THE OPEN UNIVERSITY OF SRI LANKA

B.Sc DEGREE PROGRAMME/ STAND ALONE COURSES 2007/2008

LEVEL 5 – CONTINUOUS ASSESSMENT TEST 1I (OBT)

CHU 3139 – BIO CHEMISTRY 1

DURATION : $1_{1/2}$ HOURS

Date: 26th March 2008 Time : 3.30 p.m – 5.00 p.m

Reg. No:

Question	Marks
1	
2	
Total	

Instructions to candidates:

This Question paper has 4 pages and 2 questions. Answer all questions only in the space provided. Attached sheets will not be graded.

1. (a) Acetaldehyde + $2H^+ + 2e \rightarrow$ ethanol $\quad E^0 = -0.197V$

FAD + + $2H^+ + 2e \rightarrow FADH_2 \quad E^0 = -0.219V$

Using above data, predict whether the conversion of acetaldehyde to ethanol by $FADH_2$ is feasible or not.
(Assume that all concentrations of reactants and the products are 1M)
(1 F = 96,500 C mol^{-1}) (20 marks)

(b) In the photophosphorylation process, compare the light reaction with the dark reaction. (10 marks)

(c) What are the three ways in which glucose provides energy for cells? (05 marks)

(d) Explain how pyruate is metabolized under aerobic and anaerobic conditions.
(15 marks)

2. (a) Why is it necessary to convert free fatty acids to fatty acylCoA before undergoing β oxidation? (10 marks)

(b) Palmitic acid $CH_3(CH_2)_{14}COOH$
Stearic acid $CH_3(CH_2)_{16}COOH$

Show whether the stearic acid or palmitic acid produces more energy in terms of ATP during β oxidation. Clearly explain each step in your calculation. (20 marks)

(c) What happens to acetylCoA when the citric acid cycle cannot oxidize all the acetyl CoA? (10 marks)

(d) Explain the connectivity of urea cycle with the citric acid cycle? (10 marks)

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LEVEL 5 – CONTINUOUS ASSESMENT TEST 11(OBT)

CHU 3139 –BIO CHEMISTRY 1 - ANSWER GUIDE

1. (a) Acetaldehyde + $FADH_2$ ⟶ Ethanol + FAD^+

$\Delta E^\circ = -0.197 - (-0.219)$ V

$\Delta E^\circ = 0.022$ V , $n = 2$, $1F = 96500$ C mol^{-1}

$\Delta G^\circ = -n\Delta E^\circ F$

$\Delta G^\circ = -2 \times 0.022 \times 96500$ kJ mol^{-1}

$\Delta G^\circ = -4.246$ kJ mol^{-1}

Since ΔG° is a negative value above conversion is feasible.

(b)

Light Reaction	Dark Reaction
1. Chlorophyll & other pigments absorb light energy and convert it to NADPH & ATP	1. NADPH & ATP produced in the light reaction is used up to reduce CO_2
2. Water is broken down to produce O_2	2. does not need Water
3. Can occur only in the presence of light.	3. Can occur in or light or darkness

(c) i. By releasing energy when glucose is oxidized to CO_2 and H_2O
ii. By oxidation to pyruvic acid during glycolytic pathway.
iii. By oxidation to pentoses *via* the pentose phosphate pathway.

(d) In aerobic condition -

Puruvate —(CoASH, NAD^+ → NADH; Pyruvate dehydrogenase complex, TPP, FAD, Lipoate)⟶ Acetyl CoA + CO_2

In aerobic condition, pyruvate is converted into acetyl CoA and it enters the citric acid cycle to produce ATP.

In anaerobic condition –

a) In plants,

Puruvate —(TPP,Mg^+; CO_2)⟶ Acetaldehyde —(NADH → NAD^+)⟶ Ethanol

Pyruvate decarboxylase

In plants pyruvate is converted to ethanol.
In animals pyruvate is converted into lactate.

2. (a) Acetyl CoA activates the carboxylic group of the fatty acid; so that the carbon atom β to the carboxylic group can be cleaved.
Long chain fatty acids are converted to acyl CoA. This is because β oxidation takes place in the inner membrane of the mitochondria. In order to enter the inner membrane, this fatty acyl CoA links to a carnitine and releases CoA into the cytosol

(b)

Palmitic acid, n = 16	Stearic acid, n = 18
$(n/2 \times 12) + (n-2)/n \times 5) - 2$	$(n/2 \times 12) + (n-2)/n \times 5) - 2$
$(16/2 \times 12) + (16-2)/n \times 5) - 2$	$(18/2 \times 12) + (18-2)/n \times 5) - 2$
96-35-2 = 129 ATP	108-40-2 = 146 ATP

From above calculations, stearic acid produces more energy than palmitic acid in terms of ATP.

(c) It is converted to ketone bodies in the liver. The main ketone bodies formed are acetoacetate, β hydroxyl butyrate and acetone.

(d) The fumarate produced in the urea cycle is converted to malate and then to oxaloacetate through the citric acid cycle. Oxaloacetate is then transaminated to produce aspartate.