

Faculty of Science



UNIVERSITY
OF
JOHANNESBURG

Principles of Biochemistry BIC1B01/BIC01B1
November Examination

DATE

SESSION 08h30 – 11h30

EKSAMINAR

Dr. I. Mwaba

MODERATOR

Dr G. Koorsen

TIME

3 HOURS

MARKS

80

The use of calculator is allowed.

QUESTION 1

- 1.1 Draw a hydrogen bond that forms between a water molecule and ammonia. (3)
- 1.2 Indicate on the structure above, the hydrogen bond donor, and the hydrogen bond acceptor. (2)
- 1.3 Derive the Henderson-Hasselbach equation. (5)

QUESTION 2

- 2.1 Draw the structures of the following amino acids:
- A. Glycine (3)
- B. Alanine (3)
- 2.2 Draw the dissociation reaction for the amino acid **K**. Find the relevant pKa values from the following table: (6)

Amino acid	pKa ₁	pKa ₂	pKa ₃
Glycine	2.34	9.60	---
Alanine	2.34	9.69	---
Valine	2.32	9.62	---
Leucine	2.36	9.60	---
Isoleucine	2.36	9.60	---
Methionine	2.28	9.21	---
Proline	1.99	10.60	---
Phenylalanine	1.83	9.13	---
Tryptophan	2.83	9.39	---
Asparagine	2.02	8.80	---
Glutamine	2.17	9.13	---
Serine	2.21	9.15	---
Threonine	2.09	9.10	---
Tyrosine	2.20	9.11	---
Cysteine	1.96	8.18	---
Aspartic acid	1.88	9.60	3.65
Glutamic acid	2.19	9.67	4.25
Lysine	2.18	8.95	10.53
Arginine	2.17	9.04	12.48
Histidine	1.82	9.17	6.00

- 2.3 What is the net charge of **K** at pH 3. (1)
- 2.4 What is the pI of **K**. (1)
- 2.5 Define the term native conformation. (1)
- 2.6 Which reagent is required to break disulfide bonds? (1)

- 2.7 What makes fetal hemoglobin have a stronger affinity for oxygen than adult hemoglobin. (3)
- 2.8 Describe the Bohr effect and how it regulates oxygen binding to hemoglobin. (6)

QUESTION 3

- 3.1 Draw the structure of deoxyadenosine monophosphate. (5)
- 3.2 Describe in full, the structure of A-DNA (5)
- 3.3 List 3 differences between eukaryotes and prokaryotes mRNA. (3)
- 3.4 Draw the secondary structure of tRNA. (3)

QUESTION 4

- 4.1 Draw the structure of arachidonic acid or 20:4 $\Delta^{5,8,11,14}$ (3)
- 4.2 What kind of omega-fatty acids is arachidonic acid? (2)
- 4.3 Is Arachidonic acid a saturated or unsaturated fat? (1)
- 4.4 Explain why Vitamin A is classified as a lipid molecule. (2)
- 4.5 What is the general reaction process of saponification? (4)
- 4.6 List 3 types/classes of lipids found in the plasma membrane. (3)

QUESTION 5

- 5.1 Define "reducing sugar." (2)
- 5.2 Explain why sucrose is not a reducing sugar, even though both glucose and fructose are. (3)
- 5.3 Draw the structure (Fischer Projection) of simple aldo-pentose sugar. (2)
- 5.4 Glycogen, starch and cellulose are all made of glucose molecules strung together. What makes these structures different? (4)
- 5.5 How does the cyclization of sugars introduce a new chiral center? Use a detailed diagram of glucose to answer the question. (4)