2406000101030702
EXAMINATION OCTOBER 2024
(SUPPLEMENTARY EXAM)
FIRST MBBS
BIO-CHEMISTRY (PAPER - II) (NEW) - LEVEL 3

[Time: As Per Schedule] **[Max. Marks: 100]**

Instructions:
1. Fill up strictly the following details on your answer book
   a. Name of the Examination : **FIRST MBBS**
   b. Name of the Subject : **BIO-CHEMISTRY (PAPER - II) (NEW) - LEVEL 3**
   c. Subject Code No : **2406000101030702**
2. Sketch neat and labelled diagram wherever necessary.
3. Figures to the right indicate full marks of the question.
4. All questions are compulsory.

Seat No:

Student's Signature

Section A

Q.1 Multiple choice questions (20 out of 20) **20x1=20**

1. The base sequence of the strand of DNA used as the template for transcription is GATCTAC. What is the base sequence of the RNA product? (All sequences are written 5'→ 3' according to standard convention.)
   a) CTAGATG b) GTAGATC
   c) GAUCUAC d) CUAGAUG

2. A 6-month-old infant is seen in the emergency room with a fractured rib and subdural hematoma. The child's hair is thin, colourless, and tangled. His serum copper level is decreased. Developmental delay is prominent. Which enzyme activity requires copper as co- factor?
   a) Lysyl oxidase b) Prolyl hydroxylase
   c) γ-Glutamyl carboxylase d) α-1,4-glucosidase

3. All are iron containing enzymes, EXCEPT
   a) Cytochrome oxidase b) Peroxidase
   c) Tyrosinase d) Catalase

4. A 36 years old male was diagnosed with pulmonary TB. He was receiving Isoniazid for the treatment. He started developing numbness of hands and legs. What should be given to the patient?
   a) Vitamin B 12 b) Niacin
   c) Pyridoxine d) Biotin

5. A 67-year-old man presented to the emergency department with a 1 week history of angina and shortness of breath. He complained that his face and extremities had a "blue colour." His medical history included chronic stable angina treated with isosorbide dinitrate and nitro-glycerine. Blood obtained for analysis was chocolate-coloured. Which one of the following is the most likely diagnosis?
   a) Sickle cell anemia
   b) Carboxy hemoglobinemia
   c) Met-hemoglobinemia
   d) β-Thalassemia

6. Fluidity of cell membrane is increased by
   a) Polyunsaturated fatty acids
   b) Cholesterol at temperature above the Tm
   c) Trans fatty acids
   d) Long chain saturated fatty acids

7. Which one of the following statements is true about proteolytic enzymes?
   a) Trypsin is activated by HCI.
   b) Pepsin acts on peptide bonds formed by carboxyl groups of acidic amino acids.
   c) Chymotrypsin acts on peptide bonds formed by carboxyl groups of hydrophilic amino acids.
   d) Trypsin acts on peptide bonds formed by carboxyl groups of basic amino acids.

8. Which one of the following is the toxin-based vaccine?
   a) Polio
   b) Diphtheria
   c) MMR
   d) Rabies

9. All the following amino acids are used for the synthesis of purine nucleotides, EXCEPT
   a) Glycine
   b) Alanine
   c) Aspartate
   d) Glutamine

10. The immunoglobulin which is also called Cytophilic antibody is
   a) IgG
   b) IgD
   c) IgM
   d) IgE

11. Human serum albumin, the most abundant blood protein, has multiple roles, including acting as a buffer to help maintain blood pH. Albumin can act as a buffer because of which one of the following?
   a) The amino and carboxyl ends of albumin can donate and accept protons in the range of physiologic pH.
   b) The protein contains many histidine residues containing side chain with pKa value near to the physiological pH.
   c) Albumin contains peptide bonds that readily hydrolyze, consuming hydrogen and hydroxyl ions.

d) Albumin contains a large number of hydrogen bonds in a-helices, which can accept and donate protons.

12. A 53-year-old man, who has been smoking for the past 35 years at a two-pack-a-day rate, visits his physician for a cough that will not go away, and for difficulty in breathing. A chest X-ray rules out cancer, but does display "air trapping.". At the molecular level, this disease is due to which one of the following?
a) Enhanced trypsin activity in the lung
b) Enhanced reduction of sulfhydryl groups in the lung
c) Decreased al-antitrypsin activity in the lung
d) Decreased trypsin activity in the lung

13. A 72 years old man diagnosed with Alzheimer's disease. In this patient Amyloid precursor protein's normal alpha helical structure gets disrupted due to mutation. The following mutational change affects alpha helical structure of mutant protein.
a) Methionine to Proline
b) Valine to Alanine
c) Glutamate to Aspartate
d) Lysine to Arginine

14. A bacterial mutant grows normally at 32°C but at 42°C accumulates short segments of newly synthesized DNA. Which one of the following enzymes is most likely to be defective at the higher temperature in this mutant?
a) DNA primase
b) DNA ligase.
c) DNA polymerase
d) DNA helicase

15. A pathologist, while doing an autopsy of a patient who died from Creutzfeldt-Jakob syndrome, accidentally cut himself while examining the brain. The pathologist became very concerned for his well-being. The precipitating event in the patient's brain that led to this disease is which one of the following?
a) Infection of the brain with a virus
b) Proteolytic cleavage of an existing brain protein
c) An altered secondary and tertiary structures for an existing brain protein
d) Altered gene expression

