MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FIRST YEAR SUPPLEMENTARY EXAMINATION FOR BACHELOR OF ENVIRONMENTAL SCIENCE

ENS 131: ENVIRONMENTAL CHEMISTRY

DATE: 26/9/2019 **TIME: 2:00 – 4:00 PM**

INSTRUCTIONS:

- 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) Briefly, explain the following terms (2 marks)

i) Environmental Pollution
ii) Temperature inversion

b) Clearly distinguish between the following terminologies: (6 marks)

(i) Primary and secondary air pollutant
(ii) Wet and Dry deposition
(iii) Classical and Instrumental Methods of Analysis

c) Explain the trend of the following in the periodic table (8 marks)

(i) Atomic radius

(ii) Ionic radius
(iii) Ionization energy

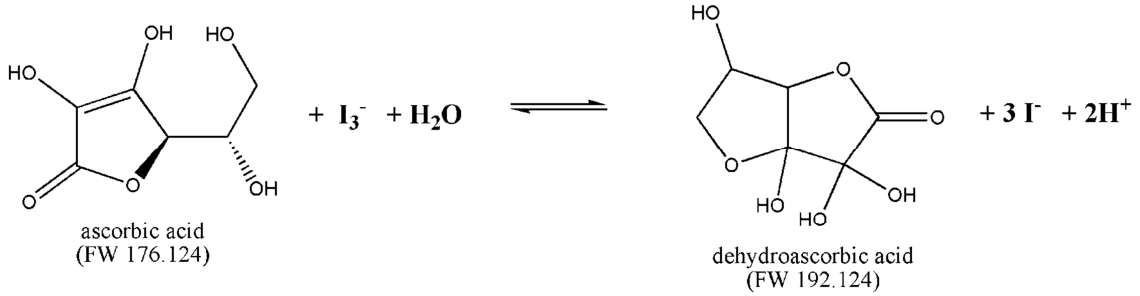
d) Predict the electron configurations of S, K, Ti, Sn, and Br- (4 marks)

e) Write the shorthand (Noble gas core) electron configuration for Ni and Cl. (3 marks)

f) Particulate matter is divided into $PM_{2.5}$ and PM_{10}. Differentiate between the two. (2 marks)

g) The Aluminum (MW = 27) content of a 5 g sample is determined gravimetrically by precipitating the aluminum as Al_2S_3 (MW = 150). If the weight of the precipitate is 0.5 g, calculate the percentage of aluminum in the sample. (3 marks)

h) To standardize I_3^- solution with ascorbic acid, 29.41 mL of I_3^- solution was required to react with 0.1970 g of pure ascorbic acid, determine the molarity of the I_3^- solution. Below is the equation for the reaction. Molecular weight (FW) of ascorbic acid is 176.124 g). (3 marks)



ascorbic acid (FW 176.124)

dehydroascorbic acid (FW 192.124)

SECTION B (ANSWER ANY TWO QUESTIONS)

QUESTION TWO

a) Air pollution has been linked to a number of environmental effects and one of them is formation of photochemical smog.

i) Differentiate between classical and photochemical smog (2 marks)
ii) Discuss two factors that influence the formation of photochemical smog (4 marks)
iii) Using appropriate equations, show how photochemical smog is formed. (4 marks)
iv) Discuss three harmful effects of photochemical smog (3 marks)

b) Discuss four technologies which can be adopted to reduce SO_2, NO_2 emissions into the atmosphere. (8 marks)

QUESTION THREE

a) Using relevant equations, discuss how stratospheric ozone is formed, the reactions involved in ozone layer depletion and the effects of ozone layer destruction. (5 marks)

b) Discuss three sources and two sinks for nitrogen oxides (NOx) (5 marks)

c) Define the term acid rain, describe how it is formed and how it affects the environment (6 marks)

d) Discuss the causes of cultural eutrophication and its consequences (4 marks)

QUESTION FOUR

a) Describe what is meant by the term greenhouse effect and enhanced greenhouse effect (4 marks)

b) Methane is one of the gases responsible for enhanced greenhouse effect. Discuss the sources and sinks of methane. (6 marks)

c) Discuss two probable consequences of enhanced greenhouse effect (2 marks)

d) Describe the four different stages in eutrophication (trophic status) (4 marks)

e) Discuss four requirements for a primary standard (4 marks)

QUESTION FIVE

a) Using a diagram, illustrate stratification of the atmosphere (4 marks)

b) The saying "the higher you go the cooler it becomes", doesn't apply to all layers of the atmosphere. Explain this deviation. (4 marks)

c) Describe four desirable properties of the precipitate formed in gravimetric analysis. (4 marks)

d) An ore is analyzed for the manganese (Mn) content by converting the manganese to Mn_3O_4 and weighing it. If a 1.52 g sample yields Mn_3O_4 weighing 0.126g, what would be the percent Mn and Mn_2O_3 in the sample? (6 marks)

e) Describe two ways in which one can determine the concentration of a standard solution.

(2 marks)