CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

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

BIOC 201: PHYSICAL BIOCHEMISTRY

STREAM: BSc. BIOCHEMISTRY (Y2S1) **TIME: 2 HOURS**

DAY/DATE: THURSDAY 25/03/2021 **2.30 P.M. – 4.30 P.M.**

INSTRUCTIONS:

(i) Answer questions **ONE** and any **TWO** questions

(ii) Do not write on the question paper

Constants

ΔG^0 for fructose -1-phosphate hydrolysis = -16KJMol^{-1}

R-8.315X10^{-3}KJMOL^{-1}K

T=25^{0}C

Question One (30 marks)

(a) ΔG is a valuable criterion in determining whether a reaction can occur spontaneously of not, explain the various fates associated with it. (6 marks)

(b) In rat 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 (ΔG) of ATP in the erythrocyte cell as standard PH and temperature (4 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 equation ATP $\rightleftharpoons$ ADP + P_i. Given that [ATP] = 1X10^{-7}M, [ADP] =1.65X10^{-1}M and [Pi] = 1x10^{-1} M, Calculate:

(i) The equilibrium constant. (5 marks)

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

Question two (20 marks)

(a) Phosphorylated compounds have large free energies of hydrolysis due to product stabilization. Describe the hydrolysis of phosphoenol pyruvate and 1, 3 bisphosphoglycerate indicating how the products are stabilized relative to reactants. (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 + P_i,

was allowed to proceed to equilibrium at 25^0C. The original concentration of Fructose-1-1Phosphate 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. (10 marks)

Question four (20 marks)

(a) Explain the chemical basis for the large free energy change associated with ATP hydrolysis. (10 marks)

(b) The process that feed phosphate into ATP/ADP cycle fall mainly within four groups. Explain these processes. (10 marks)

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