UNIVERSITY OF SWAZILAND
Faculty of Health Sciences

DEGREE IN ENVIRONMENTAL HEALTH
FINAL EXAMINATION PAPER 2005

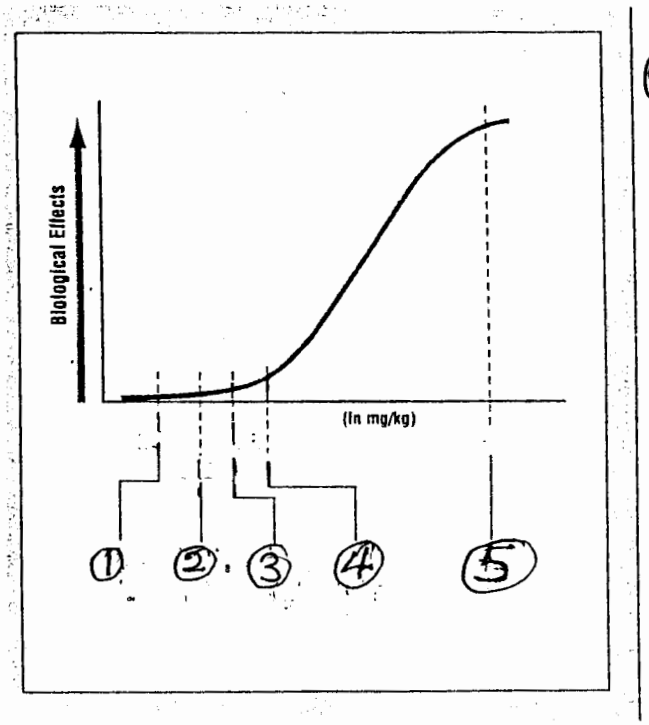
TITLE OF PAPER	:	INTRODUCTION TO ENVIRONMENTAL TOXICOLOGY
COURSE CODE	:	EHS 524
DURATION	:	3 HOURS
MARKS	:	100
INSTRUCTIONS	:	READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
	:	ANSWER ANY FOUR QUESTION
	:	EACH QUESTION CARRIES 25 MARKS.
	:	WRITE NEATLY & CLEARLY
	:	NO PAPER SHOULD BE BROUGHT INTO OR OUT OF THE EXAMINATION ROOM.
	:	BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTE BY THE INVIGILATOR.

Question 1.

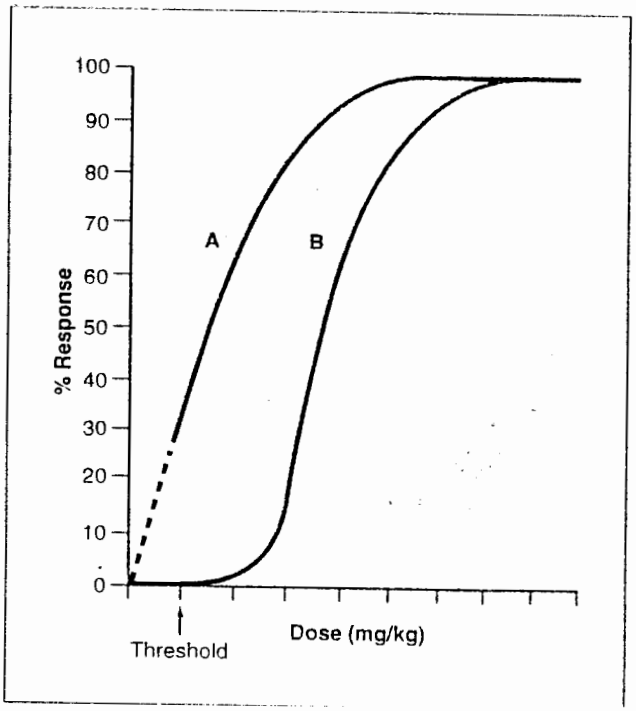
(a) What is a dose-response curve (5 marks)

