



# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

*Faculty of Applied & Health Sciences*

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR THE BACHELOR OF TECHNOLOGY IN

ANALYTICAL CHEMISTRY (BTech. AC)

ACH 4207: ENVIRONMENTAL CHEMISTRY

END OF SEMESTER EXAMINATION

SERIES: APRIL 2012

TIME: 2 HOURS

## **Instructions to Candidates:**

You should have the following for this examination

- *Answer booklet*

This paper consists of **FIVE** questions.

Answer question **ONE (COMPULSORY)** plus any other **TWO** questions.

Maximum marks for each part of a question are clearly shown

This paper consists of **FOUR** printed pages

### QUESTION ONE: (30 Marks)

- a) The Earth is divided into four layers. Give the name of each of these layers. (2 marks)
- b) The early Earth is thought to have been devoid of oxygen. How did oxygen first appear in the Earth's atmosphere? (2 marks)
- c) Give two functions of the atmosphere (2 mark)
- d) Explain the terms adsorption and absorption (2 marks)
- e) What are aerosols and, what are its major natural sources in the atmosphere? (3 marks)
- f) (i) What is soot? (1 mark)  
(ii) What does its structure contain? (2 marks)
- g) (i) What is an air pollutant (1 mark)  
(ii) Name the two categories of air pollutants, giving an example for each. (2 marks)  
(iii) State how each of these categories is produced? (2 marks)
- h) The hydroxyl radical is at the centre of the Chemistry of the troposphere. How is it produced in this sphere? (2 marks)
- i) What are the products of complete and incomplete combustion of gasoline? Give the balanced equations for each (4 marks)
- j) Atmospheric reactions that involve the O atom and the O<sub>2</sub> molecule often require the existence of a third body. What purpose does the third body serve? What would have happened in its absence? (3 marks)

### QUESTION 2: (20 Marks)

- a) The reactions that occur following the absorption of a photon of energy to produce an excited species are largely determined by the way the excited species loses its excess energy. Give the equations that illustrate how this happens as:
- i) Physical Quenching (2 marks)
- ii) Dissociation (2 marks)
- iii) Direct reaction with another species (2 marks)
- iv) Luminescence (2 marks)
- v) Inter-molecular energy transfer (2 marks)
- vi) Intra-molecular energy transfer (2 marks)

- b) Describe the electrostatic methods for removing particulate matter from industrial emissions. What is done to the particles after they are removed from the air? (8marks)

**QUESTION 3: (20 Marks)**

- a) Give the four groups of Toxic Substances in the Environment (4 marks)
- b) (i) Why are toxicants harmful to living organisms? (2 marks)
- (ii) Through which mechanisms do they become poisons? (2 marks)
- c) Give the toxic effects to humans of the following heavy metals: Cadmium, Lead, Arsenic and Mercury (8 marks)
- d) What reaction takes place between carbon monoxide and hemoglobin? Why is this reaction lethal to human health? What treatment is given for carbon monoxide poisoning? (4 marks)

**QUESTION 4 (20 MARKS)**

- a) Fertilizers contain a mixture of three main primary nutrients.
- (i) Name these nutrients (3 marks)
- (ii) If a bag of fertilizers is marked 5-10-5. What is the % primary fertilizer composition? (1 marks)
- b) What purpose does calcium, spread in the form of lime in soils, serve? (1 mark)
- c) How is sulfur deficiency in sandy, well drained soils, treated? (1 mark)
- d) Nutrients have been blamed for the eutrophication phenomenon.
- i) What is eutrophication? (1 mark)
- ii) What are the limiting nutrients in the growth of primary producers in a water body? (2marks)
- iii) What happens to water bodies on eutrophication? (8 marks)
- iv) What is the main cause of eutrophication? (1 mark)
- v) How is eutrophication controlled? (2 marks)

**QUESTION 5 (20 MARKS)**

- a) Give the factors which must be considered when designing and operating an industrial water treatment plant. (5 marks)
- b) Several characteristics are used to describe sewage. Give five such characteristics (5 marks)

- c) Discuss the origin, formation and reactions of photochemical smog. What is responsible for the brownish colour in its haze (5 marks)
- d) What is environmental chemistry? Why has it emerged as a strong and dynamic science? (3 marks)
- e) What do you understand by the term sustainable development in the context of directing human society and industrial systems to exist in better harmony? (2 marks)