



*(Knowledge for Development)*

**KIBABII UNIVERSITY**

**UNIVERSITY EXAMINATIONS 2021/2022**

**ACADEMIC YEAR**

**FIRST YEAR FIRST TRIMESTER**

**SUPPLEMENTARY EXAMINATION**

**FOR BACHELOR OF SCIENCE IN  
NURSING DEGREE**

**COURSE CODE: NUR 125**

**COURSE TITLE: MEDICAL BIOCHEMISTRY II**

**DATE: 22/09/2022**

**TIME: 2.00pm-5.00pm**

**INSTRUCTIONS TO CANDIDATES**

Answer ALL Section one (1) MULTIPLE CHOICE QUESTIONS and ALL Section two (2) SHORT ANSWER QUESTIONS and any one (1) section THREE (3) LONG ANSWER QUESTION.

TIME: 3 Hours

This paper consists of 9 printed pages. Please Turn Over 

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**SECTION A: MULTIPLE CHOICE QUESTIONS**

**50 Marks**

**INSTRUCTION: Answer ALL questions**

1. Mutation in which of the following enzymes leads to a glycogen storage disease known as Tarui's disease?

- A. Glucokinase
- B. Phosphofructokinase
- C. Phosphoglucomutase
- D. Pyruvate Kinase

2. Erythrocytes undergo glycolysis for the production of ATP. The deficiency of ..... enzyme leads to hemolytic anemia?

- A. Glucokinase
- B. Phosphofructokinase
- C. Phosphoglucomutase
- D. Pyruvate Kinase

3. Cancer cells have high energy demands for replication and division. Increased flux of glucose into glycolysis replenishes the energy demand.

Which of the following enzyme plays an important role in tumor metabolism?

- A. Glucokinase
- B. Phosphofructokinase
- C. Phosphoglucomutase
- D. Pyruvate Kinase M2

4. Which of the following glucose transporter (GLUT) are important in insulin-dependent glucose uptake?

- A. GLUT1
- B. GLUT2
- C. GLUT3
- D. GLUT4

5. Which of the following glucose transporter (GLUT) is present in beta cells of the pancreas?

- A. GLUT1
- B. GLUT2
- C. GLUT3
- D. GLUT4

6. Which of the following glucose transporter (GLUT) is important in fructose transport in the intestine?

- A. GLUT1
- B. GLUT3
- C. GLUT5
- D. GLUT7

7. Which of the following metabolite negatively regulates pyruvate kinase?

- A. Fructose-1, 6-Bisphosphate
- B. Citrate
- C. Acetyl CoA
- D. Alanine

8. In absence of oxygen, pyruvate is converted into lactate in muscle because
- A. Lactate is the substrate from the downstream pathway
  - B. Lactate acts as a substrate for the formation of amino acid
  - C. During the product of lactate two ATP are produced
  - D. During lactate formation, NADH is reconverted into NAD.
9. Which of the following glycolytic enzyme is inhibited by the accumulation of long-chain fatty acid in the liver?
- A. Hexokinase
  - B. Glucokinase
  - C. Phosphofructokinase
  - D. Pyruvate kinase
10. Which of the following statement related to phosphofructokinase-I is false:
- A. PFK-2 is the isoenzyme of PFK-1 that is present in the liver
  - B. PFK-1 is activated by AMP whereas inhibited by ATP and citrate
  - C. The binding of ATP to PFK-1 induces the conformation change from R to T state
  - D. PFK-1 is regulated by posttranslational modification such as phosphorylation
11. Which of the following step is inhibited during arsenate poisoning?
- A. Glyceraldehyde-3-phosphate dehydrogenase
  - B. 3-phosphoglycerate mutase
  - C. Enolase
  - D. Pyruvate kinase
12. Which of the following enzyme catalyzes the conversion of pyruvate to lactate?
- A. Pyruvate reductase
  - B. Lactate reductase
  - C. Lactate dehydrogenase
  - D. Pyruvate dehydrogenase
13. Which of the following organ expresses glucokinase?
- A. Kidney
  - B. Muscle
  - C. Liver
  - D. Brain
14. Gluconeogenesis is the production of glucose from non-carbohydrate molecules. Which of the following is not substrate for gluconeogenesis?
- A. Lactate
  - B. Alanine
  - C. Glycerol
  - D. Acetyl CoA
15. Gluconeogenesis occurs in the liver and kidneys. Which is of the following enzyme are important for gluconeogenesis are expressed exclusively in these tissues?
- A. Glucose-6-phosphatase
  - B. Fructose-1, 6-Bisphosphatase

