary findings - Ketone Bodies +++

- a. What is your interpretation?
- b. How does body compensate in such condition?
- c. What is the treatment given in such patients?
- d. Write the name of other acid base disorder with TWO examples of each.

- 2. Write short notes on the following (2x5=10)**

- a. Antioxidants (Definition, Types of antioxidants, mechanism of action of each of the types with 2examples each)
- b. Detoxification by conjugation (Definition, Examples of 4 conjugating agents for the appropriate xenobiotic)

- 3. (2x 5=10)**

- a. With the help of a flowchart describe the cascade of reactions of classical pathway for the activation of complement system
- b. Draw a labelled diagram to show role of glutathione as an antioxidant.

- 4. Compare and contrast: (2x5=10)**

- a. Active and Passive immunity.
- b. MHC-I and MHC-II



5. Explain why/how:

(4x2.5=10)

- a. Foods with low glycemic index are favoured in a diabetic diet
- b. Methotrexate is used in the treatment of certain cancer
- c. Body does not form antibody against its own proteins
- d. Impairment of renal function is often seen in subjects with multiple myeloma

SECTION B (50 marks)

6. a. Define transcription. Describe the process of transcription in eukaryotes Under the following headings

(1+ 6 +3=10)

- i) Initiation
- ii) Elongation
- iii) Termination

- b. Add a note on post transcriptional modifications

7. Answer the following

- a. A 40-year-old male presented with severe pain, redness, and swelling of the base of the first metatarsophalangeal joint in the night after a bout of alcohol consumption. He was in usual state of health until early in the morning. When he woke up with severe pain in his right big toe . On examination he had mild fever. Serum uric acid was 9.7mg/dL.

(1+1+1+2= 5)

- i. What is the likely diagnosis?
- ii. Indicate the biochemical defect.
- iii. Explain the reason for the observed clinical symptoms
- iv. Name two drugs used in the treatment of gout. Mention their mode of action

- b. PCR (Principle and applications)

(5)

8. Writ short notes on

(4x 2.5 =10)

- a. Chemical carcinogens
- b. Cell cycle
- c. Frame shift mutation
- d. Role of PTH in bone mineral metabolism

9. Compare and contrast:

(2x5=10)

- a. Translation in prokaryotes and eukaryotes
- b. Direct and Indirect Bilirubin test

10. Explain why/how:

(4x2.5=10)

- a. Compared to transcription, DNA replication has a much lower error rate for nucleotide incorporation
- b. T helper cell, named as a helper cell
- c. Patients receiving methotrexate for a long time develop drug resistance
- d. Phototherapy is given to neonatal bilirubinemia patients