



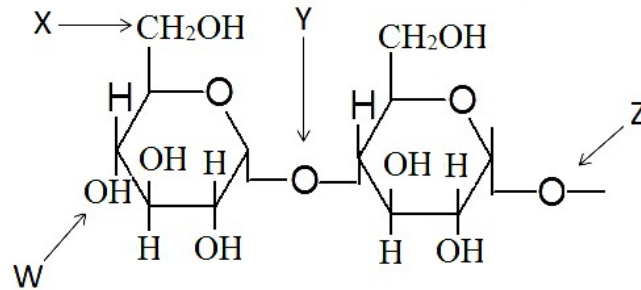
**FACULTY OF INDUSTRIAL SCIENCES & TECHNOLOGY
FINAL EXAMINATION**

PART A

(OBJECTIVE QUESTIONS)

Answer all questions.

1. In glycolysis and Krebs cycle, ATP can be produced without using electron transport chain. This is referred as _____.
(a) covalent modifications
(b) substrate level phosphorylation
(c) oxidative phosphorylation
(d) ATP hydrolysis
2. In the glycogen synthase reaction, the UDP-glucose reacts to the non-reducing end of a glycogen primer. Specify the non-reducing end.



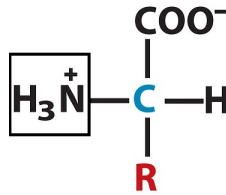
- (a) W
 - (b) X
 - (c) Y
 - (d) Z
3. All the enzymes of this catabolic pathway are located in the cytoplasm **EXCEPT**
(a) Pentose phosphate pathway
(b) Gluconeogenesis
(c) Glycolysis
(d) Krebs cycle

4. Which of the following is **TRUE** for glycolysis?
- (a) The pathway must require oxygen to complete.
 - (b) The pathway is absent in cells without any mitochondria.
 - (c) The pathway reduces two moles of NADP^+ to NADPH for each mole of glucose.
 - (d) The pathway utilizes two moles of ATP in order to catabolize each mole of glucose.
5. Which of the following is **NOT** a mechanism for altering the flux of metabolites through the rate-determining step of a pathway?
- (a) Allosteric control of the enzyme.
 - (b) Covalent modification of the enzyme.
 - (c) Genetic control in enzyme production.
 - (d) All of the above.
6. Which of the following regulates glycolysis step?
- (a) Phosphoprotein phosphatases
 - (b) Glucose-6-phosphatase
 - (c) Fructose 1,6-bisphosphatase
 - (d) Hexokinase
7. Glucose release into bloodstream for uptake by other cells is obtained from _____.
- (a) the muscle by glycolysis and hexose monophosphate pathway
 - (b) the liver by glycogenesis and gluconeogenesis
 - (c) the muscle by glycogenolysis and gluconeogenesis
 - (d) the liver by glycogenolysis and gluconeogenesis

8. One of these statements relates correctly the Krebs cycle to be a catabolic pathway.
- (a) It occurs in the center of the cell.
 - (b) Its intermediates are commonly used by other metabolic reactions.
 - (c) It is cyclic in structure.
 - (d) It is directly connected to electron transport chain.
9. In what form does the product of Krebs cycle enter the electron transport chain?
- (a) NAD^+
 - (b) NADP^+
 - (c) NADPH
 - (d) NADH
10. One of these statements is **TRUE** about Krebs Cycle.
- (a) It is located in the cytoplasm.
 - (b) It involves the reduction of the two carbon acetyl group in acetyl-CoA to CO_2 .
 - (c) It is a cyclic pathway as it regenerates acetyl-CoA.
 - (d) It operates in aerobic conditions only.
11. Which one of the following is an intermediate of the Krebs Cycle?
- (a) Succinyl CoA
 - (b) Malonyl CoA
 - (c) Propionyl-CoA
 - (d) Pyruvate