- C. Phosphoenolpyruvate carboxykinase  
D. Pyruvate carboxylase
16. During gluconeogenesis, the three irreversible steps of glycolysis have to be bypassed. The first step is the conversion of pyruvate to phosphoenolpyruvate. Which of the following statement is false regarding the reaction step?
- A. This reaction involves a two-step process catalyzed by pyruvate carboxylase and phosphoenolpyruvate carboxykinase  
B. Conversion of oxaloacetate from pyruvate occurs in mitochondria and shuttled into the cytosol.  
C. Formation of phosphoenolpyruvate requires both ATP and GTP as an energy source.  
D. Acetyl CoA is an activator of the enzyme pyruvate carboxylase.
17. During gluconeogenesis, the three irreversible steps of glycolysis have to be bypassed. The final step is the conversion of glucose-6-P to glucose that is catalyzed by glucose-6-phosphatase. Which of the following statement is true about the reaction step?
- A. Conversion of glucose-6-phosphate to glucose releases one ATP molecule  
B. It is a highly active enzyme in skeletal muscle  
C. Defect in glucose-6-phosphatase leads to abnormal accumulation of glycogen in the liver  
D. The reaction occurs in mitochondria
18. Which of the following statement is true about Cori Cycle?
- A. The Cori cycle involves three tissues muscle, liver, and brain  
B. It involves the transport of lactate from the liver to skeletal tissue for gluconeogenesis  
C. It involves the transport of lactate from skeletal muscle to the liver for gluconeogenesis  
D. It is active during resting stages and well-fed condition
19. During prolong starvation, which of the following hormone is responsible for increasing gluconeogenesis in the liver
- A. Insulin  
B. Glucagon  
C. TSH  
D. Thyroxine
20. The cholesterol serves as the precursor for the following biosynthetic pathways, EXCEPT
- A. Bile acid synthesis  
B. Steroid hormone synthesis  
C. Aldosterone synthesis  
D. Thyroid hormone synthesis
21. The enzyme that regulates the biosynthesis of cholesterol also serves as the druggable target for the reduction of hypercholesterolemia (increase blood cholesterol). Identify the regulatory enzyme from the following options:
- A. HMG-CoA synthase  
B. HMG- CoA reductase  
C. Lansterol oxidase  
D. Cholesterol synthase

22. Which of the following hormone increases the synthesis of cholesterol by regulating the enzyme HMG CoA reductase?
- Insulin
  - Glucagon
  - Glucocorticoids
  - All of the above
23. Sterol Regulatory Binding Protein binds to DNA at the sterol regulatory element to increase the expression of HMG CoA reductase, and synthesis of cholesterol. What happens when there is the presence of a high cellular concentration of cholesterol?
- Increases the proteolytic cleavage, release, and shuttling of SREBP into the nucleus
  - Decreases the proteolytic cleavage and release of SREBP from ER
  - Activates SREBP by inducing the conformational change
  - Inhibit SREBP by competitively binding to DNA binding site of SREBP
24. Hormones such as insulin & glucagon regulate HMG CoA reductase by a phosphorylation and dephosphorylation process. Phosphorylation of HMG CoA reductase results in decreased enzyme activity. Identify the correct statement from the following:
- Insulin inhibits kinase that phosphorylates HMG CoA reductase
  - Insulin activates kinase that phosphorylates HMG CoA reductase
  - Insulin activates the phosphatase that removes a phosphate group from HMG CoA reductase
  - Insulin inhibits kinase that phosphorylates HMG CoA reductase
25. Hypercholesterolemia refers to a condition with high cholesterol with a serum cholesterol level of.....
- >160 mg/dL
  - >200 mg/dL
  - >240 mg/dL
  - >280 mg/dL
26. Which of the following enzyme is responsible for the conversion of cholesterol to cholesterol ester inside the cells?
- Lecithin Cholesterol Acyl Transferase
  - Acyl CoA Cholesterol Acyl Transferase
  - Cholesterol Esterase
  - None of the Above
27. Which of the following glycolytic intermediates serves as the precursor for the backbone for the synthesis of Triglycerides, Phosphatidylcholine, Phosphatidylethanolamine?
- Glyceraldehyde-3-phosphate
  - Pyruvate
  - 1-3 Bisphosphoglycerate
  - 3-Phosphoglycerate
28. 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?
- Apoptosis

- B. Cell senescence
  - C. Cell differentiation
  - D. All of the above
29. Identify the phospholipid that possesses a surfactant activity and is synthesized shortly before parturition in full-term infants, and its deficiency in the lungs can cause respiratory distress syndrome.
- A. Dipalmitoylphosphatidyletholamine
  - B. Ceramide
  - C. Dipalmitoylphosphatidylcholine
  - D. All of the above
30. A child is was brought to the hospital with the clinical presentation of mental retardation, blindness, and muscular weakness. The biochemical examination showed the accumulation of GM2 gangliosides in the tissues. What is the possible cause of the disease?
- A. Tay Sachs Disease caused by Hexosaminidase A deficiency
  - B. Fabry Disease caused by Alpha-Galactosidase deficiency
  - C. Krabbe Disease caused by Beta-Galactosidase deficiency
  - D. Gaucher Disease caused by Beta-Glucosidase deficiency
31. Transamination is catalyzed by
- A. Transferases
  - B. Aminotransferases
  - C. Hydrogenases
  - D. Dehydrogenases
32. A person with phenylketonuria cannot convert
- A. Phenylalanine to tyrosine
  - B. Phenylalanine to isoleucine
  - C. Phenol into ketones
  - D. Phenylalanine to lysine
33. A glucogenic amino acid is one which is degraded to
- A. Keto-sugars
  - B. Either acetyl CoA or acetoacetyl CoA
  - C. Pyruvate or citric acid cycle intermediates
  - D. None of the above
34. Histidine is degraded to  $\alpha$ -ketoglutarate and is described as a
- A. Gluco amino acid
  - B. Glucogenic amino acid
  - C. Ketogenic amino acid
  - D. Keto-gluco amino acid
35. Oxidative deamination is the conversion of an amino
- A. Group from an amino acid to a keto acid
  - B. Acid to a carboxylic acid plus ammonia
  - C. Acid to a keto acid plus ammonia
  - D. Group from an amino acid to a carboxylic acid

