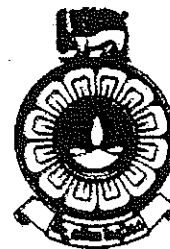


The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc. Degree Programme



Department	: Chemistry
Level	: 5
Name of the Examination	: Final Examination
Course Title and - Code	: Biochemistry - CYU5306
Academic Year	: 2020/2021
Date	: 29/03/2022
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 **FOUR** questions in **SIX** pages.
3. Answer **All** questions. 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. Answer any **Two (2)** parts from **A-C**.

- A.** i) What is the major two carbon product that results from the oxidation of many biomolecules?
- ii) What is the fate of the above compound during catabolic pathways?
- iii) Name the first **four** steps in the citric acid cycle.
- iv) Write complete chemical equations for **two** steps mentioned above in part (iii).
(Hint: No structures are required)
- v) Aconitase is a stereospecific enzyme used in the citric acid cycle. Explain this statement.

(50 marks)

- B.** i) What are the two regulatory steps of the citric acid cycle?
- ii) "Succinyl CoA is a product inhibitor of step 4 – second oxidative decarboxylation".
Explain the statement with the correct chemical equation.
(Hint: No structures are required)
- iii) What is the function of the pyruvate dehydrogenase enzyme?
- iv) Write down any **two** anaplerotic reactions of the citric acid cycle.

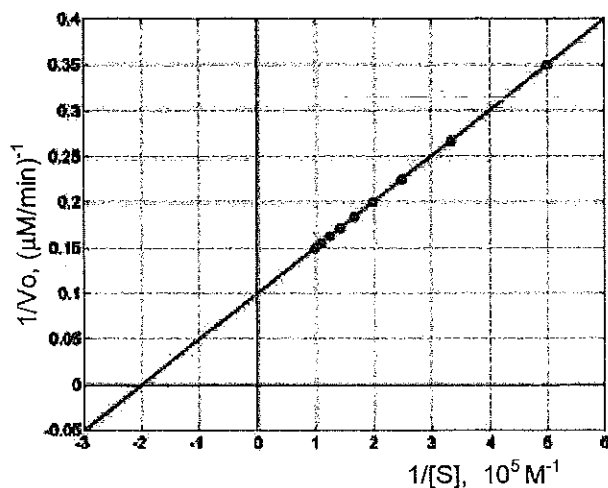
(50 marks)

- C.** i) What are the two shuttle systems used to transport NADH from the cytosol to mitochondria?
- ii) What is the function of complex V in the electron transport chain?
- iii) Write down **three** main differences between cyclic and noncyclic light reactions.
- iv) Write down **four** main features of the Calvin cycle.

(50 marks)

2. Answer any **Two (2)** parts from **A-C**.

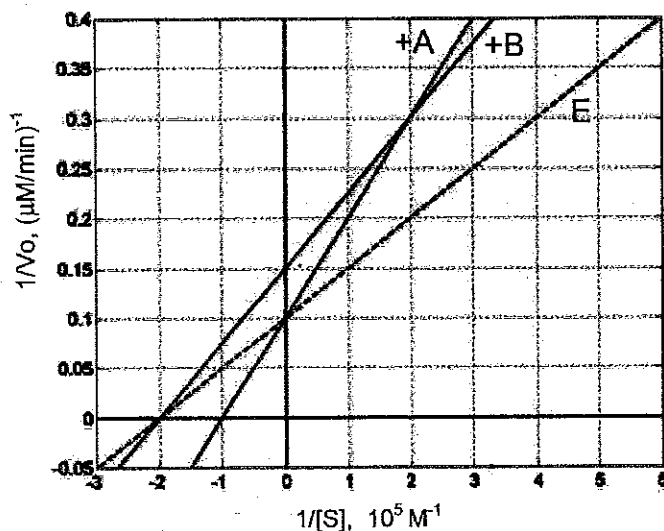
- A.** Below figure is the Line weaver Burke plot of an enzyme without any inhibitor. The enzyme concentration is maintained constant at a level of 1 μmol .



i) Using the above plot calculate the V_{max} , K_m , k_{cat} (turn over number) for the enzyme.

ii) Inhibitory studies of the above enzyme have been carried out in the presence of 5 mM of inhibitor A and inhibitor B separately. The L-B plots in the presence of those inhibitors are indicated by +A and +B in the figure below.