(b) The diagram below is an illustration of the locations of various effect-no effect levels on a dose response curve. Give the terminology associated with dose-response curves from 1 to 5. (5 marks)



Q1 (b)

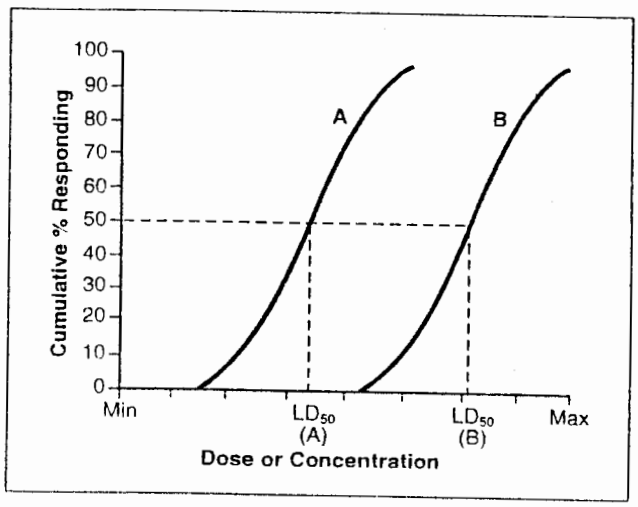
(c) Briefly explain the differences between the two response curves (A and B). (5 marks).



Q1 (C)

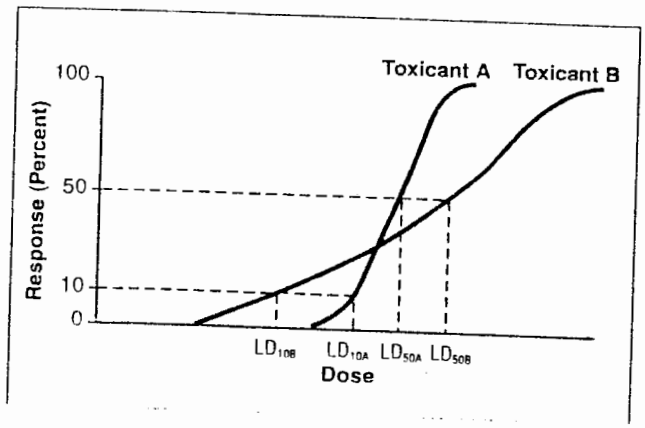
(d) From the diagram below, which chemical is more toxic over the entire range of doses and which one is not? Briefly explain. (5 marks).

Q1
(d)



(e) From the two dose-response relationship curves below briefly explain the differences between Toxicant A and B (5 marks)

Q1
(e)



Question 2.

A simple account of the "Dose Response Relationship" can be given by demonstrating the responses to a graded increase in the level of carbon monoxide in the blood, as consequence of exposure.

(a) With the aid of a diagram explain how carbon monoxide acts on the blood and give an account of the effects of increasing levels of exposure. (15 Marks)
(b) Briefly describe the following terms regarding dose-response curves
  (i) Lethal Dose 50 (LD_{50})
  (ii) Effective Dose (ED)
  (iii) Therapeutic Index (TI)
  (iv) Margin of safety
  (v) Threshold dose

(10 marks)

Question 3

Part A: Answer True or False for the following questions; (1 mark each)

1. Cadmium, Halogenated hydrocarbons, and antibiotics such as cephalosporins are potent kidney toxicants.
2. Oxygen only binds to the iron +2 state not iron +3.
3. The organ with the highest biotransformation capability is the liver.
4. The major building blocks of a cell that can be damaged by a toxicant are DNA, protein, lipid and carbohydrate.
5. Reaction of the ultimate toxicant to a target molecule is the second stage in the development of toxicity.
6. Toxicants are venoms and substances of biological origins producing adverse health effects.
7. Smokers carry a 5-7% residua CO level
8. An electrophile is the term used to describe addition of electrons and hydrogen to a molecule.
9. The three major types of Phase I reactions are hydrolysis, oxidation, and reduction.
10. DDT, PCBs, dioxins and furans are not persistent organic pollutants.