36. An example of a transamination process is
- Glutamate = hexanoic acid +  $\text{NH}_3$
  - Aspartate + hexanoic acid = glutamate + oxaloacetate
  - Aspartate +  $\alpha$  ketoglutarate = glutamate + oxaloacetate
  - Glutamate =  $\alpha$ -ketoglutarate +  $\text{NH}_3$
37. A person with phenylketonuria is advised not to consume which of the following products?
- Glycine containing foods
  - Fat containing food
  - Glucose
  - Aspartame
38. Tyrosine is degraded to acetoacetyl CoA and fumarate and is described as a
- Glucogenic amino acid
  - Ketogenic amino acid
  - Ketogenic and glucogenic amino acid
  - Keto-gluco amino acid
39. Transaminase enzymes are present in
- Liver
  - Pancreas
  - Intestine
  - None of these
40. The function of nucleotide includes:
- Second Messenger
  - Energy currency and high energy equivalents
  - Regulators of intermediary metabolism
  - All of the above
41. Carbamoyl phosphate synthetase II (CPS-II) is the committed step in the formation of carbamoyl phosphate is:
- Activated by PRPP
  - Inhibited by UMP
  - Activated by ATP
  - All of the above
42. Which of the following cofactor is used during the conversion of uracil to thymine?
- S-Adenosyl Methionine
  - Tetrahydrofolate
  - Tetrahydrobiopterin
  - Biotin
43. Which of the following cofactor/coenzyme is NOT utilized in the conversion of ribose to deoxyribose?
- NADPH
  - FADH<sub>2</sub>
  - UMP

- D. Thioredoxin
44. Followings are the example of nucleosides, EXCEPT:
- A. Adenosine
  - B. Cytidine
  - C. Cytosine
  - D. Uridine
45. The nitrogens of a purine molecule are derived from all of the following amino acids, except?
- A. Aspartic Acid and Glutamine
  - B. Asparagine and Glutamine
  - C. Glutamate and Alanine
  - D. Glycine and Alanine
46. Which of the following steps of pyrimidine biosynthesis occurs in mitochondria?
- A. Synthesis of carbamoyl phosphate catalyzed by CPS II
  - B. Conversion of carbamoyl phosphate to carbamoyl aspartate catalyzed by aspartate transcarbamoylase
  - C. Synthesis of dihydroorotate catalyzed by dihydroorotase
  - D. Formation of orotic acid catalyzed by dihydroorotase dehydrogenase
47. Methotrexate inhibits which of the following enzyme?
- A. Ribonucleotide reductase
  - B. Thymidylate synthase
  - C. Dihydrofolate reductase
  - D. PRPP-amidotransferase
48. Orotic aciduria is an inherited genetic disorder caused by a deficiency of the following enzyme:
- A. CPS II
  - B. Aspartate transcarbamoylase
  - C. Dihydroorotase dehydrogenase
  - D. UMP synthase
49. Fluorouracil is an anti-tumor agent that binds and irreversibly inhibits which of the following enzyme?
- A. Ribonucleotide reductase
  - B. Thymidylate synthase
  - C. Dihydrofolate reductase
  - D. PRPP-amidotransferase
50. Which of the following is the degradation product of pyrimidines?
- A. Beta-alanine
  - B. Uric acid
  - C. Allantoin
  - D. Glycine

**SECTION B: SHORT ANSWER QUESTIONS (SAQS) 30 Marks**



**INSTRUCTION: Answer ALL questions**

1. State the coenzyme involved in
  - i. Oxidation-reduction reactions (1 Mark)
  - ii. Carrier of acyl group (1 Mark)
  - iii. Transfers of groups to and from amino acids (1 Mark)
  - iv. Carboxylation or decarboxylation reactions (1 Mark)
  - v. Propionyl CoA to D-Methylmalonyl CoA (1 Mark)
2. Explain the Glycerol-3-phosphate shuttle. (5 Marks)
3. Discuss the diagnosis of metabolic diseases. (5 Marks)
4. Discuss Maple Syrup Urine disease (MSUD). (5 Marks)
5. Describe the Cori cycle. (5 Marks)
6. Describe the distribution and characteristics of Glucose transporter 2 (GLUT2) (5 Marks)

**SECTION C:**

**INSTRUCTION: Answer any ONE question**

1. Outline glycolytic reactions. Discuss the significance of glycolysis. (20 Marks)
2. Outline the synthesis of both Triglycerides and Phospholipids. (20 Marks)