BIOC 333: MICROBIAL BIOCHEMISTRY

STREAM: BIOC **TIME: 2 HRS**

EXAMINATION SESSION: **April, 2021**

INSTRUCTIONS
(i) Answer Question ONE and any TWO questions
(ii) Do not write on the question paper

QUESTION ONE (30 Marks)

(a) The *Embden–Meyerhof-Parnas* pathway of glycolysis is a central metabolic pathway in various eukaryotic and prokaryotic cells but the mechanisms for initial phosphorylation of glucose differ. Using chemical structure, explain how glucose is converted to G-6-phosphate by eukaryotes and prokaryote. (6 Marks)

(b) Describe the formation of Acetyl CoA from formaldehyde using serine pathway in methylotrophic bacteria. (6 Marks)

(c) Explain how thermoacidophilic Archaebacteria have modified Entner- Doudoroff glycolytic pathway to meet their cellular requirements. (6 Marks)

(d) Methylglyoxal pathway operates as an alternate to the glycolytic pathway when enteric bacteria experiences conditions of low inorganic phosphate concentration. Describe this pathway highlighting its importance. (5 Marks)

(e) Give five examples of bacteria that can fix nitrogen and demonstrate structurally how the fixation is achieved. (7 Marks)

QUESTION TWO (20 Marks)

(a)Explain how anoxygenic photosynthesis differs from oxygenic photosynthesis. (10 marks)

(b) Describe anoxygenic photosynthesis type II reaction centers in red filamentous anoxygenic phototrophs (FAPs) and purple bacteria. (10 marks)

QUESTION THREE (20 Marks)

(a) Describe electron transport chain in *E. coli* during aerobic conditions. (10 Marks)

(b) Discuss butyric Acid (butanol) fermentation, highlighting its industrial application. (10 Marks)

QUESTION FOUR (20 Marks)

(a) Discuss the reductive Acetyl CoA pathway utilized by *Acetobacterium woodii* to fix CO_2. (10 Marks)

(b) Give five examples of chemoautotrophs and reactions they catalyze. (10 Marks)

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BIOC 334: INDUSTRIAL BIOCHEMISTRY

STREAM: BIOC **TIME:** 2 HRS

EXAMINATION SESSION: **April-June, 2021**

INSTRUCTIONS
(i) Answer Question ONE and any TWO questions
(ii) Do not write on the question paper

QUESTION ONE: (30 Marks)

(a) Describe production process and benefits of biogas. (7 Marks)

(b) Discuss the aerobic sludge digestion. (5 Marks)

(c) Describe microbial production of lactic acid. (8 marks)

(d) Explain the microbial production of amino acids and their use in pharmaceutical industry. (6 marks)

(e) Explain why newspaper takes 6 weeks to degrade while plastic bags takes 10-20 years to degrade in marine environment. (4 Marks)

QUESTION TWO: (20 Marks)

(a) Describe production and use of microbial enzymes in industry. (10 marks).

(b) List and describe five classes/types of bioreactor used in bioprocess technology (10 Marks)

QUESTION THREE: (20 Marks)

(a) Using chemical and structural formulae, discuss biosynthesis of β-lactam Antibiotics by *Acremonium chrysogenum*. (12 Marks)

(b) Outline methods for the determination of organic matter content in wastewaters (8 Marks)

QUESTION FOUR: (20 Marks)

(a) Outline major causes of wines defects and explain how they are detected. (8 Marks)

(b) Modern brewing operations involve five basic steps. Discuss them. (12 Marks)

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BMED 316: METABOLISM OF LIPIDS & NITROGENOUS COMPOUNDS

STREAM: BMED **TIME: 2 HRS**

EXAMINATION SESSION: **April-June, 2021**

INSTRUCTIONS
(i) Answer Question ONE and any TWO questions
(ii) Do not write on the question paper

QUESTION ONE: (30 Marks)