Giving reasons identify the types of inhibitors, A and B



iii) Name the inhibitor that has no effect on V_{max} upon changing the inhibitor concentration?

iv) Dixon plot is the most suitable method to determine the dissociation constant (K_i) of the inhibitor-enzyme complexes. How does a Dixon plot differ from an L-B plot?

(50 marks)

B i) Write down **three** special features of the active site of an enzyme.

ii) Briefly explain how does pH becomes optimum for a particular enzyme that affect the activity of enzyme?

iii) Write down **three** catalytic mechanisms of an enzyme.

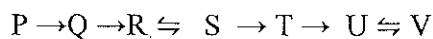
iv) "Low substrate concentration is affected on the reaction rate of an enzymatic reaction while high substrate concentration is not affected for the reaction rate" Explain the statement.

(50 marks)

C i) Name four factors that can affect the formation of the ES (enzyme-substrate) complex.

ii) What do you mean by a committed step in a biochemical pathway?

iii) Identify the committed step of the following pathway.



↓

X

iv) Briefly explain the reason for the formation of brownish colour in fruit salad after some time.

(50 marks)

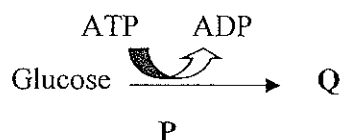
3. Answer any **Two (2)** parts from A-C.

A. Glycolysis is one of the major catabolic pathways in our body.

i) Name the two major phases of glycolysis.

(10 marks)

ii) One of the major phosphorylation steps of glycolysis is given below.



a) Identify the enzyme **P** and the product **Q** in the reaction.

b) Explain the use of this reaction.

c) Define the term isozyme and name an isozyme for the enzyme **P**.

d) Compare the differences between the isozyme and the enzyme **P**.

(40 Marks)

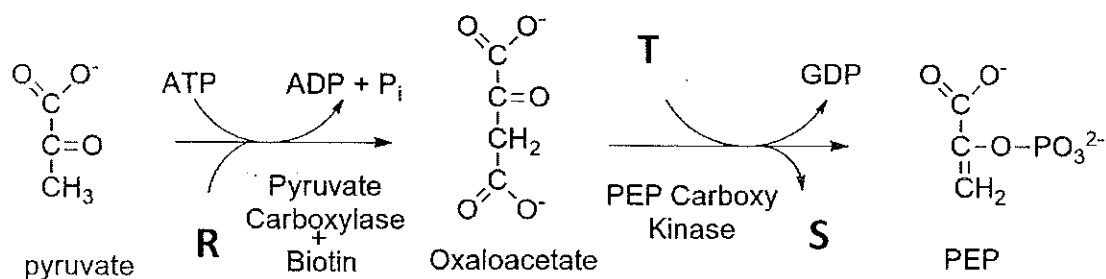
B. Both Gluconeogenesis and photosynthesis are anabolic reactions.

i) Compare photosynthesis and gluconeogenesis:

ii) Explain why gluconeogenesis is different from glycolysis.

iii) The reaction for converting pyruvate to phosphoenolpyruvate is given below. Identify the compounds **R**, **S**, and **T**.

(Hint: No structures are required)

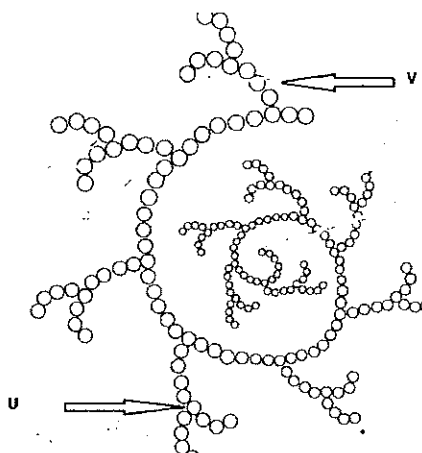


iv) In a vigorous exercising muscle, ATP requirement is high, and oxidative reflux is not enough. Explain this statement.

