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

The Open University of Sri Lanka

B. Sc. Degree Programme - 2015/2016

Faculty of Natural Sciences

Department of Chemistry

CMU3126 – Biochemistry

CONTINUOUS ASSESSMENT TEST II

Ques No.	Max.	Marks
1	24	
2	24	
3	10	
4	22	
5	20	
Total	100	

Date: November 6th, 2016 Time: 4.00 p.m. – 5.00 p.m.

1. Glycolysis is one of the most important metabolic pathways in the body.
   a) It releases energy in different forms. List three of them.

(6 marks)

b) The breakdown of glucose up to the citric acid cycle can be given as follows.

$$\text{Glucose} + 10NAD^+ + 4ADP + 2H_2O + 4Pi + 2FAD \longrightarrow 6CO_2 + 10NADH + 4ATP + 2FADH_2 + 6H^+$$

Calculate the total ATP yield for this equation by assuming that the malate-aspartate shuttle operates.

(8 marks)

c) First step of the glycolytic pathway can be shown as follows.

Glucose ⟷ Glucose -6- Phosphate

i) Identify the enzymes catalyzing the forward and backward reactions.

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ii) Name the phosphate donor in this reaction.

iii) The enzyme for the forward reaction above has an isozymes. What do you mean by isozymes?

d) What are the uses of NADPH in the body?

(10 marks)
(Total 24 marks)

2. Below is written a short strand of double helix DNA.

3' AGTACGCAAGTT
5' TCATGCGTTCAA

a) i) Label the template strand.

ii) Draw the direction of m-RNA strand with an arrow on the correct strand in the below DNA.

3' AGTACGCAAGTT

5' TCATGCGTTCAA

(4 Marks)

b) How many codons are there in the template strand?

(2 Marks)

c) Name the three phases of protein synthesis and briefly explain the final stage of protein synthesis.

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(12 Marks)

d) Describe the function of tetracycline as an antibiotic.

(6 Marks)
(Total 24 marks)

3. a) Name two nitrogen removal pathways in humans.

b) Explain **ONE** of the pathways mentioned above.

(Total 10 marks)

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4. a) What is Gluconeogenesis?

(2 Marks)

b) Name **FOUR** starting materials for gluconeogenesis.

(8 Marks)

c) Cori cycle occurs with one of the starting materials of gluconeogenesis.

i) Give the final product of Cori cycle

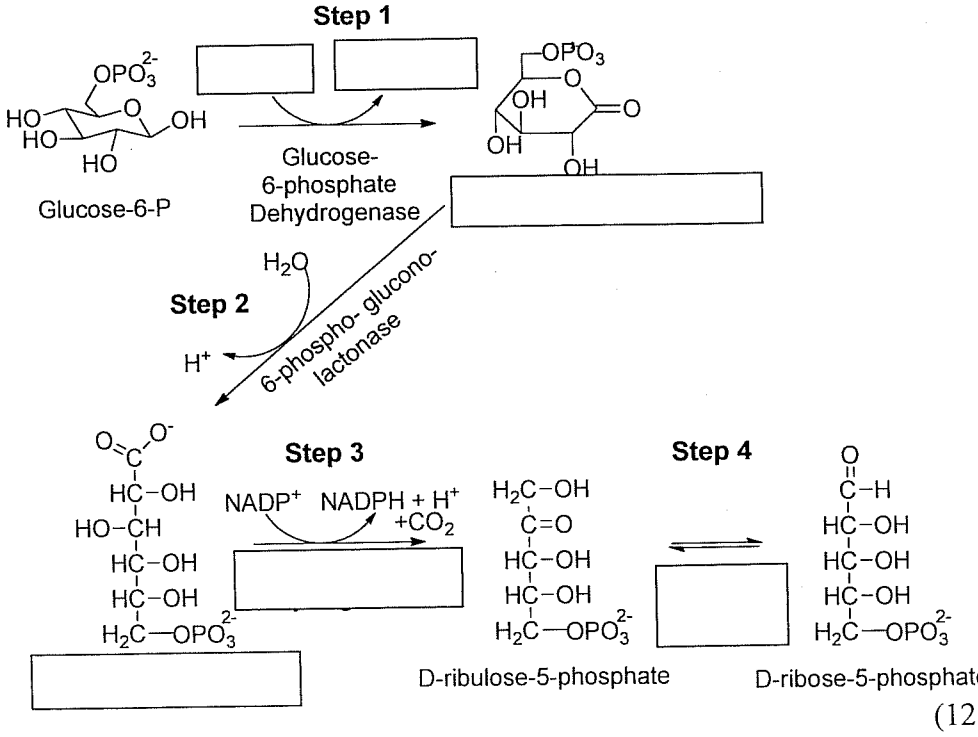
(2 Marks)

ii) Explain the function of Cori cycle.

