THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

Faculty of Applied & Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES

DIPLOMA IN ANALYTICAL CHEMISTRY 10J

**ACH 2218: CHEMICAL ANALYTICAL METHODS I
ABT 2218: BIOCHEMISTRY**

STAGE II EXAMINATION

SERIES: DECEMBER 2011

TIME: 3 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer booklet*

This paper contains **TWO** questions **A** and **B.** Answer **ALL** questions in section **A** (40 marks).
Choose any **THREE** from section **B**. Each question in section **A** carries 4 marks and 20 marks in section **B**
This paper consist of **THREE** printed pages
SECTION A (Answer all questions)

1. Explain the following terms as used in titrimetry
   (i)   Standard Solution
   (ii)   Stoichiometric point

2. Give the respective colour changes in acid and alkali of the PH indicators   (4 marks)

3. Explain the preparation of 250ml 10% w/v concentration of a solution of NaOH solution (Na = 23, H = 1 and O = 16)   (4 marks)

4. Differentiate between
   (i)   Acidic and basic buffers
   (ii)   Oxidation and reduction   (2 marks)

5. (i) Give any **TWO** examples of titrimetric apparatus   (2 marks)

   (ii)   0.3g of impure sodium hydroxide NaOH containing some Na_2CO_3 was treated with excess HCl solution to determine the % purity. Explain why a double indicator method is necessary in this determination   (2 marks)

6. List any **FOUR** redox indicators commonly used in titrations   (2 marks)

7. Explain the principle behind redox indicators in determining endpoint   (4 marks)

8. (i) Describe the behavior of amino acids in acqueous solutions   (2 marks)

   (ii) Give an example in each case of a conjugated protein with a tertiary and a quaternary Structure that is involved in oxygen transport   (2 marks)

9. Explain how ninhydrin can be used to determine amino acid composition of a protein.   (2 marks)

10. (i) State the nature of glycosidic bond in
    a) Sucrose
    b) Lactose   (2 marks)

    (ii) Name a protein a conjugated protein in each case, with a tertiary and a quaternary Structure that has capacity to transport oxygen.   (2 marks)

SECTION B (Answer any THREE questions)

11. (a) Differentiate between the following terms
    i)   Back and direct titration
    ii)   Titrant and titrand   (4 marks)

    (b) 2.0g of ethanedioic acid $H^2C^2O^4$ (EDA) was shaken with 150 cm3 sodium hydroxide to achieve complete reaction of the acid. After standardization of the sodium hydroxide with sulphamic acid the concentration was found to be 0.24mol dm3. (H=1, C=12, O=16).

i)   Give three properties of sulphamic acid as a primary standard.   (3 marks)
ii)   Calculate the volume of sodium hydroxide remaining unreacted   (6 marks)
iii)   If 1.0g of EDA had been shaken with 75cm^3 of sodium hydroxide sate with reason the volume of sodium hydroxide remaining unreacted.   (3 marks)

(c) It is considered more accurate to carry out redox self indicating titration than acid base titration using a visual indicator. Explain   (4 marks)

12. a) (i) Sketch the three major acid-base titration curves   (6 marks)
        (ii) Explain the working of phenolphthalein indicator   (3 marks)

   b) In an experiment to determine the % $CaCo^3$ in chalk 1.4g of chalk sample was reacted with known excess 50cm^3 of 1M HCl. The resulting solution was made up to 250cm^3 using distilled water. 25cm^3 aliquot of this solution required 28cm^3 of standard 0.1M NaOH for complete reaction. Work out the % of $CaCO^3$ in the chalk sample.
   (RFM $CaCO^3$ = 100.1)   (11 marks)

13. a) (i) State **FOUR** conditions necessary for a reaction to be considered suitable for Volumetric analysis

      (ii) Describe a method that can be used to standardize hydrochloric acid solution using sodium carbonate.   (6 marks)

   b) (i) Work out the oxidation state of the underlined element in the following chemical species. $\underline{Mn}O_4^-$, $Cr_2\underline{O}_7^{2-}$ and $\underline{I}O_3^-$ (3 marks)

      (ii) A 20cm^3 of industrial effluent sample containing iron (ii) ions was titrated with 0.0167M $K_2 Cr_2 O_7$ solution and 26.5cm^3 of $K_2Cr_2O_7$ was required for complete reaction. Calculate the concentration of iron in the effluent in mg/l. (Fe = 55.85).

14. a) State the classification of enzymes according to the International Union of Biochemists.   (10 marks)
   b) Describe the classification of amino acids based on their R-groups.   (6 marks)

   c) State **FOUR** factors that determine the stability of the alpha-helix conformation of the protein secondary structure.   (4 marks)

15. a) List any **EIGHT** important functions of proteins in biological processes   (4 marks)

   b) Amino acids are amphoteric electrolytes. Using glycine as an example, illustrate the **THREE** different ionization states of amino acids   (6 marks)

   c) Distinguish fibrous proteins from globular proteins based on their structure and function.   (6 marks)

   d) State any **FOUR** assumptions of the Michaelis-Menten hypothesis   (4 marks)