The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc. Degree Programme

Department	**: Chemistry**
Level	**: 5**
Name of the Examination	: Final Examination
Course Title and - Code	**: Biochemistry – CMU3126**
Academic Year	**: 2019/2020**
Date	: 09/11/2020
Time	**: 1.30 pm – 3.30 pm**
Duration	**: 2 hours**

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Six** questions in **Five** pages.
3. **Answer FOUR questions only**. All questions carry equal marks.
4. Answer for each question should commence from a new page.
5. Draw fully labelled diagrams where necessary.
6. Involvement in any activity that is considered as an exam offense will lead to punishment
7. Use blue or black ink to answer the questions.
8. Clearly state your index number in your answer script

1. A) i) What is the main function of citric acid cycle?

ii) Name the two steps that involved in production of CO_2 in citric acid cycle. Explain them using correct chemical equations.

iii) Explain the term 'substrate level phosphorylation' using the examples found in citric acid cycle.

iv) Name the enzyme complexes, which help to form the proton gradient in the inner mitochondrial membrane during the respiratory chain and state their function in electron transport chain.

(50 marks)

B) i) Name two catabolic pathways of glucose.

ii) Define the terms 'catabolism' and 'anabolism'.

iii) What is the purpose of anaplerotic reactions? Write four types of anaplerotic reactions indicating their relevant enzymes.

iv) Name the two shuttles operated in the inner mitochondrial membrane to transport NADH released from glycolysis in the cytosol to mitochondria. Explain one of the shuttles mentioned above.

(50 marks)

2. A) i) Write the detail chemical reaction for entry of pyruvate to citric acid cycle.

ii) Which step in citric acid cycle is having zero free energy change value ($\Delta G=0$)? Write the relevant complete chemical reactions including enzymes.
(Hint- chemical structures of the compounds are not necessary)

iii) What are the two stages of photosynthetic process in a living cell? Write five main features of one of the stages that is mentioned above.

iv) What is the function of Rubisco enzyme in the dark reaction?

(50 marks)

B) i) What is meant by an enzyme inhibitor?

ii) Briefly explain three main types of enzyme inhibitors.

iii) Write down Michealis – Menton equation (M-M equation) for an enzymatic reaction and define all the terms.

iv) Using the equation given above for M-M equation, derive a suitable equation to draw line-weaver burke plot and indicate the changes that could be observed in the presence of a competitive inhibition.

v) Write down two common uses of competitive inhibitors.

(50 marks)

3. A) i) Mention four factors, which affect the rate of the enzyme reaction.

ii) What is the steady state approximation in an enzymatic reaction?

iii) Define turn over number/frequency of an enzyme.

iv) What do you mean by isozyme? Give two examples.

v) Explain why enzymes are stereospecific.

(50 marks)

B) i) What is allosteric regulation of enzyme?

ii) Describe the differences between product inhibition and feedback inhibition of an enzyme.

iii)What are the two types of enzymes which catalyzed by metal ions. Give two examples for each.

iv) Write down three methods where metal ions participate in catalysis process of an enzyme.

(50 marks)

4. A) Gluconeogenesis is the formation of glucose from non-carbohydrate precursors.

i) Give two precursors for gluconeogenesis.

ii) Explain why gluconeogenesis is not a reversal of glycolysis.

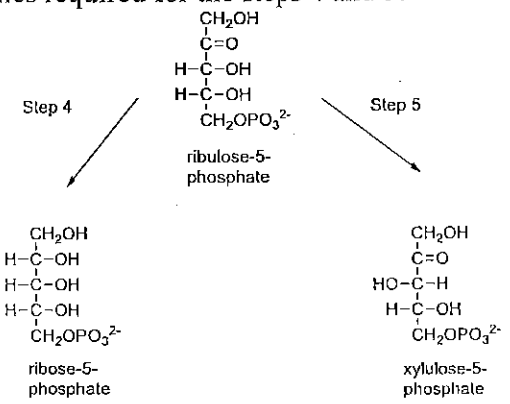
iii) Glycerol enters the gluconeogenic pathway as dihyroxy actone phosphate. Explain the reactions for the conversion of glycerol to dihyroxy actone phosphate.