(10 Marks)

(Total 22 marks)

5) a) The following figure shows the four steps of the oxidative reactions of pentose phosphate pathway. Fill in the empty boxes with correct compounds/enzymes.



(12 Marks)

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b) What are the end products of the NON oxidative reactions of pentose phosphate pathway?

(4 Marks)

c) What are the purposes of pentose phosphate pathway in the body?

(4 Marks)
(Total 20 marks)

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1. a) pyruvate
ATP
NADH

b)

10NADH = 30
2FADH2 = 4
ATP = 4
Total is 38

c) i) Hexokinase/Glucokinase and G-6-Phosphatase

ii) ATP

iii) Different forms of enzyme catalyzing same reaction.

d) To reduce double bonds and carbonyl groups in intermediates
In conversion of RNA to DNA
Reduction of glutathione
To provide energy for fatty acid synthesis
(for any two reasons)

2. a) i) Strand starting with 3'

ii) 3' AGTACGCAAGTT
5' TCATGCGTTCAA
←

b) 4

c) Initiation
Elongation

Termination

- Detachment of of protein from t-RNA
- A site of the ribosome faces a stop codon (UAA, UAG, or UGA).
- no tRNA can recognize it, but releasing factor can recognize nonsense codons and cause the release of the polypeptide chain.
- The peptidyl-tRNA is attacked by water as the nucleophile to hydrolyze it from tRNA and release the protein.
- The uncharged tRNA is released
- Finally the ribosome dissociates into its 30S and 50S subunits and releases the mRNA.

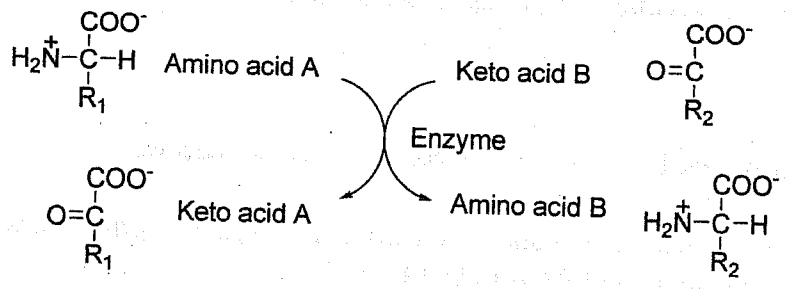
d)

- Prevent the binding of aminoacyl-tRNA by blocking the A (aminoacyl) site of the 30S ribosome.
- They are capable of inhibiting protein synthesis in both 70S (prokaryotic) and 80S (eukaryotic) ribosomes, but they preferentially bind to bacterial ribosomes due to structural differences in RNA subunits.
- Additionally, tetracyclines are effective against bacteria by exploiting the bacterial transport system and increasing the concentration of the antibiotic within the cell to be significantly higher than the environmental concentration.

3. a) transamination
oxidative deamination

b) **Transamination**

Transamination is the removal of the α-amino group of an amino acid (A) by an enzyme, and transfer of this group to the α-carbon atom of a keto acid (usually α-keto glutarate).



- no net loss of nitrogen. Only a transfer of nitrogen between the amino acid and the keto acid to form a new amino acid (glutamate) and a new keto acid (A).
- The enzyme responsible is an amino transferase (or a transaminase).
- Amino transferases require a coenzyme for activity. Pyridoxal phosphate (PLP) or vitamin B_6 is the coenzyme.
- There are two important aminotransferases aspartate aminotransferase (AST) and alanine aminotransferase (ALT).
- AST is also known as glutamate-oxaloacetate amino transferase
- ALT is known as glutamate-pyruvate amino transferase

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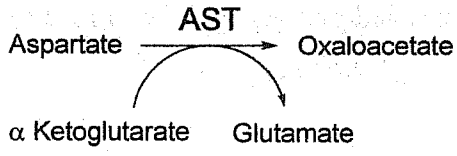
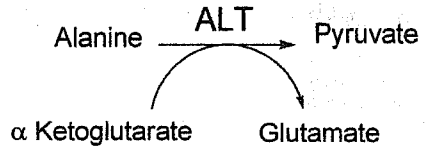
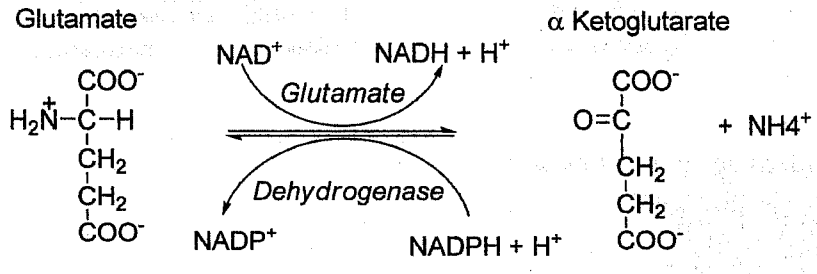