(a) Using specific examples, explain the meaning of the following;
- (i) Intermediary metabolism (2 Marks)
- (ii) Transamination reaction (2 Marks)
- (iii) Oxidative deamination (2 Marks)

(b) Discuss de novo synthesis of the pyrimidine nucleotides (7 marks)

(c) Outline biosynthesis of chorismate from PEP and Erythrose-4 phosphate in bacteria and plants. (7 marks)

(d) Distinguish between essential and non-essential amino acids and explain why tyrosine is a non-essential amino acid. (5 marks)

(e) List and describe five disease conditions associated with defective amino acid metabolism. (5 marks)

QUESTION TWO: (20 Marks)

(a) Discuss in details the degradation of aromatic amino acids in the body. (12marks)

(b) Discuss the mobilization of triacylglycerol stored in adipose tissue for energy production. (8 marks)

QUESTION THREE: (20 Marks)

Using illustrative diagrams, describe the following processes of lipid metabolism:

(a) Ketolysis. (12 marks)

(b) ω-oxidation of fatty acids (8 marks)

QUESTION FOUR: (20 Marks)

(a) Discuss the synthesis of lysine in plants and bacteria. (10 marks)

(b) Describe β-Oxidation of 18-carbon fatty acid, hence calculate Kilojoules of energy produced. (10 marks)

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BIOC 204: BIOCHEMISTRY OF AMINO ACIDS AND PROTEINS

STREAM: BIOC **TIME: 2 HRS**

EXAMINATION SESSION: **April-June, 2021**

INSTRUCTIONS
(i) Answer Question ONE and any TWO questions
(ii) Do not write on the question paper

QUESTION ONE (30 Marks)

(a) Briefly describe the differences between secondary and tertiary levels of protein structure. (6 Marks)

(b) Outline chemical properties of amino acids. (4 Marks)

(c) Describe the amino acids reaction with ninhydrin and explain its relevance in amino acid determination. (8 Marks)

(d) List and describe the agents that cause protein denaturation. (5 Marks)

(e) What are the major functions of conjugated proteins in the body? (5 Marks)

(f) Differentiate between semi-essential and essential amino acids. (2 Marks)

QUESTION TWO (20 Marks)

(a) Describe the chemistry and functions of plasma proteins. (10 marks)

(b) What is a peptide bond? Enumerate peptides of physiological importance. (10 marks)

QUESTION THREE (20 Marks)

(a) Using illustrative diagram, discuss the structure of β_2-adrenergic receptor in relation to signal transduction. (10 Marks)

(b) Describe methods used to determine protein structure. (10 Marks)

QUESTION FOUR (20 Marks)

(a) Using suitable diagram discuss the following;

i. General features of immunoglobulin molecule. (10 Marks)

ii. Genetic mechanisms that allow vertebrate B cells to generate diverse pool of antibodies from small number of antibody genes.

(b) With a use of suitable diagram, describe the structure, properties and functions of aromatic amino acids found in proteins. (10 Marks)

CHUKA UNIVERSITY
DEPARTMENT OF NURSING
NURU 119: MEDICAL BIOCHEMISTRY II

16th April, 2021

INSTRUCTIONS: All questions are compulsory. Ensure that all your answers are properly numbered.

Part I: multiple Choice Questions (MCQ): Write the correct answer on the space provided in the answer booklet. Each MCQ is one mark.
Part II: Short Answer Questions-Answer questions following each other on the answer booklet.
Part III: Long Answer Questions: Answer each question on the answer booklet.

