

UNIVERSITY OF SWAZILAND

FINAL EXAMINATION 2006

TITLE OF PAPER : Chemical Pollution Studies

COURSE NUMBER : C516

TIME : 3 Hours

INSTRUCTIONS : Answer ANY FOUR questions.

**Begin the answer to each question
on a separate sheet of paper.**

Each question is worth 25 marks.

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

QUESTION 1

- (a) The activated sludge process is probably the most versatile and effective of all waste treatment processes. Discuss. **[10 marks]**
- (b) Some of the most important micro organism - mediated chemical reactions in aquatic and soil environments are those involving nitrogen compounds. Summarize. **[8 marks]**
- (c) Of the organochlorine insecticides, the most notable has been DDT. Discuss. **[7 marks]**

QUESTION 2

- (a) Discuss the Fate and Residence Times of Hazardous Waste Compounds in the atmosphere. **[10 marks]**
- (b) The processes by which organisms metabolize xenobiotic species are enzyme catalysed Phase I and Phase II reactions. Explain. **[8 marks]**
- (c) The binding of a toxicant to a receptor may result in some kind of bio-chemical effect. Discuss the major biochemical effects. **[7 marks]**

QUESTION 3

- (a) Environmental Science may be defined as the study of the earth, air, water and living environments and the effects of technology thereon. With the aid of a diagram, illustrate the close relationship among the air, water and earth environments with each other and with living systems, as well as the tie-in with technology. **[10 marks]**
- (b) Next to phosphorus, nitrogen is the algal nutrient most commonly removed as part of advanced wastewater treatment. Summarize the techniques most commonly used for nitrogen removal. **[10 marks]**
- (c) Explain how temperature inversions can occur in the atmosphere. **[5 marks]**

QUESTION 4

- (a) The hydroxyl radical, HO^\bullet , is the single most important reactive intermediate species in atmospheric chemical processes. It is formed by several mechanisms. Discuss. **[6 marks]**
- (b) A number of terms are commonly used to describe atmospheric particles; state and explain five of the most important of these. **[10 marks]**
- (c) Many processes have been proposed or studied for the removal of sulphur dioxide from stack gas scrubbing systems. Summarize 3 major gas scrubbing systems. **[6 marks]**
- (d) What phenomenon is responsible for the temperature maximum at the boundary of the stratosphere and the mesosphere? **[3 marks]**

QUESTION 5

- (a) Discuss the flocculation of colloids by polyelectrolytes. **[5 marks]**
- (b) Of all environmental hazards, there is little doubt that major disruptions in the atmosphere and climate have the greatest potential for catastrophic and irreversible environmental damage. What measures can be taken to deal with this problem? **[8 marks]**
- (c) Distinguish among teratogenesis, mutagenesis, carcinogenesis, and immune system effects. Are there ways in which they are related? **[12 marks]**

QUESTION 6

- (a) Several physical, chemical, and biochemical processes are particularly important in determining the transformations and ultimate fates of hazardous chemical species in the hydrosphere. Discuss. **[10 marks]**
- (b) What is the distinction between chemiluminescence and luminescence caused when light is absorbed by a molecule or atom? **[5 marks]**
- (c) Outline a generalized scheme for the formation of photochemical smog. **[10 marks]**