Reg. No. | | | | | | | | | |

The Open University of Sri Lanka

B. Sc. Degree Programme - 2016/2017

Faculty of Natural Sciences

Department of Chemistry

CMU3126 – Biochemistry

CONTINUOUS ASSESSMENT TEST II

Ques No.	Max.	Marks
1	35	
2	50	
3	15	
Total	100	

Date: November 4th, 2017 Time: 4.00 p.m. – 5.00 p.m.

1. Following is a mRNA used for protein synthesis.

3' AAUAGCAUGCACCUGAAAGUA 5'

i) Circle the starting code in the above mRNA.

(5 marks)

ii) How many amino acids will be found in the protein strand synthesized by this mRNA?

(5 marks)

iii) Briefly explain the three major steps of protein synthesis.

(15 marks)

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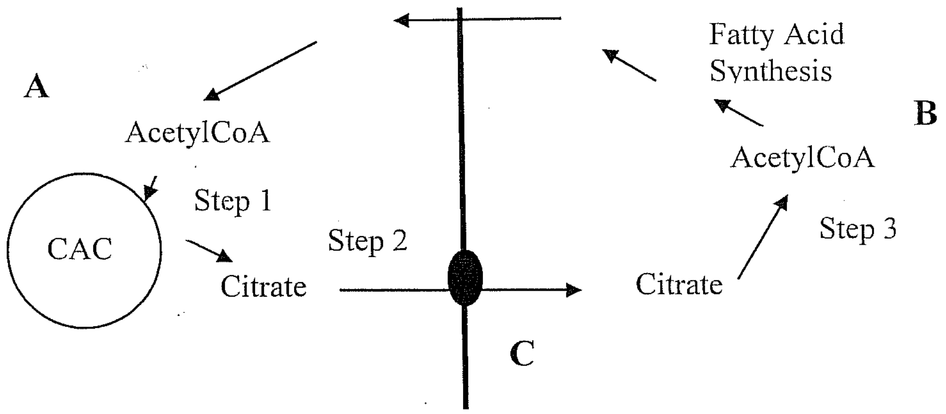
iv) Explain the basic structure of a tRNA molecule.

(10 marks)
(Total 35 marks)

2. Given below is a schematic representation of transporting AcetylCoA in the cell. (CAC = Citric Acid Cycle) **A** and **B** are cellular locations. **C** is a facilitator for transport citrate molecules.



i) Identify the cellular locations **A** and **B**.

(10 marks)

ii) Identify **C** and explain why AcetylCoA cannot be transported from **A** to **B**.

(5 marks)

iii) Explain the steps (steps 1, 2 and 3) in transporting AcetylCoA from **A** to **B.** Give relevant equations.

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(15 marks)

iv) AcetylCoA is converted to malonylCoA by a carboxylation reaction in synthesis of fatty acids. Identify the following in this carboxylation reaction

a) Carboxyl group donor ----------------------------------

b) Energy provider ----------------------------------

c) Enzyme ----------------------------------

d) Prosthetic group for the enzyme ----------------------------------

(20 marks)

(Total 50 marks)

3. Pentose Phosphate Pathway(PPP) and gluconeogenesis are important metabolic pathways for glucose. PPP operates in different modes maximizing various products.

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

(5 marks)

ii) Explain the steps in pyruvate catabolism under anaerobic conditions forming ethanol.

(10 marks)

(Total 15 marks)

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Answer Guide

1. i) Circle the AUG code at 5'

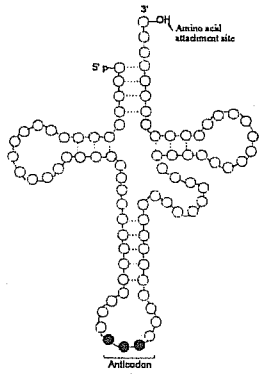
   ii) 6

   iii) **Initiation** is when the ribosome and mRNA are assembled in the correct conformation to start the synthesis. (binding of mRNA on ribosome)

   Elongation is the joining of the amino acids brought to the ribosome by tRNA onto a nascent (growing) polypeptide chain. After the peptide binds the new amino acid, the entire assembly moves one position along the mRNA to enable the reading of the codon of the next amino acid to be added. The tRNA is released from the site.

   Termination happens when a stop codon is reached. There is no new amino acid to be added and the polypeptide chain (new protein) is released from the ribosome

   iv)



   A tRNA specific for an amino acid has an anticodon sequence that can interact with the codon of the mRNA. The tRNA can therefore bring the correct amino acid that the mRNA codes for because of this codon-anticodon interaction.

   tRNA has a special cloverleaf structure (three loops and a stem). At the 3' stem end it has a site to which the specific amino acid binds. The anticodon is located on the second loop. Watson and Crick base pairing. keeps this structure intact. For each amino acid there exists a specific tRNA with its own anticodon.

2.

   i) A- Mitochondria/ Mitochondrial matrix
      B- cytosol

   ii) C - Tricarboxylate transporter
      mitochondrial membrane is impermeable to acetylCoA

iii) Citrate is formed when acetylCoA combines with oxaloacetate in the CAC in the mitochondrion as shown below.

$$\text{AcetylCoA} + \underset{\text{(mitochondrion)}}{\text{Oxaloacetate}} \xrightarrow{\text{citrate synthase}} \text{Citrate} + \text{CoASH}$$

The citrate is pumped out from the mitochondrion to the cytosol by the tricarboxylate transport system.

In the cytosol, citrate is converted to acetylCoA when the enzyme ATP-citrate lyase breaks it up to acetylCoA and oxaloacetate.

$$\underset{\text{(cytosol)}}{\text{Citrate}} + \text{CoASH} + \text{ATP} \xrightarrow{\text{ATP citrate lyase}} \text{AcetylCoA} + \text{Oxaloacetate} + \text{ADP} + P_i$$

iv)

a) Carboxyl group donor -bicarbonate
b) Energy provider - ATP
c) Enzyme – AcetylCoA carboxylase
d) Prosthetic group for the enzyme - biotin

3. i) Production of NADPH, ribose-5-phosphate

ii)