SECTION A: MULTIPLE CHOICE QUESTIONS (20 MARKS)

1. In *Rapaport-Leubering shunt* in erythrocytes, 2,3-biphosphoglycerate (2,3-BPG) is produced from which intermediate in glycolytic pathway?
   A). 3-phosphoglycerate
   B). 2-phosphoglycerate
   C). 1,3-biphosphoglycerate
   D). Glyceraldehyde-3-P
   E). Dihydoxyacetone-P

2. β-oxidation of odd-carbon fatty acid chain produces:
   A). Succinyl-CoA
   B). Propionyl-CoA
   C). acetyl-CoA
   D). Malonyl-CoA
   E). acetoacetyl-CoA

3. All statements regarding ketone bodies are true *except:*
   A). They may result from starvation
   B). They are formed in kidneys
   C). They include acetoacetic acid and acetone
   D). They may be excreted in urine
   E). They are present in high concentration in uncontrolled diabetes mellitus

4. Untreated diabetes mellitus may result in all of the following except:
   A). Blindness
   B). Cardiovascular disease
   C). Tinnitus
   D). Kidney disease
   E). lower limb amputation

5. Tryptophan is best described by which of the following statement?
   A). It produces thyroid hormones

B). Is a precursor for melanin
C). It is a precursor of the pineal hormone melatonin
D). It produces catecholamine
E). It is a precursor of Epinephrine hormone

6. In haem catabolism, the first bile pigment formed is:
A). Cholic acid
B). Bilirubin
C). Lithocholic acid
D). Deoxycholic acid
E). Biliverdin

7. The enzyme responsible for conjugation of bilirubin is:
A. Bilirubin esterase
B. Haemoglobin reductase
C. Bilirubin conjugase
D. Glucuronyl transferase
E. Glutamyl-bilirubin esterase

8. A 42-year-old male patient undergoing radiation therapy for prostate cancer develops severe pain in the metatarsal phalangeal joint of his right big toe. Monosodium urate crystals are detected by polarized light microscopy in fluid obtained from this joint by arthrocentesis. Uric acid crystals are present in his urine. This patient's pain is directly caused by the overproduction of the end product of which of the following metabolic pathways?
A). Purine degradation
B). Pyrimidine degradation.
C). De novo purine biosynthesis.
D). Purine salvage.
E). Amino acid degradation

9. Medium-chain fatty acids are given because they:
A). stimulates VLDL production by the liver.
B). can only be metabolized by the liver.
C). are activators of lipoprotein lipase.
D). are more efficiently packed into serum lipoproteins.
E). enter directly into the portal blood, and can be metabolized by the liver.

10. Bilirubin is derived from all of the following except:
A). Destroyed effete red blood cells
B). Cytochromes
C). Haemoglobin
D). Catalase
E). Coenzymes

11. A patient has large deposit of liver glycogen, which after an overnight fast had shorter than normal branches. This abnormality could be caused by a defective form of which of the following proteins?
A). Amylo 1,6 glucosidase
B). Amylo 4,6 transferase

C). Glycogen phosphorylase
D). Glycogenin
E). Glycogen synthase

12. Which of the following statements is not true about chylomicrons?
A). Transport exogenous dietary fats and cholesterol from intestines to tissues.
B). Transport endogenous dietary fats and cholesterol from tissues to liver.
C). Consists of triglycerides, phospholipids, cholesterol and proteins.
D). Travel into the bloodstream via lymph system.
E). They are lipids

13. Which of the following enzyme is not involved in gluconeogenesis?
A). Hexokinase
B). Glucose- 6-phosphatase
C). PEP Carboxykinase
D). Pyruvate carboxylase
E). Fructose 1,6BPase

14. Glucagon and epinephrine stimulate glycogen breakdown to glucose 6-phosphate
A) Directly by binding to glycogen phosphorylase
B) Indirectly by first stimulating adenylate cyclase to make cAMP
C) Only in the liver
D) Only in muscle cell
E).Only in the kidney

15. The main function of pentose phosphate pathway is to;
A). Give the cell an alternate pathway should glycolysis fail
B). Degrade G-6-P
C). Provide mechanism for utilization of the carbon skeletons of excess amino acids
D). Supply glyceraldehydes 3- phosphate for glycolysis
E). Supply pentose and NADPH

