



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF EDUCATION (SCIENCE)

SCH 407: ENVIRONMENTAL CHEMISTRY

DATE: 02/5/2019

TIME: 2.00-4.00 PM

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).

QUESTION ONE COMPULSORY (30 MARKS)

- a) Define the following terms as applied to Environmental Chemistry
- Environment (2 marks)
 - Ecosystem (2 marks)
 - Atmosphere (2 marks)
- b) i Briefly describe the tropospheric-chemistry that occurs in the troposphere accounting for the source of $\cdot\text{OH}$ free radicals responsible for the reactions therein. (3 marks)
- ii Explain how ozone (O_3) is formed and depleted (natural control) to maintain a steady state in the stratosphere. (3 marks)
- iii Why is the depletion of the ozone layer an environmental concern to mankind? (2 marks)
- iv Explain the NO_x catalytic chain in ozone depletion. (3 marks)
- c) Due to urban air pollution by transportation there has been an attempt to eliminate the exhaust gases, NO_x , CO and volatile organic compounds (VOC) and, the liquid fuels used in transport have substantially been changed especially the composition of gasoline.
- i. Explain how these gases have been eliminated from the exhaust gases through a

- ii. Three- way catalytic converter. (4 marks)
- iii. Explain knocking and octane rating in gasoline. (3 marks)
- iv. Explain how the anti-knock agent is used to control knocking (3 marks)
- v. Explain the major improvements on the gasoline composition that has ensured pollution resulting from the use of the antiknock agent mentioned in b (iv) has been eliminated. (3 marks)

QUESTION TWO (20 MARKS)

- a) The variation of temperature with altitude has resulted in the stratification of the atmosphere;
 - i. Sketch a diagram showing the various layers of the atmosphere showing temperature variation with altitude. (5 marks)
 - ii. Explain temperature variation with altitude at different layers. (4 marks)
- b) Chlorofluorocarbons (CFCs) are also known to deplete ozone
 - i. Explain what is the source of CFCs in the environment (3 ½ marks)
 - ii. Explain why they are known to be persistent in the environment (3 ½ marks)
 - iii. Explain how they deplete ozone with the help of chemical equations. (4 marks)

QUESTION THREE (20 MARKS)

- a) Water is expected to have a pH of 7. However, the pH of rain water can be lowered to the range of 5-3.5 in both unpolluted and polluted areas.
 - i. Explain why the pH of rain water is 5.7 instead of 7 even in unpolluted areas. (3 ½ marks)
 - ii. Explain what are the three prominent acidic constituents that can lead to the depression of pH of rain water further to 3.5 in polluted areas. (3 ½ marks)
 - iii. Describe how the pH of rainwater initially at 5.7 at the top soil varies down the soil profile. (5 marks)
- b) Describe fully with the help of a sketch diagram the three different types of buffering zones in the soil environment depending on the underlying rock. (8 marks)

QUESTION FOUR (20 MARKS)

- a) What is biological oxygen demand and how is it a measure of organic pollution of a water system? (4 marks)
- b) i Describe how Eutrophication occurs in fresh water lakes. (6 marks)

- ii Differentiate between non-point sources of pollution and point source of pollution with the help of examples. 5 marks
- iii Describe different strategies of controlling pollution. (5 marks)

QUESTION FIVE (20 MARKS)

- a) Due to the loss of nutrients from soil occasioned by acid rain or poor methods of farming, minerals have to be replaced by application of chemical fertilizers.
 - i. Briefly explain the difference between synthetic and organic fertilizers. (2 marks)
 - ii. Describe briefly the negative environmental consequences of the use of synthetic fertilizers. (3 marks)
- b) Pesticides also play an important role in boosting food production and also in the control of vectors in public health.
 - i. Describe briefly how pesticides help in boosting food production. (3 marks)
 - ii. Describe briefly how these pesticides behave in terms of persistence both in the tropical and temperate conditions. Describe methods by which pesticides are removed from the environment. (5 marks)
- c)
 - i Explain some of the industrial processes known to generate toxic wastes (3 marks)
 - ii Explain the available technologies for toxic waste disposal. (4 marks)