3S

(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS
MAIN EXAMINATIONS

UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

END OF TERM ONE EXAMINATIONS
FOR THE DEGREE
OF
BACHELOR OF MEDICINE AND BACHELOR OF SURGERY

COURSE CODE: MBS 201

COURSE TITLE: MEDICAL BIOCHEMISTRY II

DATE: 28:02:23 **TIME: 8.AM-10AM**

INSTRUCTIONS TO CANDIDATES

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

TIME: 3 Hours

SECTION A: MULTIPLE CHOICE QUESTIONS (1 mark each. Total 40 marks). Answer all questions

1. Which of the following statements is the most appropriate definition of an endergonic reaction
   A. It is spontaneous
   B. It is non-spontaneous
   C. It has a negative ΔG
   D. It has a positive ΔG
   E. B and D
2. List the following compounds in the order of increasing oxidizing power
   (a) Acetoacetate (E'^0=-0.346V), (b) cytochrome b (Fe^{3+}) (E'^0=0.077V), (c) NAD^+ ($E'0$=-0.315V), (d) SO_4^{2-} ($E'0$=-0.515V) and (e) pyruvate ($E'0$=-0.185V)
   A. c, a, , d, e and b
   B. d, a, c, e, and b
   C. b, a, e, c and d
   D. b, e, c, a and d
   E. None of the above
3. Which of the following enzymes catalyzes the pacemaker reaction of glycolysis
   A. Pyruvate kinase
   B. Hexokinase
   C. Phosphoglycerate kinase
   D. Phosphofructokinase 1
   E. Aldolase
4. Pyruvate dehydrogenase complex requires all of the following coenzymes with an **exception** of
   A. NADP+
   B. FAD
   C. CoASH
   D. TPP
   E. Lipoic acid
5. The following are intermediates of the TCA cycle **except**
   A. Malate
   B. Oxaloacetate
   C. Oxoglutarate
   D. Succinate
   E. Acetyl CoA
6. Pyruvate carboxylase catalyzes conversion of pyruvate to oxaloacetate. Which of the following molecules stimulates action of pyruvate carboxylase
   A. Pyruvate
   B. Fructose 1,6-bisphosphate
   C. Acetyl CoA
   D. Oxaloacetate

E. B and C

7. Which of the following groups of enzymes are common in glyoxylate and TCA cycles
   A. Citrate synthase, aconitase, α-ketoglutarate dehydrogenase
   B. Citrate synthase, aconitase, malate dehydrogenase
   C. Isocitrate dehydrogenase, α-ketoglutarate dehydrogenase
   D. Succinate CoA thiokinase, citrate synthase, isocitrate dehydrogenase
   E. None of the above
8. Which of the following electron carriers facilitate transfer of electrons from succinate into the electron transport chain
   A. NAD+
   B. Ubiquinone
   C. Cytochrome c
   D. FMN
   E. FAD
9. Complete oxidation of glucose in the skeletal muscles yields how many ATP molecules
   A. 30
   B. 32
   C. 48
   D. 40
   E. 2
10. 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
11. Which of the following compounds is a cofactor for the enzyme transketolase
   A. Biotin
   B. TPP
   C. ATP
   D. NADP+
   E. Mg2+
12. Which enzymes catalyze the first gluconeogenic reaction
   A. Pyruvate carboxylase
   B. Glucose-6-phosphatase
   C. Phosphoenolpyruvate carboxykinase
   D. A and B
   E. A and C
13. Which reaction is catalyzed by glycogen phosphorylase
   A. Glycogen ⟶ Glucose-6-phosphate
   B. Glycogen ⟶ glucose-1-phosphate
   C. Glucose-1-phosphate ⟶ glycogen
   D. Glycogen ⟶ glucose

E. None of above

14. Which of the following proteins initiates glycogen synthesis
    A. Glycogenin
    B. Glucogenenin
    C. Glycogen phosphorylase
    D. UDP-glucose pyrophosphorylase
    E. Glycogen synthase
15. Which of the following molecules marks damaged proteins for destruction
    A. Ubiquinone
    B. CoASH
    C. Ubiqutin
    D. Pyridoxal phosphate
    E. Biotin
16. Which of the following statements best describes transamination reaction
    A. Leads to deamination of amino acids
    B. Results in collection of amino groups from different amino acids in the form of glutamate
    C. It is associated with synthesis of energy
    D. It is a catabolic reaction
    E. A and B
17. Identify the enzyme that catalyzes oxidative deamination of glutamate
    A. Glutamate deaminase
    B. Glutamate dehydrogenase
    C. Glutamate oxidoreductase
    D. A and B
    E. None of the above
18. In the urea cycle, carbomylation of ornithine forms
    A. Argininosuccinate
    B. Carbomyl phosphate
    C. Citrulline
    D. Urea
    E. Fumarate
19. Which of the following amino acids is **not** a precursor for glucose
    A. Alanine
    B. Threonine
    C. Phenylalanine
    D. Lysine
    E. Serine
20. Select a pair constituting degradative products of threonine
    A. Pyruvate; Acetyl CoA
    B. Acetyl CoA; Alpha-ketoglutarate
    C. Succinyl CoA; Oxaloacetatae
    D. Pyruvate; Succinyl CoA