12. Identify one of the following gluconeogenesis intermediates found in glycolysis pathway.
- (a) Acetyl CoA
 - (b) Phosphoenolpyruvate
 - (c) Ribose-5-phosphate
 - (d) Oxaloacetate
13. Pentose phosphate pathway _____ .
- (a) assists in regenerating oxidized glutathione (GSSG)
 - (b) linked to glycolytic pathway via dihydroxyacetone phosphate and fructose-6-phosphate
 - (c) produces precursor to synthesize the sugar moiety of nucleic acid
 - (d) produces NADH for H_2O_2 elimination
14. Identify the statement that is **TRUE** regarding gluconeogenesis.
- (a) Both gluconeogenesis and glycolysis utilizes enzyme hexokinase.
 - (b) It requires NADPH.
 - (c) Muscle gluconeogenesis maintains normal blood glucose levels.
 - (d) For starting materials, it can use carbon skeletons derived from amino acid.
15. The catabolism of glucose and fatty acid is similar because _____ .
- (a) both must require oxygen.
 - (b) both generate NADH.
 - (c) both generate equal amount of ATPs.
 - (d) both located in mitochondria.
16. Cholesterol is utilized in the synthesis of all of these **EXCEPT** _____ .
- (a) vitamin D
 - (b) insulin
 - (c) chylomicron
 - (d) cell membrane

17. In birds, the functional group within the boxed area will be converted to _____ for disposal.



- (a) ammonia
(b) uric acid
(c) nitrogen
(d) urea
18. Amino acids can be divided to being either ketogenic, glucogenic or both. An amino acid that is solely ketogenic refers to _____ .
- (a) the carbon skeleton degraded to oxaloacetate or acetoacetyl CoA.
(b) the carbon skeleton degraded to acetoacetyl CoA only.
(c) the carbon skeleton degraded to oxaloacetate only.
(d) the carbon skeleton degraded to α -ketoglutarate only.
19. The term essential amino acid refers to _____ .
- (a) amino acid must be supplied in diet.
(b) amino acid produced by the organism.
(c) amino acid used by gluconeogenesis pathway.
(d) amino acid required due to particular conditions.

20. One of the following statements is **NOT TRUE** regarding nucleotide biosynthesis.
- (a) It can be synthesized either by de novo or salvage pathways.
 - (b) The nitrogenous base is assembled first and followed by attachment to ribose during the pyrimidine biosynthesis.
 - (c) The purine base is assembled first and followed by attachment onto a ribose-based structure.
 - (d) Ribose is generated by reduction of deoxyribose sugar within a fully formed nucleotide.

(20 Marks)

(SUBJECTIVE QUESTIONS)

Answer all questions.

QUESTION 1

Energy is important to do works such as active movement of solutes, contraction of muscles and anabolic pathways e.g. formation of glycogen. This energy is provided by food intake being digested into simpler molecules which in turn oxidized step-wise into energy molecules.

- (a) Assuming that oxidations of $\text{FADH}_2 \equiv 2\text{ATPs}$ and $\text{NADH} \equiv 3\text{ATPs}$ and no loss of ATP in transporting NADH into mitochondria, calculate the total yield of ATPs in glycolysis under aerobic (only up to pyruvate) and anaerobic processes in humans. Explain your answer for each condition.

(12 Marks)

- (b) “The number of ATPs generated in Krebs cycle is much more than in glycolysis”. Explain this statement.

(8 Marks)

QUESTION 2

Compare glycolysis and pentose phosphate pathway in terms of starting materials, products, connections, reactions pathway/steps (briefly) and location.

(20 Marks)

QUESTION 3

(a) In the recent Antarctica expedition, a new species of mammal, **X**, was found by a Malaysian zoologist. Biochemical investigations on its amino acid classification and synthesis were done and given in Figure 1 and Table 1, respectively.

