



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN CAMPUS  
MAIN EXAMINATIONS**

**UNIVERSITY EXAMINATIONS  
2020/2021 ACADEMIC YEAR**

**END OF TRIEMESTER EXAMINATIONS  
FOR THE DEGREE  
OF  
BACHELOR OF MEDICINE AND BACHELOR OF SURGERY**

**COURSE CODE: MBS 201**

**COURSE TITLE: MEDICAL BIOCHEMISTRY II**

**DATE: 25/04/22**

**TIME: 3 HOURS**

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**INSTRUCTIONS TO CANDIDATES**

Answer ALL questions in section A and B and ANY THREE selected from section C

TIME: 3 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 8 Printed Pages. Please Turn Over.



**SECTION A: MULTIPLE CHOICE QUESTIONS (1 mark each, total 40 marks) Answer all questions**

1. ....and .....are solely ketogenic amino acids that yield only acetyl CoA or acetoacetyl CoA
  - A. Lysine and leucine
  - B. Proline and leucine
  - C. Lysine and Proline
  - D. Leucine and Isoleucine
2. Which of the compound below is a Carbon transfer cofactors?
  - A. Lipoic acid
  - B. Glutathione
  - C. Pyridoxamine
  - D. Homogentisate
  - E. S-Adenosylmethionine
3. ....is a **COMMON** intermediate for amino acids that are degraded to produce succinyl-CoA
  - A. Glutamate
  - B. Homogentisate
  - C. Oxaloacetate
  - D. Propionyl-CoA
  - E. Acetyl CoA
4. Deficiency of vitamin B12 leads to an accumulation of methylmalonyl CoA and propionyl CoA that cause .....
  - A. Severe mental retardation
  - B. Permanent neurologic dysfunction.
  - C. Renal dysfunction
  - D. Hepatic dysfunction
  - E. Muscle weakness
5. Which statement is **ODD** about porphyrinogens?
  - A. Are reduced form of porphyrins
  - B. The difference with porphyrins is 6 hydrogens
  - C. They are unstable *in vitro*
  - D. Are spontaneously oxidised to respective porphyrins
  - E. Serve as intermediates of heme synthesis in situation of low oxygen tension
6. Choose a neurotransmitter that is **NOT** a derivative of amino acids
  - A. Glycine
  - B. Epinephrine
  - C. Serotonin
  - D. Dopamine
  - E. Gamma aminobutyric acids
7. Taurine has multiple functions in the human body that include the following with the **EXCEPTION** of .....
  - A. Conjugation of bile acids,
  - B. Antioxidant role,

- D. All of the above
  - E. None of the above
15. An allosteric enzyme responsible for controlling the rate of TCA cycle is
- A. Aconitase
  - B. Isocitrate dehydrogenase
  - C. Fumarase
  - D. Pyruvate dehydrogenase
  - E. Malate dehydrogenase
16. In normal resting state of humans most of the blood glucose burnt as fuel is consumed by
- A. Liver
  - B. Kidney
  - C. Muscles
  - D. Brain
  - E. Adipose tissue
17. Glucose 6-phosphate is converted to 6-phosphogluconate by
- A. ATP
  - B. GTP
  - C.  $\text{NAD}^+$
  - D.  $\text{NADP}^+$
  - E. FAD
18. Which of the following is a positive allosteric modifier of the enzyme pyruvate carboxylase
- A. Glucose-6-phosphate
  - B. Oxaloacetate
  - C. Biotin
  - D. AcetylCoA
  - E. ATP
19. Hydrolysis of Glucose-6-phosphate is catalyzed by an enzyme phosphatase that is not found in which of the following
- A. Kidney
  - B. Liver
  - C. Muscle
  - D. Spleen
  - E. Brain
20. Conversion of glucose in the liver requires
- A. Lactic acid
  - B. Pyruvic acid
  - C. UTP
  - D. GTP
  - E. CTP