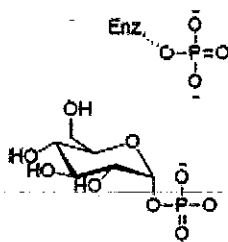
(50 Marks)

C. Glycogen is the main storage form of carbohydrate in the body.

- i) The following structure depicts a glycogen molecule. Name the bonding indicated by U and V.



- ii) Name three enzymes involved in glycogenolysis.
 iii) Explain the phosphorolysis reaction in glycogenolysis.
 (Hint: No structures are required)
 iv) Give the mechanism of action of the following reaction in glycogenolysis.



Glucose-1-phosphate

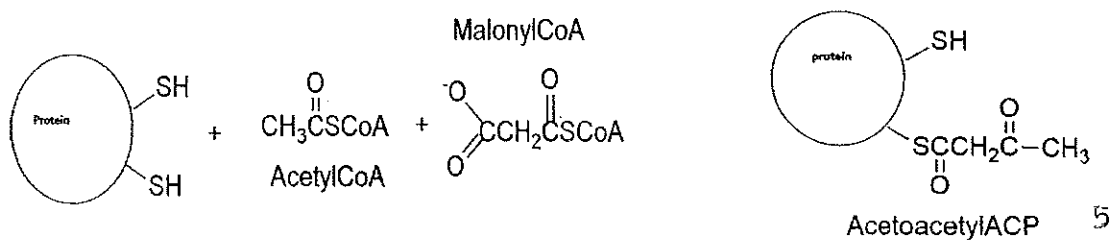
(50 Marks)

4. A. Fatty acids are biosynthesized in the cytosol using acetyl CoA.

- i) Explain how acetyl CoA travels across the mitochondrial membrane, giving a suitable equation.

(Hint: No structures are required)

- ii) Name the protein required for the immobilization of acetyl CoA and malonyl CoA and give the mechanism for the formation of acetoacetylACP using the following depiction.



iii) Briefly explain the chain lengthening of fatty acid chains having more than 16 fatty acids.

iv) Explain how does Insulin stimulate fatty acid synthesis.

(50 Marks)

B. Amino acids undergo degradation, and their carbon skeleton enter as many different compounds of the citric acid cycle.

i) Name three major compounds of the citric acid cycle used to form the carbon skeletons of amino acids.

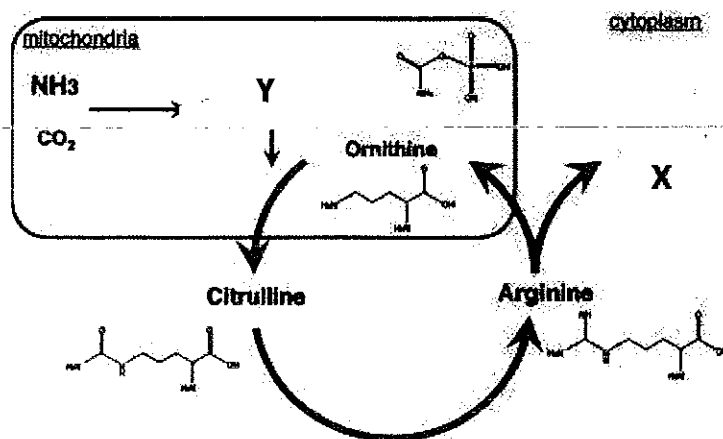
ii) a) Define transamination and give the transamination reaction.

(Hint: No structures are required)

b) Name two enzymes used for the transamination reaction.

iii) Briefly explain how ammonia level is kept low in human blood.

iv) a) Identify the compounds X and Y in the urea cycle given below.



b) Explain how the ammonium group glutamine is released as ammonia to be used in the urea cycle.

(Hint: No structures are required)

(50 Marks)
