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University Examinations 2024/2025

SECOND YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF MEDICAL LABORATORY

HML 3212: MEDICAL BIOCHEMISTRY II

DATE: JANUARY 2025 **TIME: 3 HOURS**

INSTRUCTIONS:
Answer ***All*** *questions*
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. Which of the following processes involves the breakdown of glucose to produce pyruvate?
   a) Glycolysis
   b) Gluconeogenesis
   c) TCA cycle
   d) Beta-oxidation
2. Which enzyme is primarily responsible for the conversion of glucose to glucose-6-phosphate in glycolysis?
   a) Hexokinase
   b) Phosphofructokinase

c) Pyruvate kinase

d) Glucose-6-phosphatase C)

3. The final product of the TCA cycle is:
   a) Acetyl-CoA
   b) ATP
   c) C02 and reduced coenzymes (NADH, FADH2)
   d) Pyruvate
4. What is the key regulatory enzyme in glycogen synthesis (glycogenesis)?
   a) Glycogen synthase
   b) Glycogen phosphorylase
   c) Glucose-6-phosphatase
   d) Glucokinase
5. Beta-oxidation is the process by which:
   a) Glucose is broken down into pyruvate
   b) Amino acids are converted into urea
   c) Fatty acids are broken down into acetyl-CoA
   d) Nucleotides are synthesized
6. Which of the following is a key enzyme involved in the synthesis of cholesterol?
   a) HMG-CoA reductase
   b) Lipoprotein lipase
   c) Acetyl-CoA carboxylase
   d) Pyruvate dehydrogenase
7. The urea cycle is primarily responsible for:
   a) Excreting excess amino acids
   b) Converting ammonia into urea
   c) Synthesizing purines and pyrimidines
   d) Breaking down nucleic acids

8. The Hexose Monophosphate Pathway (HMP) is important for:
   a) The production of ribose for nucleotide synthesis
   b) The degradation of fatty acids
   c) The oxidation of cholesterol
   d) The synthesis of proteins
9. Which organ plays a key role in the metabolism of lipids, carbohydrates, and proteins?
   a) Brain
   b) Liver
   c) Kidney
   d) Pancreas
10. Glycogen storage diseases are typically caused by defects in:
   a) Glycolysis
   b) Glycogen metabolism
   c) TCA cycle
   d) Protein degradation
11. Cholesterol biosynthesis occurs mainly in the:
   a) Mitochondria
   b) Endoplasmic reticulum
   c) Cytoplasm
   d) Golgi apparatus
12. During Oxidative phosphorylation, ATP is generated in the:
   a) Cytosol
   b) Inner mitochondrial membrane
   c) Endoplasmic reticulum
   d) Golgi apparatus
13. The breakdown of amino acids for energy primarily produces:
   a) Urea
   b) Lactic acid

c) Ammonia

d) Glucose

14. The major form of lipid transport in the bloodstream is via:

a) Chylomicrons

b) LDL

c) VLDL

d) HDL

15. The urea cycle takes place primarily in the:

a) Liver

b) Kidney

c) Muscle

d) Adipose tissue

16. Purines and pyrimidines are required for the synthesis of:

a) Amino acids

b) Lipids

c) Nucleotides

d) Carbohydrates

17. Which of the following tissues is most dependent on glucose for energy?

a) Adipose tissue

b) Brain

c) Liver

d) Muscles

18. The main storage form of energy in the body is:

a) Glucose

b) Glycogen

c) Fat

d) Protein

19. Which biochemical test is primarily used to assess kidney function?
    a) Serum creatinine
    b) Liver enzymes
    c) Thyroid function test
    d) Amylase test
20. Oxidative phosphorylation generates ATP by using the energy from:
    a) Electron transport chain
    b) Glycolysis
    c) Beta-oxidation
    d) Urea cycle

SECTION B: SHORT ANSWER QUESTIONS (ANSWER ALL) (40 MARKS)

1. Explain the difference between glycolysis and gluconeogenesis in terms of their processes and functions (5 Marks)
2. Describe the role of the TCA cycle in carbohydrate metabolism and its significance for energy production (5 Marks)
3. Outline the steps involved in glycogenolysis and explain how it is regulated (5 Marks)
4. Discuss the significance of the Hexose Monophosphate Pathway in nucleotide synthesis (5 Marks)
5. Describe the process of beta-oxidation and its role in lipid metabolism (5 Marks)
6. Explain the role of the urea cycle in amino acid metabolism (5 Marks)
7. Outline the biosynthesis and excretion of cholesterol in the human body (5 Marks)
8. Briefly describe the biochemical tests used to assess liver function (5 Marks)

SECTION C: LONG ANSWER (CHOOSE ANY TWO) (40 MARKS)

1. Explain the steps of oxidative phosphorylation and its role in energy production (10 Marks)

   b) Discuss the regulation of oxidative phosphorylation and the role of electron transport chain complexes (10 Marks)

2. a) Compare and contrast the metabolism of carbohydrates and lipids in terms of their storage and energy production (10 Marks)

   b) Discuss the role of insulin and glucagon in regulating blood glucose levels (10 Marks)

3. a) Explain the process of amino acid catabolism and its link to the urea cycle (10 Marks)

   b) Discuss the importance of purine and pyrimidine metabolism in nucleic acid biosynthesis (10 Marks)