TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN ANALYTICAL CHEMISTRY

DAC 14S

ACH 2301: Chemical Analytical Methods II

END OF SEMESTER EXAMINATION

SERIES:DECEMBER2016

TIME:2HOURS

DATE: Pick DateSelect MonthPick Year

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE

a) Write the balanced half reactions of the following reactions:

(i) $NiO_2 + 2\ H_2O + Fe \rightarrow Ni(OH)_2 + Fe(OH)_2$ in basic solution (2marks)

(ii) $CO_2 + 2\ NH_2OH \rightarrow CO + N_2 + 3\ H_2O$ in basic solution (2marks)

b) Find the oxidation number of

(i) Cr in $Cr_2O_7^{2-}$ (2marks)

(ii) V in VO_2^+ (2marks)

(iii) Cl in $HClO_4^-$ (2marks)

c) Differentiate between the following terms

(i) Back and blank titration (2marks)

(ii) Titration error and titrant (2marks)

d) Show how you can obtain the equivalence point from the following curves.

(i) A sigmoidal titration curve (3marks)

(ii) Linear-segmenta titration curve (3marks)

e) Explain why 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 (4marks)

f) State SIX properties of Primary Standards solution (6 marks)

Question TWO

Electrolytic conductivity of an electrolyte can be determined experimentally by use of a Wheatstone bridge circuit

(i) Draw a fully labeled diagram of the circuit (6 marks)

(ii) State the function of each component in the circuit (4 marks)

(iii) Direct current DC is unsuitable for work on conductivity. Give TWO reasons (2 marks)

(iv) List THREE factors that determine the resistance of a solution of an electrolyte (3 marks)

Question THREE

Discuss the application of the following indicator methods used in argentometric titrations.

(i) Volhard method (5marks)

(ii) Fajan method (5marks)

(iii) Mohr method (5marks)

Question FOUR

a) Magnesium oxide is not very soluble in water, and is difficult to titrate directly. Its purity can be determined by use of a 'back titration' method. 4.06 g of impure magnesium oxide was completely dissolved in 100 cm^3 of hydrochloric acid, of concentration 2.00 mol dm^{-3} (in excess). The excess acid required 19.7 cm^3 of sodium hydroxide (0.200 mol dm^{-3}) for neutralisation. This 2nd titration is called a 'back-titration', and is used to determine the unreacted acid. [atomic masses: Mg = 24.3, O = 16)

(i) Write equations for the two neutralisation reactions. (2marks)

(ii) Calculate the moles of hydrochloric acid added to the magnesium oxide. (2marks)

(iii) Calculate the moles of excess hydrochloric acid titrated. (2marks)

(iv) Calculate the moles of hydrochloric acid reacting with the magnesium oxide. (2marks)

(v) Calculate the moles and mass of MgO that reacted with the initial hydrochloric acid. (1marks)

(vi) Calculate the % purity of the magnesium oxide. (1marks)

b) state any FIVE advantages of potassium dichromate over potassium permanganate (5marks)

Question FIVE

a) 25.0 cm^3 of seawater was diluted to 250 cm^3 in a graduated volumetric flask. 25.0 cm^3 aliquot of the diluted seawater was pipetted into a conical flask and a few drops of potassium chromate (VI) indicator solution was added. On titration with 0.100 mol dm^{-3} silver nitrate solution, 13.8 cm^3 was required to precipitate all the chloride ion. [Atomic masses: Na = 23, Cl = 35.5]

(i) Write the ionic equation for the reaction of silver nitrate and chloride ion (1mark)

(ii) Calculate the moles of chloride ion in the titrated 25.0 cm^3 aliquot (2marks)

(iii) Calculate the molarity of chloride ion in the diluted seawater (2marks)

(iv) Calculate the molarity of chloride ion in the original seawater (2marks)

(v) Assuming that for every chloride ion there is a sodium ion, what is the theoretical concentration of sodium chloride salt in g dm^{-3} in seawater? (2marks)

b) Using labeled sketches, explain the conductometric titration curves obtained in each of the following

(i) CH COOH $_3$ against NaOH (3marks)

(ii) HCl against NH OH (3marks)