

UNIVERSITY OF SWAZILAND

FINAL EXAMINATION - 2006

TITLE OF PAPER : Special Topics in Environmental Chemistry

COURSE NUMBER : C515

TIME : Three (3) Hours

INSTRUCTIONS : There a six questions. Answer **ANY FOUR** Questions. Each question carries 25 marks.

You must not open this examination paper until the chief invigilator has granted permission to do so.

Question 1

- (a) Define the term “environmental toxicology” and explain in detail how it impacts human life each day. **(12 marks)**
- (b) Briefly describe the major classes of pollutants and outline the main routes by which pollutants enter ecosystems. **(13 marks)**

Question 2

- (a) Briefly comment on the fate of metals and radioactive isotopes in contaminated ecosystems. **(8 marks)**
- (b) Describe the fate of organic pollutants in individuals. **(8 marks)**
- (c) Write brief notes on the biochemical effects of the toxicity to mammals of the following substances:
- (i) Nitromethane
 - (ii) Lead
 - (iii) White phosphorus
- (9 marks)**

Question 3

Describe the relative merit and drawbacks of hydropower, wind energy and geothermal energy. **(25 marks)**

Question 4

- (a) What are the principle advantages of biomass compared to other renewal sources of energy. **(13 marks)**
- (b) Discuss ways that can be used to transform waste into energy. **(12 marks)**

Question 5

- (a) The role of analytical chemistry in solving environmental problems is quite significant. Describe this role in so far as the following are concerned:
- (i) Environmental Impact Assessment in relation to site hydrology. **(3 marks)**
 - (ii) Environmental Audit in relation to air pollution in a pulp mill. **(3 marks)**
 - (iii) Comprehensive Mitigation Plan in relation to effluent discharge of a distillery. **(3 marks)**
- (b) The siting of a landfill for solid waste disposal is associated with many challenges. Explain in scientific detail why landfills should not be sited:
- (i) Within a 5 km radius of an airport **(2 marks)**
 - (ii) In the vicinity of aquifers. **(2 marks)**
- (c) The design of a landfill is a challenging scientific and engineering task. Describe:
- (i) Leachate, how it is generated in a landfill, its chemical composition, leading to reasons why it should never be released into an open environment. **(1 mark)**
 - (ii) Engineered landfill cells, and how they contain leachate. **(1 mark)**
- (d) Landfills are monitored regularly during operation and bi-annually after closure for about 30 years.
- (i) Name one parameter that is regularly monitored during operation and bi-annually after closure for about 30 years, and explain why. **(2 marks)**
 - (ii) Name one gas that is monitored in a landfill even after closure, and explain why. **(2 marks)**
- (e) The Basel convention prohibits the transboundary shipment of waste for non-signatory parties. Name the culprit substances in each of the following waste streams, and briefly explain why in each case:
- (i) Agricultural waste **(2 marks)**
 - (ii) Medical waste **(2 marks)**
 - (iii) Nuclear waste **(2 marks)**