(50 marks)

B) Pentose Phosphate Pathway(PPP) is an important metabolic pathway for glucose. PPP operates in different modes maximizing various products.

i) What are the main purposes of PPP in the cell?

ii) Ribulose-5-phosphate is a product of the oxidative reactions of PPP and it undergoes two different enzymatic reactions as given below in PPP. Identify the enzymes required for the steps 4 and 5.



iii) PPP can operate in different modes depending on the needs of a cell. Briefly explain the mode of operation when the cell requires both ATP and NADPH.

(50 marks)

5. A) Glycogen is the main form of storing glucose as an energy source in the body.

i) Why is glycogen preferred as an energy source over fat molecules?

ii) Explain the structure of glycogen.

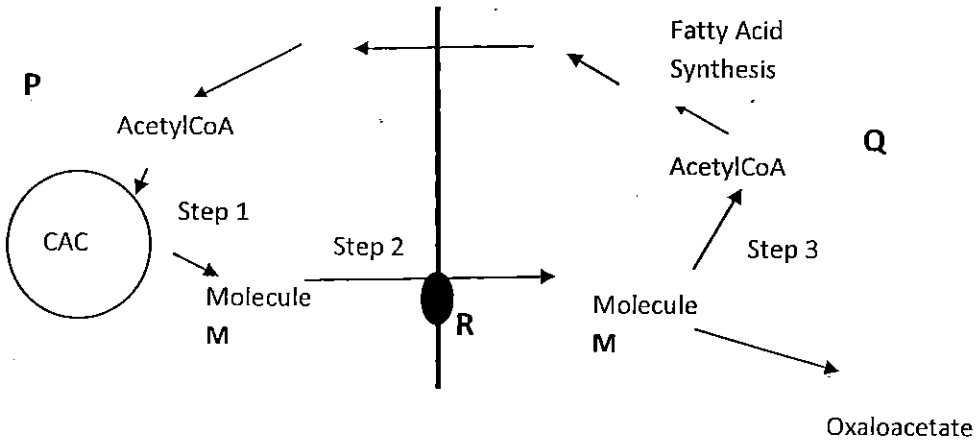
Hint; Chemical structures are not necessary.

iii) Name two main enzymes involved in glycogenolysis.

iv) Name the five steps involved in the synthesis of glycogen. 20

(50 marks)

B) Given below is a schematic representation of transporting AcetylCoA in the cell. (CAC = Citric Acid Cycle) P and Q are cellular locations. R is a tricarboxylate transporter to transport molecules labeled as M.



i) Identify the cellular locations **P** and **Q** and the molecule **M**.

ii) Name two reactions that produce AcetylCoA in mitochondria.

iii) Explain why AcetylCoA cannot be transported directly from **P** to **Q**.

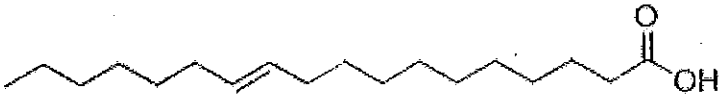
iv) Explain the steps (Steps 1,2 and 3) in transporting AcetylCoA from P to **Q**. Give relevant equations.

(50 marks)

6. A) Fatty acid synthesis and Beta oxidation are two important reactions in the body.

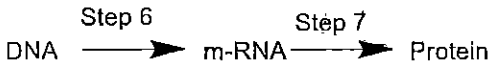
i) The primary product of the fatty acid synthesis reaction is Palmitic acid (C-16). Explain how the chain lengthening and unsaturation happens in fatty acids.

ii) Consider the structure of vaccenic acid, a trans fatty acid given below. Explain the beta oxidation of vaccenic acid.



(50 marks)

B) The process of the biosynthesis of proteins under genetic control is shown in the figure below.



i) Identify the steps 6 and 7.

ii) Briefly explain the processes at the step 6.

iii) Name the three steps of protein synthesis.

iv) Tetracycline is an effective antibiotic against acne. Explain the mode of action of Tetracycline as an antibiotic.

(50 marks)

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