16. The degradation of amino acids can be classified into families, which are named after the end product of the degradative pathway. Which of the following is such an end product?
A). Citrate
B). Glyceraldehyde-3-phosphate
C). Fructose-6-phosphate
D). Succinyl-CoA
E). Acetate

17. How many moles of ATP are generated by the complete aerobic oxidation of 1 mole of glucose to 6 moles of CO_2?
A). 2–4
B). 18–22
C). 30–32
D). 40–42
E). 108

18. Albinism is a congenital disorder resulting from the lack of which enzyme?

A). Homogentisate dioxygenase
B). xanthine oxidase
C). catalase
D). fructokinase.
E). tyrosinase

19. A patient presented with a bacterial infection that produced an endotoxin that inhibits phosphoenolpyruvate carboxykinase. In this patient, then, under these conditions, glucose production from which of the following precursors would be inhibited?

A). pyruvate
B). Glycerol
C). Even-chain-number fatty acids
D). Phosphoenolpyruvate
E). Alanine

20. Which of the following amino acids produce a vasodilator on decarboxylation:

A). Glutamic acid
B). Histidine
C). Ornithine
D). Cysteine
E). Arginine

PART II: SHORT ANSWER QUESTIONS (30 MARKS)

1. Describe the process of glycogen formation and breakdown in the Liver. Highlight the points of difference and their significance. (7 marks)
2. Describe glycolytic pathway and its relevance in metabolism. (8 marks)
3. Outline five disease conditions associated with defective aromatic amino acid metabolism. (5 marks)
4. Explain action and importance of hypocholesterolemic drugs. (5 marks)
5. Describe mitochondrial chemiosmotic synthesis of ATP and explain how the process can be chemically inhibited. (5 marks)

PART III: LONG ANSWER QUESTIONS (30 MARKS)

1. Describe biosynthesis of fatty acids and their role in metabolism during exercise. (15 marks)

2. Discuss metabolic changes that occur during diabetes mellitus highlighting possible danger. (15 marks)

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DEPARTMENT OF PHYSICAL SCIENCES
BIOC 842: SPECIAL TOPICS IN MEDICAL BIOCHEMISTRY
STREAM: MSc BIOCHEMISTRY
TIME: 2 HRS

EXAMINATION SESSION: April-June, 2021

INSTRUCTIONS (Total= 90 Marks)
(i) Answer Question ONE and any THREE questions
(ii) Do not write on the question paper

QUESTION ONE
Coronavirus Disease of 2019 (Covid-19) has posed a serious threat to the global public health, with daily mortality and morbidity increasing exponentially. Discuss Covid-19 under the following headings:

(a) Metabolic complications in affected tissues/organs
(b) Viral replication
(c) "Silent spreaders"
(d) Variant strains of covid-19
(e) Nucleic acids vaccines developed and their efficacy **(30 marks)**

QUESTION TWO
There are many critics of human pheromone research and this has led to some confusion in the general public about whether humans produce and detect pheromones. Discuss possible role of the following pheromones and their application in perfume and beauty industry.

(a) Estratetraenol **(10 marks)**
(b) Copulins (vaginal aliphatic acids) **(10 marks)**

QUESTION THREE
Safety is a major concern of the public when it comes to agricultural food production, and subsequently the use of genome-editing. Where do we stand on the safety of genome-edited plants? How likely is that this evidence may change in the future?
(**20 marks)**

QUESTION FOUR
Discuss HIV/AIDS under the following sub-headings;

(a) Organization and expression of HIV genes. **(10 marks)**
(b) Novel regulatory pathways in HIV gene expression. **(10 marks)**

QUESTION FIVE
Heterotrimeric G proteins function as transducers to activate many signalling pathways.

(a) Discuss above statement citing specific examples. **(10 marks)**
(b) Itemize the role of G-protein coupled receptor (GPCR) in the body. **(10 marks)**

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