- C. Calcium absorption
  - D. Osmoregulation
  - E. Membrane stability
8. Which of the following is **FALSE** about oxidative deamination reaction?
- A. Catalysed by glutamate dehydrogenase
  - B. Requires  $\text{NAD}^+$  or  $\text{NADP}$  as cofactor
  - C. Is allosterically activated by ADP
  - D. Produces  $\alpha$  ketoglutarate and ammonia
  - E. Is inhibited by AMP
9. Choose a compound that is **NOT** detoxified by glutathione through transfer of cysteinyl group.
- A. Organophosphorus compounds
  - B. Snake poison
  - C. Halogenated compounds
  - D. Nitrogenous substances
  - E. Drug metabolism.
10. .... is a cellular site of heme biosynthesis
- A. Mitochondrial matrix
  - B. Mitochondrial membrane
  - C. Nucleus
  - D. Endoplasmic reticulum
  - E. Lysosome
11. Which one is **NOT** associated with Homocystinuria?
- A. Muscle weakness
  - B. Mental retardation
  - C. Thin blond hair
  - D. Self-mutilation
  - E. Defective cystathionine  $\beta$  synthase
12. Choose a condition that results from degradation of branched chain amino acids
- A. Methyl malonic acidemia
  - B. Homocystinuria
  - C. Phenylketonuria
  - D. Alkaptonuria
  - E. Maple syrup disease
13. .... is used to regulate the synthesis of heme
- A. Heavy metals like lead
  - B. Leucocytes
  - C. Erythropoietin
  - D. Vitamin B6
  - E. Hematin
14. Gluconeogenesis
- A. Is the reverse of glycolysis
  - B. Is the synthesis of glucose from glycogen
  - C. Is the synthesis of glucose from amino acids

21. How many ATP molecules will be required for conversion of 2 molecules of lactic acid to glucose
- A. 2
  - B. 4
  - C. 6
  - D. 8
  - E. 10
22. Out of 24 molecules of ATP formed in citric acid cycle, two molecules of ATP can be formed at substrate level by which of the following reaction
- A. Succinyl CoA  $\longrightarrow$  Succinate
  - B. Succinate  $\longrightarrow$  Fumarate
  - C. Malate  $\longrightarrow$  Oxaloacetate
  - D. Citrate  $\longrightarrow$  isocitrate
  - E. Isocitrate  $\longrightarrow$  Oxaloacetate
23. Which of the following compounds is a cofactor for the enzyme transketolase
- A. Biotin
  - B. TPP
  - C. ATP
  - D. NADP+
  - E.  $Mg^{2+}$
24. Which one of the following compounds is not an intermediate of the TCA cycle
- A. Pyruvate
  - B. Oxaloacetate
  - C. Malate
  - D. Succinate
  - E. Fumarate
25. Select an enzyme that catalyses conversion of Glucose-6-phosphate to glucose
- A. Hexokinase
  - B. Glucokinase
  - C. Glucose-6-phosphatase
  - D. Phosphofructokinase
  - E. None of the above
26. Identify enzyme that catalyzes the rate limiting step of HMP shunt
- A. Phosphogluconate dehydrogenase
  - B. Glucose-6-phosphate dehydrogenase
  - C. Transketolase
  - D. Transaldolase
  - E. All of the above
27. Identify the key regulators of the ketogenic pathway
- A. AcylCoa/CoA ratio

