



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:

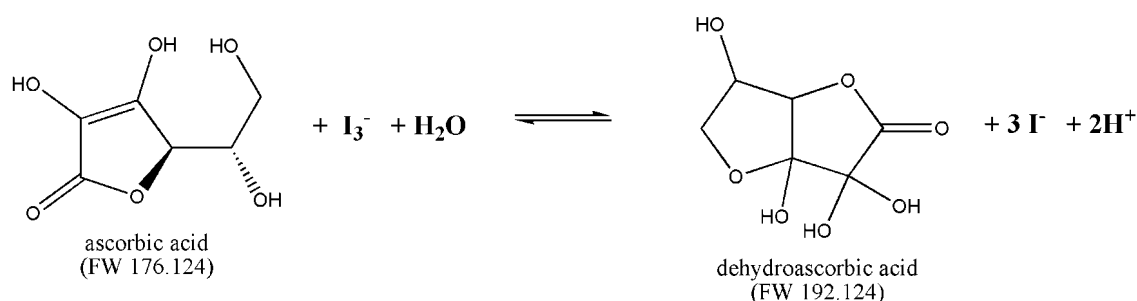
- The paper consists of **two** sections.
- Section **A** is **compulsory** (30 marks).
- Answer any **two** questions from section **B** (each 20 marks).

SECTION A (COMPULSORY)

QUESTION ONE (30 MARKS)

- a) Briefly, explain the following terms (2 marks)
- Environmental Pollution
 - Temperature inversion
- b) Clearly distinguish between the following terminologies: (6 marks)
- Primary and secondary air pollutant
 - Wet and Dry deposition
 - Classical and Instrumental Methods of Analysis
- c) Explain the trend of the following in the periodic table (8 marks)
- Atomic radius
 - Ionic radius
 - 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 PM₁₀. 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 Al₂S₃ (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 I₃⁻ solution with ascorbic acid, 29.41 mL of I₃⁻ solution was required to react with 0.1970 g of pure ascorbic acid, determine the molarity of the I₃⁻ solution. Below is the equation for the reaction. Molecular weight (FW) of ascorbic acid is 176.124 g). (3 marks)



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.
- Differentiate between classical and photochemical smog (2 marks)
 - Discuss two factors that influence the formation of photochemical smog (4 marks)
 - Using appropriate equations, show how photochemical smog is formed. (4 marks)
 - Discuss three harmful effects of photochemical smog (3 marks)
- b) Discuss four technologies which can be adopted to reduce SO₂, NO₂ emissions into the atmosphere. (8 marks)

QUESTION THREE

- 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)
- Discuss three sources and two sinks for nitrogen oxides (NO_x) (5 marks)
- Define the term acid rain, describe how it is formed and how it affects the environment (6 marks)
- 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)