Table 1: Classification of Amino Acids found in Mammal X

Essential and Nonessential Amino Acids in Mammal X		
Essential	Nonessential	
Arginine*	Alanine	
Histidine*	Asparagine	
Isoleucine	Aspartate	
Leucine	Cysteine	
Lysine	Glutamate	
Methionine	Glutamine	
Phenylalanine	Glycine	
Threonine	Proline	Note: * Arginine and histidine are essential in the diets of juveniles, not adults
Tryptophan	Serine	
Valine	Tyrosine	

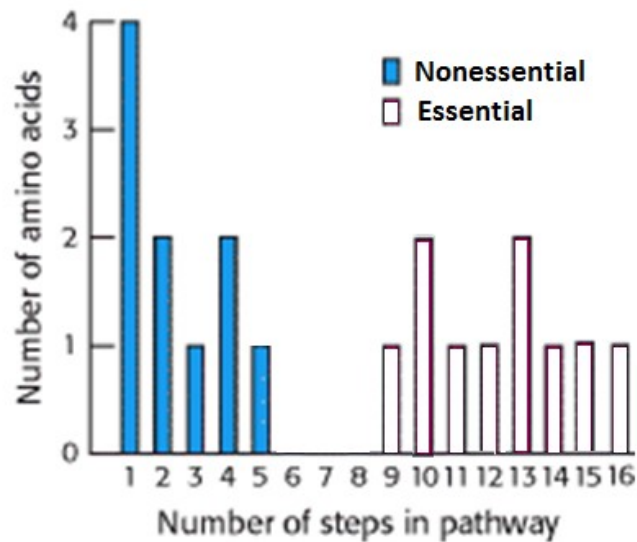


Figure 1: The number of biochemical reaction steps required to synthesis the essential and non-essential amino acids in mammal X.

(i) Analyze **Table 1** and **Figure 1** to explain the synthesis of essential and non-essential amino acids within the mammal's body.

(6 Marks)

(ii) What can be described about arginine and histidine in this finding?

(4 Marks)

(b) In studying the amino acid metabolism of mammal X, a pathway as shown in **Figure 2**, was found useful to eliminate excess of a toxic material generated in the breakdown of amino acids.

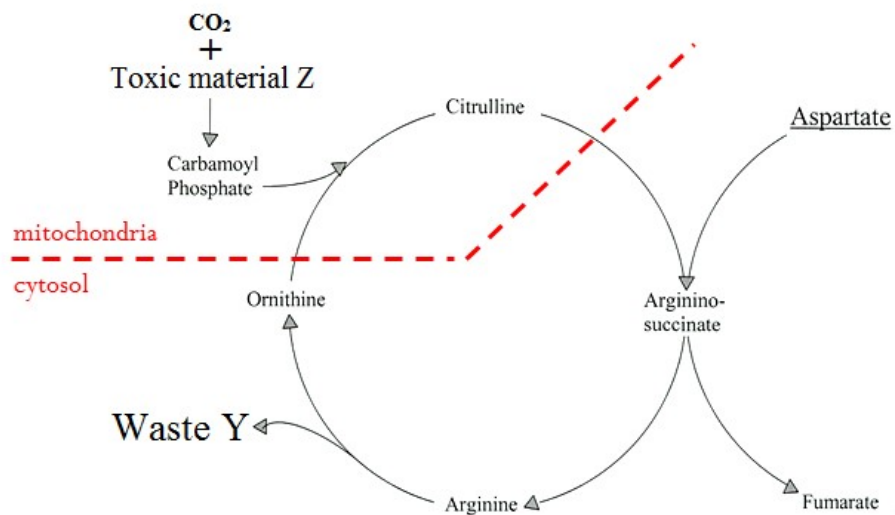


Figure 2

(i) Name waste Y and toxic material Z.

(4 Marks)

(ii) Explain the pathway in **Figure 2** related to purpose, reactions pathway/steps and location.

(6 Marks)

PART B

QUESTION

Metabolism defined as the combination of both catabolic and anabolic pathways. Many coenzymes play important role in various biochemical pathways.

(a) ATP has been considered as the energy currency of the cell. Explain how ATP can be generated with appropriate examples.

(6 Marks)

(b) Compare between NADPH and NADH coenzymes in terms of their contributions in metabolism with appropriate examples.

(14 Marks)

END OF QUESTION PAPER