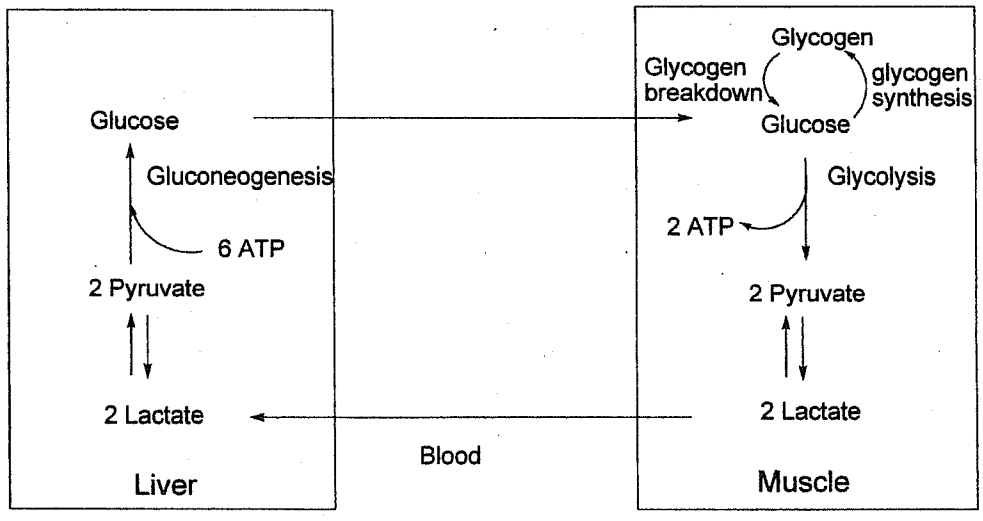
Oxidative deamination

- Oxidative deamination is the process for removal of nitrogen from glutamate.
- The nitrogen is converted to ammonia and glutamate is deaminated to α-KG. Glutamate dehydrogenase (Glutamate DH) enzyme catalyzes the reversible reaction.



- Glutamate DH enzyme is present only in the mitochondrial matrix.
- It requires NAD^+ or NADPH as a coenzyme. NADH is produced on deamination and nitrogen liberation.
- The reverse reaction uses NADPH as the reductant to incorporate ammonia into α-KG (Figure 23.5).

4. a) Synthesis of glucose from non hexose molecules
   b) Pyruvate, lactate, glycerol and amino acids
   c) i) pyruvate/glucose/glycogen/lactate
      ii)



Lactate from muscles enters blood and transported to liver
Lactate dehydrogenase convert lactate to pyruvate, then used for gluconeogenesis
Glucose is then transported back to muscles and stored as glycogen.

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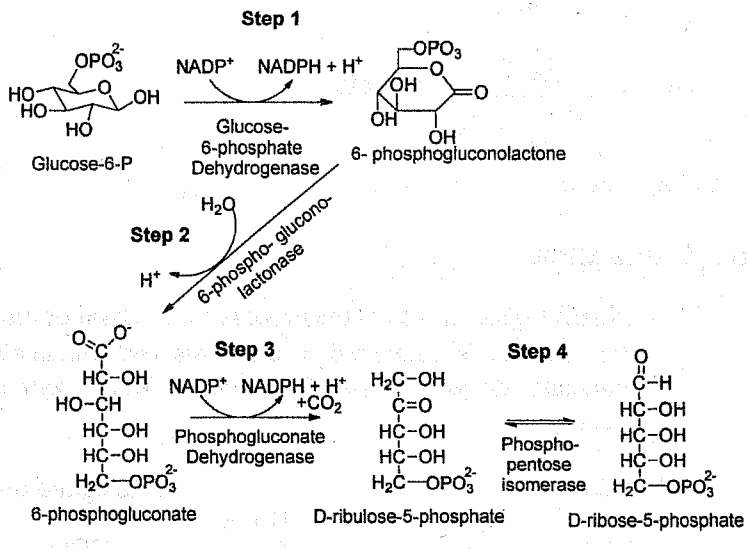
Glucose will be synthesized in muscles and pyruvate will be formed by glycolysis. Pyruvate will be converted to lactate by lactate dehydrogenase.

5) a)



b) Glyceraldehyde -3- phosphate
Fructose -6- phosphate

c) To produce NADPH
To produce ribose-5-phosphate