

UNIVERSITY OF SWAZILAND
FIRST SEMESTER EXAMINATION 2008/2009

TITLE OF PAPER : **Environmental Pollution**

COURSE CODE : **ERM 603**

TIME ALLOWED : **Three (3) Hours.**

INSTRUCTIONS : **Answer any Four (4) Questions. Each Question Carries 25 Marks**

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

Question 1 (25 marks)

- (a) For the four major constituents of the environment, namely, the atmosphere, the hydrosphere, the biosphere and the geosphere :
- (i) Give a precise definition (or description) of each of them. [4]
 - (ii) Use a diagram to illustrate the close relationship between each other and technology. [5]
- (b) Differentiate between the following terms :
- (i) The biotic environment and the abiotic environment. [2]
 - (ii) Habitat and niche. [2]
- (c) For ecological studies, the environment is often conveniently divided into four categories:
- (i) Identify the four categories. [2]
 - (ii) Briefly discuss the peculiar features and the constituents of each of them. [8]
- (d) What are the major challenges facing chemical analysis in environmental science? [2]

Question 2 (25 marks)

- (a) Concerning an environmental pollutant :
- (i) Define 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) Distinguish between 'the receptor' and 'the sink' of a pollutant. Give an illustrative example of each of them. [4]
- (c) Technology has become an inevitable part of the 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 3 (25 marks)

- (a) Explain the following terms with respect to atmospheric pollution:
- (i) Residence time.
 - (ii) Particulate matter.
 - (iii) Primary and Secondary pollutants. [4]
- (b) Give four examples of air pollutants that are hazardous to humans, animals and buildings. [2]
- (c) With respect to pollutants emitted from the automobile internal combustion engine:
- (i) Identify the major components of the pollutants emitted from the exhaust manifold of the engine. Discuss the respective hazard/s associated with each of them. [6]
 - (ii) What other pollutants are released into the atmosphere from some other parts of the engine? [2]
 - (iii) Using an illustrative diagram, discuss the significance of the air: fuel ratio in determining the relative emission levels of the various components of the exhaust emission. Which other factors influence the emission levels of the engine exhaust and how? [9]
 - (iv) Catalytic converters are used to control exhaust emissions into the air. For which kind of petrol are they unsuitable and why? [2]

Question 4 (25 marks)

- (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 occurrence, the advantage, and the factors influencing this phenomenon. [6]
- (b) With respect to 'Global Warming' :
- (i) Explain its origin/cause. [1]
 - (ii) What factors are likely to enhance it? [2]
 - (iii) What are its consequences on human health, agriculture, sea levels, ecosystems, water resources, weather etc? [8]
- (c) What is 'atmospheric or radiation window'? What is the implication of its occurrence on global warming? [4]

Question 5 (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) Discuss the sources and 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 groundwater pollutants. Discuss:
- (i) the main sources and pathways of nitrates in groundwater systems. [4]
 - (ii) the health hazards associated with excess nitrate in drinking water. [4]

Question 6 (25 marks)

- (a) Briefly discuss the formation of soil and give four of its basic functions or usefulness. [6]
- (b) The soil consists of organic and inorganic materials:
- (i) What are the relative percentages by weight of these soil components? [1]
 - (ii) For the component with the higher percentage, classify its particulate composition according to their sizes and explain how their relative percentage compositions affect some soil properties. [5]
- (c) With respect to soil texture:
- (i) Explain the term 'pore space' [1]
 - (ii) Differentiate between 'open pores' and 'closed pores' [2]
 - (iii) By what means are soil pore spaces increased, and what are the corresponding advantages thereof? [4]
- (d)
- (i) What are the major types of soil with respect to soil pH? Indicate their corresponding pH regimes. [3]
 - (ii) The hydrogen ion concentration, $[H^+]$, of a given soil solution is $4.50 \times 10^{-5}M$. Determine its pH. What type of soil is it in terms of acidity/alkalinity? [3]