BIOC 201

CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

**SECOND YEAR EXAMINATION FOR THE AWARD OF DEGREE
OF BACHELOR OF SCIENCE IN BIOCHEMISTRY**

BIOC 201: PHYSICAL BIOCHEMISTRY

STREAMS: BSC (BIOCHEM) Y2S1   **TIME: 2 HOURS**

DAY/DATE: TUESDAY 05/12/2017   **8.30 A.M. – 10.30 A.M.**

INSTRUCTIONS:
- **ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS**
- **DO NOT WRITE ON THE QUESTION PAPER**

<u>**Constants**</u>

ΔG^0 **for fructose – 1- phosphate hydrolysis =-16KJ/Mol^{-1}**

R=8.315X10^{-3} KJMol^{-1}K

T=25˚C

QUESTION ONE (30 MARKS)

(a)   In human erythrocytes the concentration of ATP, ADP and Pi are 2.25, 0.25 and 1.65 mM
        respectively, calculate the actual free energy of hydrolysis (ΔGp) of ATP in the
        erythrocyte cell at standard pH and temperature.   [5 marks]

(b)   Explainthe fates of the actual free energy change (ΔG) with regard to chemical reaction.

                                                                                      [5 marks]

(c)   Explain why ΔG for favorable processes is always a negative value.   [5 marks]

(d)   Explain the relevance of the first and second laws of thermodynamics to biological
        systems.   [5 marks]

(e)   ATP is usually hydrolyzed in cells according to the equation $ATP \rightleftharpoons ADP + P_i$. Given
        that $[ATP] = 1x10^{-7}M, [ADP] = 1.65x10^{-1}M \ and \ [P_i] = 1x10^{-1}M,$ calcuate:

        (i)   The equilibrium constant   [5 marks]

        (ii) ΔG^0 for ATP hydrolysis   [5 marks]

QUESTION TWO (20 MARKS)

(a)   Using an example, describe how ATP energizes active transport.   [10 marks]

(b)   Describe the nucleophilic displacement reactions of ATP.   [10 marks]

QUESTION THREE (20 MARKS)

(a)   Explain the role of myokinase in the production of AMP during muscle contraction.

[10 marks]

(b)   An enzymatic hydrolysis of Fructose-1-phosphate,

Fructose-1-PO4+H2O Fructose + Pi,

Was allowed to proceed to equilibrium at 25°C. The original concentration of Fructose-I-phosphate was 0.2M, but when the system had reached equilibrium the concentration of Fructose-I-phosphate was only 6.52x10-5M. Calculate the equilibrium constant for this reaction and the free energy of hydrolysis of fructose-I-phosphate.   [10 marks]

QUESTION FOUR (20 MARKS)

(a)   Explain the biochemical basis for glowing of the firefly.   [10 marks]

(b)   Outline and explain the Ping – Pong mechanism (double – displacement) of nucleoside diphosphate kinase.   [10 marks]