E. Pyruvate; Oxaloacetate

21. Select amino acid precursor for serotonin
    A. Tryptophan
    B. Serine
    C. Tyrosine
    D. Phenylalanine
    E. Threonine
22. Which of the following cofactors may act as a carrier for methyl groups during amino acid catabolism
    A. CoASH
    B. S-adenosylmethionine
    C. Biotin
    D. NAD^+
    E. FAD
23. Which of the following amino acids is degraded via oxaloacetate
    A. Threonine
    B. Phenylalanine
    C. Glutamine
    D. Asparagine
    E. Serine
24. Degradation of the following amino acids occurs in the liver with an **exception** of
    A. Glycine
    B. Alanine
    C. Valine
    D. Tyrosine
    E. Tryptophan
25. Maple urine disease is a genetic disorder resulting from defective catabolism of
    A. Glycine
    B. Threonine
    C. Phenylalanine
    D. Leucine
    E. All of the above
26. Which of the following amino acid provides C-skeleton of cysteine
    A. Histidine
    B. Glycine
    C. Methionine
    D. Serine
    E. Tyrosine
27. Niacin is produced in the body from which of the following amino acid
    A. Tyrosine
    B. Tryptophan
    C. Glycine
    D. Histidine

E. Serine

28. All of the following are produced from the breakdown of heme **except**
    A. Urobilinogen
    B. Stercobilinogen
    C. Porphobilinogen
    D. Bilirubin
    E. Biliverdin
29. Which of the following compounds serve as a primary link between the TCA cycle and the urea cycle
    A. Citrate
    B. Fumarate
    C. Malate
    D. Oxaloacetate
    E. Succinate
30. What is the primary site of fatty acid oxidation in the body?
    A. Adipose tissue
    B. Liver
    C. Skeletal muscle
    D. Brain
    E. Kidneys
31. How many carbons are typically in a fatty acid that is transported via the carnitine shuttle?
    A. 2-4
    B. 6-8
    C. 10-12
    D. 14-18
    E. 20-24
32. Which of the following is a hormone that inhibits fatty acid mobilization from adipose tissue?
    A. Insulin
    B. Glucagon
    C. Leptin
    D. Cortisol
    E. Thyroxine
33. Which of the following is a condition that can result from a deficiency in fatty acid oxidation?
    A. Type 2 diabetes
    B. Hypothyroidism
    C. Fatty liver disease
    D. Sickle cell anemia
    E. Acidosis
34. Which of the following hormones stimulates the uptake of glucose and fatty acids into adipose tissue for storage?

A. Insulin
B. Glucagon
C. Leptin
D. Cortisol
E. Thyroxine

35. What is the role of NADPH in cholesterol biosynthesis?
A. To reduce HMG-CoA to mevalonate
B. To convert acetyl-CoA to mevalonate
C. To convert mevalonate to cholesterol
D. To activate HMG-CoA reductase
E. To convert cholesterol to bile acids

36. What is the name of the enzyme that catalyzes the rate-limiting step in the carnitine shuttle?
A. Acetyl-CoA carboxylase
B. Acyl-CoA synthetase
C. Carnitine palmitoyltransferase I
D. Carnitine acyltransferase
E. Fatty acid synthase

37. What is the end product of beta-oxidation of unsaturated fatty acids?
A. Acetyl-CoA
B. Propionyl-CoA
C. Malonyl-CoA
D. Fumarate
E. Succinyl-CoA

38. What is the primary site of alpha oxidation of fatty acids in the body?
A. Liver
B. Brain
C. Kidneys
D. Spleen
E. Muscle

39. What is the role of the enzyme enoyl-CoA isomerase in beta-oxidation of unsaturated fatty acids?
A. To convert trans-fatty acids to cis-fatty acids
B. To convert cis-fatty acids to trans-fatty acids
C. To convert unsaturated fatty acids to saturated fatty acids
D. To convert cis- to trans-double bonds in unsaturated fatty acids
E. To convert trans- to cis-double bonds in unsaturated fatty acids

40. What is the role of the glyoxylate cycle in fatty acid oxidation?
A. To convert fatty acids to glucose
B. To convert glucose to fatty acids
C. To produce ATP from fatty acids
D. To produce NADH and FADH2 from fatty acids
E. To produce acetyl-CoA from fatty acids

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

1. Metabolic pathways frequently contain reactions with positive standard free energy values, yet the reactions still take place. With an illustration explain how this is possible
2. State the medical importance of the pentose phosphate pathway
3. State the roles of vitamins in amino acid catabolism
4. State the roles of glutathione in the body
5. Explain how the oxidation of fatty acids differ between the liver and other tissues such as muscle and adipose tissue?
6. Compare and contrast the oxidation of fatty acids in peroxisomes and mitochondria

SECTION C: LONG ESSAY QUESTIONS (10 marks each. Total 30 marks). Answer question 1 and any other two questions

1. Describe how genetic defects results in impaired lipid metabolism (**COMPULSORY**)
2. Describe pathophysiology of phenylketonuria
3. Trace the fate of gluco-6-phosphate in the body
4. Describe degradation and elimination of heme from the body