- B. NADH/NAD ratio
  - C. Insulin/Glucagon ratio
  - D. All of the above
  - E. None of the above
28. The complete beta-oxidation of palmitoyl CoA yield
- A. 8 molecules of acetyl CoA and 16 NADH
  - B. 8 molecules of Acetyl CoA and 16 FADH<sub>2</sub>
  - C. 8 molecules of Acetyl CoA, 8 NADH, and 8 FADH<sub>2</sub>
  - D. 8 molecules of Acetyl CoA and 16 NADPH
  - E. None of the above
29. Hypercholesterolemia refers to a condition with high cholesterol with a serum cholesterol level of
- A. >160 mg/dL
  - B. >200 mg/dL
  - C. >240mg/dL
  - D. >280mg/dL
  - E. >300 mg/dL
30. Ceramide is synthesized in the endoplasmic reticulum from the amino acid serine. Ceramide is an important signaling molecule (second messenger) that regulates the pathways including which of the following process?
- A. Apoptosis
  - B. Cell senescence
  - C. Cell differentiation
  - D. All of the above
  - E. None of the above
31. Which organ is the most active in the human body and has the ability to synthesize triacylglycerol?
- A. Spleen
  - B. Kidney
  - C. Liver and intestine
  - D. Adipose tissue
  - E. Brain
32. Which of the following enzymes is not involved in the hydrolysis of triacylglycerol in the adipose tissues?
- A. Epinephrine
  - B. Norepinephrine
  - C. Glucagon
  - D. Insulin
  - E. All of the above
33. Cholesterol serves as a precursor for the biosynthesis of the following pathways except

- A. Thyroid hormones
  - B. Bile acid synthesis
  - C. Steroid hormones synthesis
  - D. Aldosterone synthesis
  - E. All of the above
34. How many carbons are present in HMG CO-A
- A. 2
  - B. 3
  - C. 5
  - D. 6
  - E. 8
35. Geranyl pyrophosphate has how many carbons
- A. 8
  - B. 9
  - C. 10
  - D. 11
  - E. 12
36. Alpha oxidation of fatty acids occur in
- A. Brain
  - B. Adipose tissue
  - C. Liver
  - D. Muscles
  - E. Kidneys
37. The long-chain fatty acids get transported through the inner mitochondrial membrane
- A. As acyl-CoA derivative
  - B. Freely
  - C. As carnitine derivative
  - D. Requiring sodium-dependent carrier
  - E. None of the above
38. Where do long-chain fatty acids get first activated?
- A. Microsomes
  - B. Mitochondria
  - C. Cytosol
  - D. Nucleus
  - E. Peroxisomes
39. Which are the FIVE main series of apoproteins that have been identified?
- A. apoA, apoB, apoC, apoD, and apoE
  - B. apoA, apo(a), apoB, apoC and apoE

- C. apoA, apoB, apoC, apo E, and apoL
  - D. apoB, apoC, apoD, apoE and apoM
  - E. None of the above
40. Which of the following statements is incorrect regarding fatty acid  $\beta$ -oxidation?
- A. The major site of fatty acid  $\beta$ -oxidation is the peroxisomes, the mitochondria also contain enzymes for this pathway
  - B. Within the liver peroxisomes serve to oxidise very long chain fatty acids to medium chain products
  - C. The rate of  $\beta$ -oxidation is regulated by the availability of fatty acids and the rate of utilisation of  $\beta$ -oxidation products
  - D. Peroxisomes are the site for the degradation of xenobiotics and eicosanoids
  - E. All of the above

**SECTION B: SHORT ANSWER QUESTIONS (5 marks each total 30 marks). Answer all questions**

1. Discuss the biochemical basis of porphyrias
2. Describe Hyperammonemia Type II (Ornithinemia)
3. State the biomedical importance gluconeogenesis
4. Apart from ATP list five other high energy compounds found in the cell
5. Explain the clinical significance of ketogenesis and outline the difference between ketosis and ketogenesis
6. Briefly describe the regulation of the carnitine shuttle

**SECTION C: LONG ESSAY QUESTIONS (10 marks each, total 30 marks). Answer ALL questions.**

1. Discuss the clinical correlations associated with aromatic amino acid degradation
2. (a) With an illustration describe the oxidative phase of the pentose phosphate pathway (5marks)  
(b) Explain why the TCA cycle is regarded as the metabolic "hub" of the cell. (5 marks)
3. Explain the energetics of complete  $\beta$ -oxidation of Palmitic acid and highlight the steps involved in its regulation of fatty acid oxidation.