



MACHAKOS UNIVERSITY

University Examinations 2019/2020 Academic year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FIRST YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN ANALYTICAL CHEMISTRY

SAN 100: CHEMICAL SAFETY AND SECURITY

DATE: 5/12/2019

TIME: 2.00-4.00 PM

INSTRUCTIONS TO CANDIDATES

- The paper consists of **two** sections.
- Section **A** is **compulsory**.
- Answer any **two** questions from section **B**.

SECTION A - COMPULSORY.

QUESTION ONE (30 MARKS)

- a) Define each of the following terms as used in chemical safety and security;
- Asphyxiants
 - Chemical security
 - Essential personnel
 - UPS
 - Chemicals of concern (5 marks)
- b) Differentiate between the following terms
- Flash point and boiling point. (2 marks)
 - Electronic security and operational security. (2 marks)
- c) Briefly discuss three best practices of a performance measurement program. (6 marks)
- d) One of the most important elements of emergency preparedness is the communications plan. Using a specific example, prepare a brief communication plan for emergency preparedness in Machakos University. (5 marks)

- e) Explain implications of the following safety statements:
- i) 'In the past, martyrdom for the sake of science was acceptable; today the attitude seems as ancient as alchemy'. (1 mark)
 - ii) 'Know your neighbor'. (1 mark)
- f) Chemical contact with the skin is a frequent mode of injury in the laboratory. List four factors that influence the absorption of chemicals through the skin. (2 marks)
- g) Discuss two factors that affect how an inhaled material is absorbed by the human body. (4 marks)
- h) Draw a diagram to illustrate the concept of concentric level of protection. (2 marks)

Section B: Answer any two questions

QUESTION TWO (20 MARKS)

- a) List:
- i) Four (4) factors to consider when preparing an emergency plan check list. (2 marks)
 - ii) The general guidelines for handling incidental, nonemergency elemental mercury spills. (4 marks)
- b) Briefly describe three (3) reasons as to why inventory and record keeping system in a chemical laboratory is important. (6 marks)
- c) It is challenging to change behaviors and foster a culture of best practices. Briefly discuss four (4) approaches that can be used to change poor behaviors and improve laboratory safety and security. (8 marks)

QUESTION THREE (20 MARKS)

- a) Briefly explain the four major phases to managing a large-scale chemical security and safety emergency. (8 marks)
- b) A laboratory security program should employ a combination of human, physical, electronic, and operational components for an integrated system. Briefly explain the main functions of a security system. (2 marks)
- c) Machakos University has academic programmes that entail laboratory practicals that use chemicals. Describe five (5) steps that can be applied to reduce the risk of theft or the use of dual-use chemicals for terrorist activities. (10 marks)

QUESTION FOUR (20 MARKS)

- a) From time immemorial, a number of international efforts and agreements on the use, development, prohibition and destruction of chemical weapons have been done. Briefly state the successes of the following international bodies:
- i) The 1925 Geneva Protocol. (2 marks)
 - ii) The 1997, Organization for the Prohibition of Chemical Weapons. (2 marks)
- b) Describe three (3) specific incidences in Kenya that can be used to explain the importance of studying chemical safety and security. (6 marks)
- c) Discuss in details the ten steps to creating an effective laboratory chemical safety and security management system. (10 marks)

QUESTION FIVE (20 MARKS)

- a) State article X111 of the Chemical Weapons Convention. (1 mark)
- b) Analytical chemists cannot avoid working with chemicals. However, to reduce exposure, a number of methods can be employed. List three of these methods. (3 marks)
- c) Briefly explain:
- i) The chemical weapons convention. (2 marks)
 - ii) The four (4) fundamental principles to consider when working with chemicals. (7 marks)
- d) The terrible disabilities that countless civilians and soldiers endured as a result of chemical warfare have led to a number of efforts to limit and control the use chemicals as weapons.
- i. Define the term dual use chemicals. (1 mark)
 - ii. List and explain three laboratory/industrial chemicals that qualify as dual use chemicals. (6 marks)