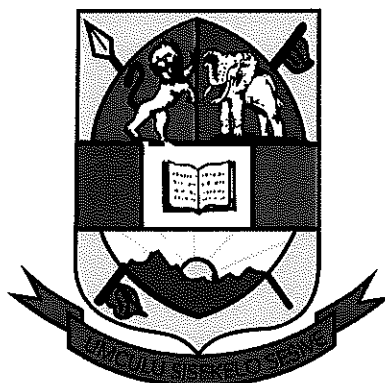


# UNIVERSITY OF ESWATINI



## MAIN EXAMINATION 2019/2020

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**TITLE OF PAPER:** CHEMICAL POLLUTION STUDIES

**COURSE NUMBER:** CHE 610

**TIME ALLOWED:** THREE (3) HOURS

**INSTRUCTIONS:** ANSWER ANY FOUR (4) QUESTIONS

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**Special Requirements**

NONE

YOU ARE NOT SUPPOSED TO OPEN THIS PAPER UNTIL PERMISSION TO DO SO HAS BEEN GIVEN BY THE CHIEF INVIGILATOR.

**QUESTION 1 [25]**

- (a) The release of domestic effluent into the environment is one cause of water pollution.
- (i) List any two (2) major chemical pollutants found in domestic sewage [2]
  - (ii) What are the sources of these pollutants? [4]
- (b) Oxidation pond technology is one way of treating domestic sewage prior to release into the environment.
- (i) List the four (4) stages involved in domestic effluent treatment in an oxidation pond facility [4]
  - (ii) Use chemical equations to describe the process taking place at each stage of treatment of domestic sewage in an oxidation pond facility [4]
- (c) Used oil is a major pollutant in industrial effluents.
- (i) Describe the constituents of used oil that render oil a major water pollutant [2]
  - (ii) Use a diagrams to explain how a conventional oil trap used in the construction industry works[4]
- (d) The “carbon economy” is one of the primary contributors to climate change. Use diagrams and chemical equations to describe the Carbon Cycle [5]

**QUESTION 2 [25]**

- (a) What is the major difference between a “dumpsite” and a “landfill” [2]
- (b) Discuss the consequences of disposal of rubber waste in dumpsites [2]
- (c) (i) How does evapotranspiration and precipitation influence the design of a landfill? [4]
- (ii) Describe how engineered landfill cells are designed [4]
  - (iii) Describe how a monitoring borehole for landfills is designed, and what is its role? [4]
  - (iv) Describe the processes involved in the decommissioning of a landfill, and explain why decommissioned landfills are excluded in spatial physical development of towns and cities [4]
- (d) Use diagrams and equations to discuss the Sulphur Cycle [5]

**QUESTION 3 [25]**

- (a) Mercury spills are common occurrences in the laboratory. How are mercury spills handled and managed in the laboratory [4]
- (b) In Artisanal Small Scale Gold Mining (ASGM), mercury is used in large quantities.
- (i) Describe each of the two (2) “worst - practices” involved during mercury usage in ASGM according to the Minamata Convention [4]

- (ii) Describe the equipment proscribed by the Minamata Convention to prevent exposure of ASGM miners to mercury [4]
- (c) Global warming is attributed to the “carbon economy”.
- (i) What is meant by “global warming”? [1]
  - (ii) What causes the “green-house effect”? [2]
  - (iii) List two (2) gases that contribute to the green house effect [2]
- (d) One of the Persistent Organic Pollutants (PoPs) identified under the Strategic Approach to International Chemicals management (SAICM) is DDT.
- (i) Explain how DDT gets into environment [2]
  - (ii) Explain how DDT is harmful to the environment [2]
- (e) (i) List any two compounds that cause the destruction of the ozone layer [2]
- (ii) Discuss any two (2) industrial sources of compounds that destroy the ozone layer [2]

#### QUESTION 4 [25]

- (a) With the emergence of a digital economy, a new waste type “e-waste” is emerging as a problem in both developed and developing countries.
- (i) What is meant by “e-waste”? [1]
  - (ii) How is e-waste hazardous to humans and the environment? [2]
  - (iii) In a waste disposal facility, how is e-waste managed? [3]
- (b) Describe the sources of, and how the following, are harmful to both human health and the environment.
- (i) Mercury [3]
  - (ii) Lead [3]
  - (iii) Cadmium [3]
- (c) As an alternative to use of mercury in gold mines, describe the cyanation process, and explain its harmful effects on human health and the environment. [4]
- (d) Asbestos mine tailings are of environmental concern.
- (i) Discuss how asbestos is a hazard to human health [1]
  - (ii) List any two monitoring and evaluation indicators for asbestos in soil and water in and around asbestos mine tailings [2]
  - (iii) Describe an analytical tool that can be used for monitoring and evaluation during asbestos mine tailings rehabilitation [3]

**QUESTION 5 [25]**

- (a) Explain what is meant by
- (i) Carbon footprint [2]
  - (ii) Carbon credits [2]
  - (iii) Carbon fund [2]
- (b) Large Scale Coal Fired Power stations (>300 MW) are considered major contributors to green house gas emissions and mercury emissions to air.
- (i) Describe the technologies used in modern coal fired power plants to reduce mercury emissions to the atmosphere [5]
  - (ii) Describe the technologies used in modern coal fired power plants to reduce carbon emissions to the atmosphere [5]
- (c) Describe the concept of carbon capture, and briefly discuss any available technology to carry out this process [4]
- (d) Use diagrams and equations to describe the Nitrogen Cycle [5]

**QUESTION 6 [25]**

- (a) Eswatini has large coal reserves, some of which are actively mined, and some of which are old abandoned shafts.
- (i) Describe "acid mine drainage AMD" in coal mining [2]
  - (ii) Use equations to explain the origins of AMD [3]
  - (iii) What pollution risks does AMD pose? [2]
- (b) Treatment technologies are specific for industrial wastewater.
- (i) Explain why oxidation pond technology is not suitable for industrial effluents [1]
  - (ii) Describe how activated sludge technology works, and give an example of the type of industrial pollutants it is targeted for [4]
  - (iii) Describe how reverse osmosis works, and give an example of the type of industrial pollutants it is targeted for [4]
- (c) Nanotechnology is one of the promising new emerging wastewater treatment technologies.
- (v) What are carbon nanotubes [2]
  - (vi) Explain how they work in wastewater treatment [3]
- (d) Use diagrams and chemical equations to describe the Nitrogen Cycle [4]