



THE OPEN UNIVERSITY OF SRI LANKA

B.Sc Degree Program 2014/15

CMU 3126 – LEVEL 5 – BIOCHEMISTRY

Duration : Two Hours

Date : 04th November 2015

Time: 1.30-3.30 pm

Instructions to candidates:

This paper consists of six (06) questions. You are required to answer four questions out of six.

- 1) The citric acid cycle is often the metabolic hub of biomolecules while the respiratory chain is the last stage of oxidation of biomolecules.
 - (i) Briefly explain the importance of the citric acid cycle? (6 marks)
 - (ii) Citric acid cycle comprises two thermodynamically unfavourable reactions. What are those reactions and how are those reactions made to occur? (8 marks)
 - (iii) What are the control points of the citric acid cycle? (6 marks)
 - (iv) State the importance of the cellular locations of the citric acid cycle and respiratory chain. (5 marks)

- 2) A) Photosynthesis is fundamental to the existence of all living forms on earth.
 - (i) Name the two stages of photosynthesis and state the cellular locations of those reactions. (2 marks)
 - (ii) Compare and contrast the non-cyclic and cyclic light reactions of photosynthesis. (6 marks)

- B) The respiratory chain produces energy by transport of electrons from reducing equivalents.
 - (iii) State the names of the two pathways by which NADH enter the respiratory chain. (2 marks)

- (iv) Explain why one pathway gives a higher number of ATP molecules from NADH than the other pathway stated in (iii) above. (6 marks)
- (v) State the role of each protein complex of the respiratory chain. (9 marks)
- 3) A) Fat is a form of energy storage in the body and a high energy source.
- (i) Compare and contrast β -oxidation and fatty acid biosynthesis. (8 marks)
- (ii) Explain how β -oxidation is regulated. (4 marks)
- B) An alternative pathway for glucose metabolism is via the pentose phosphate pathway.
- (iii) What are the two parts of the pentose phosphate pathway? (4 marks)
- (iv) During the conversion of glucose-6-phosphate to D ribose-5-phosphate, 4 important reactions are undergone. Describe the steps which lead to production of NADPH. (6 marks)
- (v) Which is the committed step of the pathway described in (iv) above? (3 marks)
- 4) A) Amino acids are monomers of peptides that form both functional and structural proteins.
- (i) Name the methods of deamination and briefly stating what happens in each method? (6 marks)
- (ii) Explain the glucose-alanine cycle. (7 marks)
- B) Enzymes are biological catalysts.
- (iii) List the factors that affect the rate of enzyme reactions. (1 mark).
- (iv) What are the interactions possible when a substrate binds an enzyme? (2 marks).
- (v) What is the steady state assumption? (2 marks)
- (vi) What is the turnover number of an enzyme? What is its definition? (2 marks)
- (vii) What is K_m in Michaelis-Menten equation? Give the definition and what it means. (2 marks)
- (viii) Why is there a maximum velocity (V_{max}) for an enzyme catalyzed reaction? (1 mark)
- (ix) To what/where does the inhibitor bind in uncompetitive inhibition? (1 mark)
- (x) At which substrate concentration is the effect of an uncompetitive inhibitor minimum? (1 mark)

5) Answer all parts A,B and C.

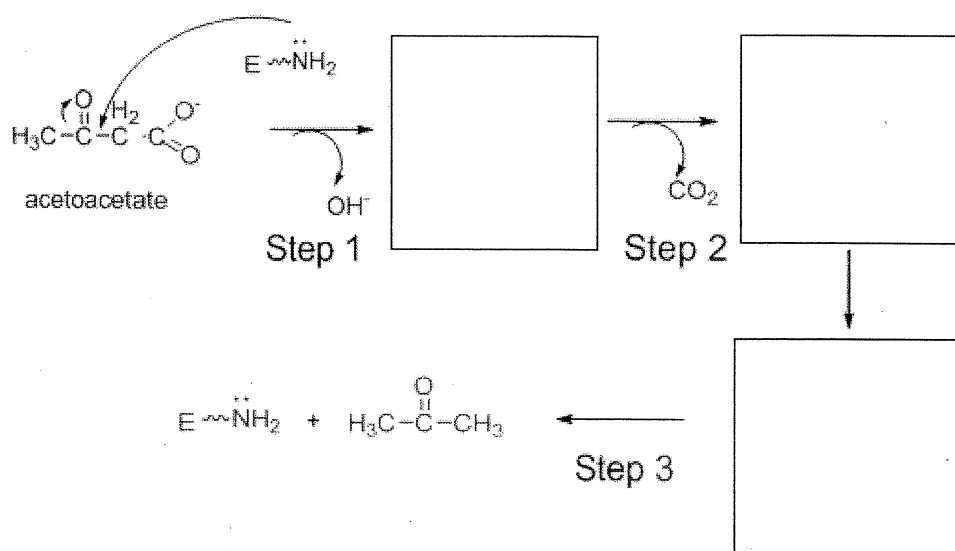
A. Step 3 of the glycolytic pathway involves the conversion of fructose-6-phosphate to fructose-1,6-bis phosphate.

(i) Which enzymes catalyze the forward and backward reactions? (4 marks)

(ii) Can the glycolytic pathway be controlled at this step? If so describe how it is regulated. (6 marks)

B. List three types of enzyme mechanisms of action. (3 marks)

(i) Describe the type of mechanism of action undergone when acetoacetate is converted to acetone. Using arrows and the sketch given below, indicate how this catalytic pathway goes to completion. (6 marks)



(ii) List the important characteristics of a good catalyst of this type. (2 marks)

C. What is a heterotropic modulator? What is the significance of heterotropic modulation of hemoglobin by CO_2 and H^+ ? (4 marks)

- 6 (i) Give a brief description of the steps in the synthesis of glycogen. (10 marks)
- (ii) Explain why glycogen is synthesized in the liver and not in the muscle. (4 marks)
- (iii) Why is Glucose -1-phosphate converted to UDP-glucose during glycogen synthesis? (4 marks)
- (iv) Using the figure below, indicate the point at which insulin activates the glycogen synthesis process. Briefly explain how this mechanism activates the enzyme responsible for glycogen synthesis. (7 marks)