16. A medical student has been exposed to a patient with tuberculosis and developed a positive tuberculin test (PPD), but exhibited a normal chest X-ray. He is placed on a 6-month course of prophylactic treatment of isoniazid, but subsequently develops peripheral neuropathies. Which of the following vitamins would be considered a treatment for the neurotoxicity?
a) Niacin
b) Cobalamin
c) Folic acid
d) Pyridoxine

17. A 45-year-old male is concerned about his risk of a heart attack since his brother just had a heart attack at the age of 46. His physician orders an HbA1C, lipid panel, and homocysteine level. A high homocysteine level could be associated with a deficiency of which one of the following vitamins?
a) Pyridoxine
b) Riboflavin
c) Niacin
d) Ascorbic acid

18. Identify the incorrect statement about Ion exchange chromatography
a) Carboxylic & sulphonic acid are bound to a stationary phase for cation exchange.
b) Anion-exchange solid phases have quaternary amines.
c) Solutes are eluted with a solution containing sodium for anion exchange.
d) Can be used for analyses hemoglobin.

19. Leukemia patients are often given the compound Folinic acid (N5-formyl THF) following treatment with the drug methotrexate. Why is Folinic acid useful as part of this treatment protocol?
a) It facilitates the uptake of methotrexate by cells
b) It can be converted to THF by bypassing folate reductase reaction
c) It acts as an activator of thymidylate synthase
d) It stimulates cells of the immune system

20. A vaginal swab was collected from a rape victim. The sample was processed and check for presence of sperm cells. Confirmation of actual culprit can be done by matching his DNA with the DNA of sperm cells found in the sample. This technique is based on
a) Constant number of tandem repeats
b) Long interspersed nuclear element
c) Single nucleotide polymorphism
d) Variable number of tandem repeats

Section B

Q.2 Long Answer Questions. (2 out of 3) **2x10=20**

1. Describe phenylalanine and tyrosine metabolism (4). Describe various products (only steps) formed from tyrosine (3). Write defect, clinical features, and treatment of phenylketonuria (3).
2. Describe the characteristics of genetic code (2). Describe the translation process in eukaryotes (6). Explain the role of chaperones in protein folding (2)
3. Describe formation, uptake, conjugation, and excretion of bilirubin (4). Describe pre-hepatic. hepatic and post-hepatic jaundice with differential diagnosis (6).

Q.3 Short Answer Questions (10 out of 11) **10x2=20**

1. Write at least four biologically active nucleotides with their functions.
2. Edema develops when the albumin level is decreased. Why?
3. Explain why ammonia is toxic to our body.
4. Write at least two products formed from glycine with their significance.
5. Write the biological and clinical significance of the transamination reaction.
6. What is a folate trap? Explain by drawing reactions.
7. How does vitamin D activate in our body?
8. Explain why barbiturates precipitate an attack of porphyria and why administration of glucose alleviates symptoms of porphyria.
9. Write the principle of electrophoresis. Draw a normal electrophoretogram of plasma proteins.
10. Write at least six secondary causes of hyperuricemia. Why allopurinol is given in the treatment of gout?
11. Describe eukaryotic DNA polymerases and their functions.

Section C

Q.4 Short Answer Questions (4 out of 5) **4x5=20**

1. Describe any five factors that affect enzyme activity.
2. Describe steps and clinical applications of DNA recombinant technology (3+2)
3. Describe the structure and functions of immunoglobulins.
4. Enumerate cardiac biomarkers in the order of their earliest rise in myocardial infarction. What is a flipped pattern? Describe cardiac biomarkers that are not enzymes. (1+1+3)
5. Describe the second messenger system.

Q.5 Clinical Cases (2 out of 2) **2x10=20**

1. A 4-year-old child had loose, hypermobile joints, and soft, hyperflexible skin. His fingers could be extended to such an extent that they touched the back of his hand. The skin was easily iron or scarred. In addition, he had scoliosis (bent spine). A sample of collagen tissue was obtained by biopsy from two sources: skin and cartilage. The skin collagen was deficient in hydroxylysyl residues, whereas the collagen obtained from cartilage had a normal content of these residues. The patient did not have any features that were suggestive of vascular collagen involvement.

1. What is the biochemical defect in this case? Explain (2)
2. Write amino acid sequence in collagen. What is a 'quartered staggered arrangement'? (2)
3. How does collagen get mature? (2)

4. How does cross-linking form in collagen structure? (2)
5. Write four collagen disorders caused by mutation. (2)

2. A 15-year-old Indian aboriginal girl presents to the emergency room with complaints of bilateral thigh and hip pain. The pain has been present for 1 day and is steadily increasing in severity. Acetaminophen and ibuprofen have not relieved her symptoms. She denies any recent trauma or excessive exercise. She reported fatigue and a burning sensation during urination. She reports having similar pain episodes in the past, sometimes requiring hospitalization. On examination, she is afebrile. Her conjunctiva and mucosal membranes are slightly pale in color. She has nonspecific bilateral anterior thigh pain with no abnormalities appreciated. The remainder of her examination is completely normal. Her white blood cell count is elevated at 17,000/mm3, and her hemoglobin (Hb) level is decreased to 7.1 g/dL. Peripheral blood smear showed sickle cells. The urinalysis demonstrated an abnormal number of numerous bacteria.

1. Explain the mechanism of polymerization that takes place inside the RBCs of this patient. (3)
2. Why Oxygen dissociation curve of Hb is sigmoid in shape? (2)
3. Why does sickling occur only under a deoxygenated state? (1)
4. How Hb electrophoresis helps to differentiate sickle cell disease and trait patients? (2)
5. Explain the basis behind pain crisis in this patient. (2)

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