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 **FOUR** printed pages
SECTION A (Answer all questions)

1. Explain the following terms as used in volumetric analysis
   (i)   Stoichiometric equivalence
   (ii)   Titrand   (4 marks)

2. Classify classical titrations according to the types of reactions involved.   (4 marks)

3. Calculate the concentration using the following units of a solution containing 2.65g if Na_2CO^3 in 250ml solution prepared to standardize HCl. (Na = 23, C = 12 and O = 16)
   (i)   Molarity   (2 marks)
   (ii)   Normality   (2 marks)

4. Differentiate between
   (i)   PH and PKw   (2 marks)
   (ii)   Reduction potential and reducing agent   (2 marks)

5. (a) Give **TWO** examples of pipettes   (2 marks)

   (b) 0.3g of impure sodium hydroxide NaOH containing some Na_2CO_3 was treated with excess HCl solution. Write the two ionic equations involved in these reactions.
                                                                                       (2 marks)
6. Explain preparation of a standard solution by dilution method   (4 marks)

7. With the help of an equation, explain why potassium permanganate should be standardized before use.   (4 marks)

8. (a) Draw the structural formula of a tripeptide formed by glycine (Gly), Glutamate (Glu) and alanine (Ala) joined in that order.   (2 marks)

   (b) With the aid of appropriate structures, distinguish between D-amino acids and L-amino acids   (2 marks)

9. State the differences between fibrous and globular proteins based on their structure.(4 marks)

10. (a) Define the following terms:
    (i)   Racemization   (1 mark)
    (ii)   Mutarotation   (1 mark)

    (b) Distinguish between anomers and epimers   (2 marks)

SECTION B (Answer any THREE questions)

11. (a) Differentiate between the following terms
    (i)   Back and blank titration
    (ii)   Titration error and titrant   (4 marks)

    (b) (i) Back titration is considered suitable for situations where direct titration is inadequate. State and explain four such instances.   (8 marks)

(ii) Explain the working of a named PH indicator (4 marks)

(c) In redox titration where starch is used as indicator hot water is used in dissolution and the starch solution added towards the end of titration. Explain (4 marks)

12. (a) Describe the determination of the % of $CaCO_3$ in egg shell sample by back titration (10 marks)

(b) 2.0g of ethanedioic acid $H_2C_2O_4.2H_2O$(EDA) was shaken with 150cm^3 standardized 0.24M sodium hydroxide to achieve complete reaction of the acid, Sulphamic acid was used in standardization of the sodium hydroxide (H=1, C=12, O=16)

(i) Give **TWO** properties of sulphamic acid that makes it a good standardizing agent (2 marks)

(ii) Work out the volume of sodium hydroxide that reacted with EDA (5 marks)

(iii) Calculate the moles of sodium hydroxide remaining unreacted (3 marks)

13. (a) (i) Give **THREE** examples of redox indicators apart from starch. (3 marks)

(ii) A 100cm^3 of effluent water sample containing iron (II) ions was titrated with 0.0167M $K_2Cr_2O_7$ solution and 26.5cm^3 of $K_2Cr_2O_7$ was required for complete reaction. Calculate the concentration of iron in the effluent in ppm. (Fe = 55.85) (7 marks)

(b) (i) State **FOUR** conditions necessary for reaction to be considered suitable for volumetric analysis (4 marks)

(ii) Describe the **THREE** major steps in preparation of a standard solution of hydrochloric acid using sodium carbonate (6 marks)

14. (a) Name the reagent that is used to test for the presence of a alpha amino acids (1 mark)

(b) Describe the classification of amino acids based on their R-groups (5 marks)

(c) Sketch a typical electrometric titration curve for a dipolar amino acid (4 marks)

(d) List any **EIGHT** important functions of proteins in biological processes (4 marks)

(e) Explain the consequences of a partial double bond in the polypeptide backbone (6 marks)

15. (a) State **FOUR** structural roles of collagen in the body (4 marks)

(b) Discuss the following features of enzymes

(i) Most of the enzymes are proteins (5 marks)
(ii) Enzymes are regulated. (2 marks)

(c) Explain using a suitable example, the meaning of broad specificity in enzyme activity.
(3 marks)

(d) State examples of enzyme activities in the following enzyme specificities

    i) Absolute specificity (2 marks)

    ii) Group specificity (2 marks)

    iii) Stereo specificity (2 marks)