Part B: Multiple Choice - Choose the best answer for each statement or question.
(2 marks each = 10 marks)

1.Which of the following produces fatty infiltration of the liver and centrilobular necrosis?
  a. benzene
  b. phosphorus
  c. beryllium

d. carbon tetrachloride
e. allyl alcohol.

2. In developmental toxicology, toxicity of a xenobiotic will depend on;
   a. Stage of embryonic or foetal development
   b. Dosage of the toxicant, route and extent of exposure, chemical half-life
   c. Ability of the toxicant to pass the placenta
   d. Ability of the martial tissues to detoxify or bioactivate the toxicant
   e. The size of the toxicant (Toxicants generally pass through the placenta if they are less than 800MW)
   f. All of the above are correct.
   g. Items a, b, c, and d are correct.

3. Examples of human teratogens include
   a. Rubella infections
   b. Thalidomide
   c. Antineoplastics or anti cancer drugs
   d. Antiepileptic drugs as valporic acid
   e. All of the above are correct
   f. Only a, b, c and d are correct

4. Examples of aerosols are;
   a. fumes, dust, gas, mists, fog, vapour, and smoke.
   b. Haze, smog, fumes, dust, gas, mists, and fog
   c. Haze, smoke, vapour, mists, dust, fumes, and vapour
   d. Smog, haze, smoke, fog, mists, dust and vapour
   e. Fumes, dusts, mists, fog, smoke, haze, and smog.

5. Which of the following produces proximal tubular damage in the kidney in acute poisoning?
   a. kerosene
   b. carbon tetrachloride
   c. carbon disulphide
   d. tetraethyl lead
   e. carbon monoxide

Part C: Short answer - answer the following question very precisely;
Describe the difference between axanopathy, myelinopathy, and neuropathy and give examples of agents causing each type of neurotoxicity. (5 marks)

Question 4.

Case Study: Answers will be graded on organization, clarity of presentation, and thoroughness.

Case 1. In a metal processing factory the valve on a tank of poisonous gas, XXX, breaks open and two employees nearby are exposed to the same amount of dose of this toxicant. One man named Joe becomes very confused, nauseated, weak, and almost faints. The second man Bill, feels a little nauseated and weak but definitely is able to walk out of the factory. Both men are rushed to the hospital emergency room of the nearby hospital. Later that evening, Bill is sent home seeming to be in good health with no meaningful aftermath of the exposure. Joe is kept in the hospital because he still seems weak and confused.

You are the safety officer for the company and have to explain to a Vice-Chairman of the firm;

a) The information the doctor should have and did ask about the incident on entry into the emergency room to insure that proper medical care was given to the men and no lawsuit would be charged, and

b) What could be given as possible explanations for the differences in the toxic effect of gas XXX on Bill and Joe?

(15 marks)

Case 2. A man and woman working in a plastic industry are responsible for plastic coating of paper charts to be distributed as instruction sheets for Xerox machines. After working in the coating room for about six months where they allow the plastic to coat the paper as the six carbon hydrogen solvent evaporates under hoods they begin to find difficulty in separating out individual sheets and develop a stiffness in the bottom of their legs. They think it is from standing so much and having to move so many pieces of paper.

a) What could be another explanation for their clumsiness or stiffness?
b) What would be the biological and chemical process that might be going on?

(10 marks)

(Total = 25 marks)

Question 5

A. Organophosphates are used as pesticides in gardens and agriculture and in chemical warfare;

a. What is the basic structure of organophosphates and the differences in structure and action between the agent used in chemical warfare versus a common pesticide? (10 marks)

b. What is the mechanism of action of organophosphates that makes them toxic (5 marks)

B.

(i) The Stockholm Convention on Persistent Organic Pollutants (POPs) has targeted twelve (12) POPs for elimination and eight of these are

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pesticides; Name only five (5) of these pesticides.

(5 marks)

(ii) What is meant by the statement that the toxicity and absorption of a toxicant in the lung is dependent on the particle size of the toxicant?

(5 marks)