

UNIVERSITY OF SWAZILAND
FIRST SEMESTER EXAMINATION 2015/2016

TITLE OF PAPER: Environmental Pollution

COURSE CODE: CHE 613

TIME ALLOWED: 3 (THREE) HOURS

INSTRUCTIONS:

- 1) Answer any Four (4) questions
- 2) Each question is weighted 25 marks
- 3) Write neatly and clearly
- 4) A periodic table and other useful data have been provided with this paper.

**DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION TO DO
SO HAS BEEN GRANTED BY THE CHIEF INVIGILATOR**

Question 1 (25 marks)

- (a) With regards to the term 'environmental pollutant':
- (i) Explain it, and differentiate it from a contaminant. (2)
 - (ii) What parameter is used as the dividing line between a pollutant and a contaminant? Give one example. (1)
 - (iii) Why is the knowledge of its source important to an environmental scientist? (2)
- (b) Explain the terms - 'the receptor' and 'the sink' of a pollutant. Give an illustrative example in each case. (4)
- (c) With regards to **Technology** as an inevitable part of the modern environment.
- (i) Discuss the major ways in which it has contributed to environmental alteration and pollution. (5)
 - (ii) How can it be employed to help in minimizing the problem of environmental pollution? (6)
 - (iii) Use a diagram to illustrate how the points in (ii) above can be achieved through the design of a hypothetical manufacturing process. (5)

Question 2 (25 marks)

- (a) Discuss the constituents and the environmental impacts of the atmospheric pollutants present in automobile exhausts. (14)
- (b) Photochemical smog is a highly hazardous atmospheric pollutant:
- (i) Identify its usual constituents and classify them as either primary or secondary pollutants. (4)
 - (ii) State the conditions necessary for its formation. (4)
 - (iii) Briefly discuss its environmental impacts. (3)

Question 3 (25 marks)

- (a) Water or the hydrosphere is a vital part of the environment at large. Discuss:
- (i) The various forms in which it occurs in the environment. (2)
 - (ii) Its general functions within the environment at large. (3)
- (b) Identify the sources and summarize the hazardous health effects of three of the most important and most commonly encountered heavy metal pollutants in water. (12)
- (c) Nitrate is one of the most important ground water pollutants. Discuss:
- (i) The main sources and pathways of nitrates in ground water systems. (4)
 - (ii) The health hazards associated with excess nitrate in drinking water. (4)

Question 4 (25 marks)

- (a) Discuss the influence of the soil type on the transportation and ultimate fate of a soil pollutant. (2)
- (b)
- (i) Briefly discuss the concept of soil texture. With appropriate explanation, identify the soil texture that offers favourable environment for organisms and plants roots. (5)
 - (ii) Explain the term 'Pore space' (with respect to soil texture), and distinguish between open and closed pores.. (2)
 - (iii) Discuss the significance of increasing pore spaces. Identify the agents responsible for this process. (3)
- (c)
- (i) With respect to soil pH identify the three major types of soil and state their corresponding pH regimes. (5)
 - (ii) Account for the difference in the pH of soils in areas with high rainfall and soils in arid areas. (3)
 - (iii) Summarize the influence of the soil pH on the levels of potential pollutants in the environment, (particularly the aquatic which is directly in contact with soil).

- (2)
- (iv) The measured $[H^+]$ for a particular soil was $3.0 \times 10^{-9}M$. Calculate its pH and state the type of soil it is with respect to pH. (3)

Question 5 (25 marks)

- (a) With regards to the plant residue in soil, discuss:
- (i) The major constituents and describe the various microbial actions involved in the accumulation process. (5)
 - (ii) The dry weight percent compositions and the factors that influence them. (5)
 - (iii) The effects of its degradation on soil. (2)
- (b) With respect to soil atmosphere, discuss:
- (i) Its constituents and the control of its concentration. (5)
 - (ii) The importance and relative amounts of soil oxygen in soil solution and pores. (3)
 - (iii) The factors controlling the amount of available oxygen in the soil. (3)
 - (iv) The relative contents of O_2 in dry soils and soils saturated with water, with appropriate explanation. (2)

Question 6 (25marks)

- (a) (i) What is a greenhouse gas? Give *four* major examples and identify the most notorious among them. (4)
- (ii) What is greenhouse effect? Discuss the mechanism of its occurrence, its importance, and the factors influencing this phenomenon. (6)
- (b) With respect to 'Global Warming', discuss:
- (i) Its origin/cause. (1)
 - (ii) The factors are likely to enhance it. (2)

- (iii) Its consequences on human health, agriculture, sea levels, ecosystems, water resources, weather etc (8)
- (c) What is 'atmospheric or radiation window'? Discuss the implication of its occurrence on global warming? (4)