MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE AGRICULTURAL EDUCATION AND EXTENSION

KST 104: FUNDAMENTALS OF CHEMISTRY

DATE: 9/5/2019 **TIME: 8.30-10.30 AM**

INSTRUCTIONS TO CANDIDATES

- The paper consists of **two** sections.
- Section **A** is **compulsory** (30 marks).
- Answer any **two** questions from section **B** (each 20 marks).

SECTION A (COMPULSORY)

QUESTION ONE (30 MARKS)

a) Differentiate between end point and equivalence point in a titration (2 marks)

b) Explain the principle behind reverse osmosis and state two advantages of reverse osmosis. (3 marks)

c) Define a primary standard as used in volumetric analysis (2 marks)

d) Explain why hydrogen bonding is stronger than most dipole interactions (3 marks)

e) By giving suitable examples explain why most acids and alkalis cannot be used as primary standard (3 marks)

f) State and give a mathematical expression for the first law of thermodynamics (3 marks)

g) State beer-Lambert law (2 marks)

h) Explain why ice is less dense than water (3 marks)

i) State four methods used to remove suspended matter in municipal water treatment (2 marks)

j) Define the term hybridization (2 marks)

k) Show that pH+ pOH=14.0 in all dilute aqueous solutions (3 marks)

l) Explain why boiling point of icosane is higher than that of methane (2 marks)

SECTION B (ATTEMPT ANY TWO QUESTIONS)

QUESTION TWO (20 MARKS)

a) Not all chemical reaction can be used in the volumetric analysis. State and explain five conditions to be met for chemical reaction to be used as the basis for titration (5 marks)

b) For the following reaction at a certain high temperature,

$CO(g) + H_2O(l) \rightleftharpoons CO_2(g) + H_2(g)$

The concentration in a mixture are $CO_{(g)}$, 0.0600 mol/L; $H_20_{(g)}$, 0.120mol/L; $CO_{2(g)}$, 0.150mol/L; and $H_2(g)$, 0.300mol/L. Calculate the value of the equilibrium constant at this temperature (5 marks)

c) State and explain three causes of boiler scales (6 marks)

d) A certain gas expands from 250mL to 750mL very slowly at 25^{o}C. If there is one mole of the gas in the chamber, calculate the work involved when the gas behaves ideally. Take R =8.314J/Mol/K (4 marks)

QUESTION THREE (20 MARKS)

a) 20 mL of 0.5M acidified $KMnO_4$ solution oxidized 25mLof Fe^{2+} in 40g/L of impure iron (II) sulphate to $Fe^{3+}{}_{aq}$. Calculate the percentage impurities in the iron II sulphate (7 marks)

b) Explain why water is liquid at relatively high temperature (3 marks)

c) State and explain three characteristics of a chemical equilibrium (6 marks)

d) Classify the following as open, closed or isolated (4 marks)

i. a tightly stoppered bottle of soda

ii. The earth

iii. Thermos flask

iv. Living things

QUESTION FOUR (20 MARKS)

a) Explain why water is referred as a universal solvent (3 marks)

b) When 1 mole of water, at 100^{o}C and 1 atm. pressure is converted to steam (at 100^{o}C) the amount of heat absorbed is 40670J, calculate ΔU for the change. Take 1atm=101325NM^{-2} (7 marks)

c) Using suitable drawing show sp^3 hybridization in carbon (5 marks)

d) State three disadvantages of ion exchange resins as a method of water purification (3 marks)

e) Describe two characteristics of a good standardizing agents (2 marks)

QUESTION FIVE (20 MARKS)

a) State the Le Chatelier's principle (2 marks)

b) Consider the following equilibrium process

$PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$

State and explain the direction of equilibrium shift when

i. More chlorine gas is added to reaction mixture (2 marks)

ii. Pressure of the gas is increased (2 marks)

iii. Catalyst is added to the reaction mixture (2 marks)

iv. $PCl_{5(g)}$ is removed from the equilibrium mixture (2 marks)

c) Classify the following reactions as either addition, elimination, substitution or rearrangement (4 marks)

i. $CH_3Br\ (g) + KOH(ag) \rightarrow CH_3OH(g) + KBr(s)$

ii. $CH_3CH_2Br(g) \rightarrow H_2C = CH_2(g) + HBr(g)$

iii. $H_2C = CH_2(g) + H_2(g) \rightarrow CH_3CH_{3(g)}$

iv. $CH_3CH_2Br(g) + NaCN(s) \rightarrow CH_3CH_2CN(s) + NaBr(s)$

d) Define portable water and state five essential requirements for portable water (6 marks)