CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

RESIT/SPECIAL EXAM

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN BIOCHEMISTRY

BIOC 201: PHYSICAL BIOCHEMISTRY

STREAM: BSC (BIOC) Y2S1 **TIME: 2 HOURS**

DAY/DATE: TUESDAY 16/11/2020 **2.30 P.M. – 4.30 P.M.**

INSTRUCTIONS

(i) Answer Question ONE and any TWO questions

(ii) Do not write on the question paper

QUESTION ONE (30 MARKS)

Constants

$\Delta G^{0'}$ for fructose-1-phosphate hydrolysis = -16KJMol^{-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. Explain the 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 hydrolysed 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, calculate:

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-PO_4 + H_2O $\longleftrightarrow$ Fructose + Pi,

was allowed to proceed to equilibrium at 25°C. The original concentration of Fructose-1-Phosphate was 0.2M, but when the system had reached equilibrium the concentration of Fructose-1-Phospahate was only 6.52 x 10^{-5}M. Calculate the equilibrium constant for this reaction and the free energy of hydrolysis of Fructose-1-Phosphate. (10marks)

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)
