

UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Science

Diploma in Environmental Health Science
MAIN EXAMINATION PAPER May 2012

TITLE OF PAPER : SOLID WASTE MANAGEMENT

COURSE CODE : EHS:205

DURATION : 2 HOURS

MARKS : 100

INSTRUCTIONS : THERE ARE 5 QUESTIONS IN THIS EXAM.
: ANSWER ANY 4 OF THE 5 QUESTIONS
EACH QUESTION CARRIES 25 MARKS
: NO PAPER SHOULD BE BROUGHT INTO OR OUT OF THE
EXAMINATION ROOM

QUESTION 1 (25 MARKS)

- A. Define the following terms used in solid waste management: i) Fly ash ii) Pyrolysis iii) mixed waste iv) Putrescible waste v) Landfilling vi) vermi-composting.[6 Marks]
- B. Supposing that you want to take a 100 Kg of solid waste sample for composition analysis from a truck load of waste weighing 3200 Kg. Describe the procedure for taking this 100 kg sample from the 1600 kg waste pile. What precautions should be taken during such sampling from waste piles?.....[6 Marks]
- C. Which of the following statements is/are false about specific weight of a solid waste?
- i. The specific weight of solid waste is determined using the wet method is greater than the dry density of the same solid waste.
 - ii. The specific weight of a compacted waste is less than the specific weight of loose (uncompacted waste).
 - iii. The specific weight of solid wastes varies markedly with geographic location, season of the year and length of time in storage.
 - iv. The specific weight has a unit of mass, i.e. Kg or gm..[6 Marks]
- D. The field capacity of a given compacted solid waste has been determined to be 25%. If a rainfall precipitation measured as 50 mm falls over this solid waste that has a dimension of 1mX1m base area and 10 cm depth, determine the amount of water collected as leachate in liters from this solid waste.[7 Marks]

QUESTION 2 (25 MARKS)

- A. The use of Volatile solids determined at 550⁰c in describing the biodegradability of the organic fraction of solid waste is misleading. Explain.[6 Marks]
- B. What are the characteristics of three major component fractions resulting from the pyrolysis of organic fraction of municipal solid waste?[7 Marks]
- C. It is said that combustion is an exothermic process while pyrolysis is an endothermic process. Explain this in terms of energy production and energy use.[6 Marks]
- D. Describe how the oxygen content affects the temperature of a combustion process and what effect this will have on combustion.[6Marks]

QUESTION 3 (25 MARKS)

A. Describe how the following 5 design factors affect the efficiency of aerobic composting processes a) particle size b) moisture content c) temperature.d) oxygen e) carbon to nitrogen ratio.[10 Marks]

B. State in each of the following cases whether the C:N ratio is high or low:

- i. Activated sludge
- ii. Grass clippings
- iii. Fruit wastes
- iv. Potato peelings. [5 Marks]

C. Operational problems with composts can be detected through lack of rise in temperature. Explain the possible factors contributing to low temperature.[5 Marks]

D. List the advantages that are claimed for vermi-culture composting[5Marks]

QUESTION 4 (25 MARKS)

A. Discuss the following types of landfilling processes:

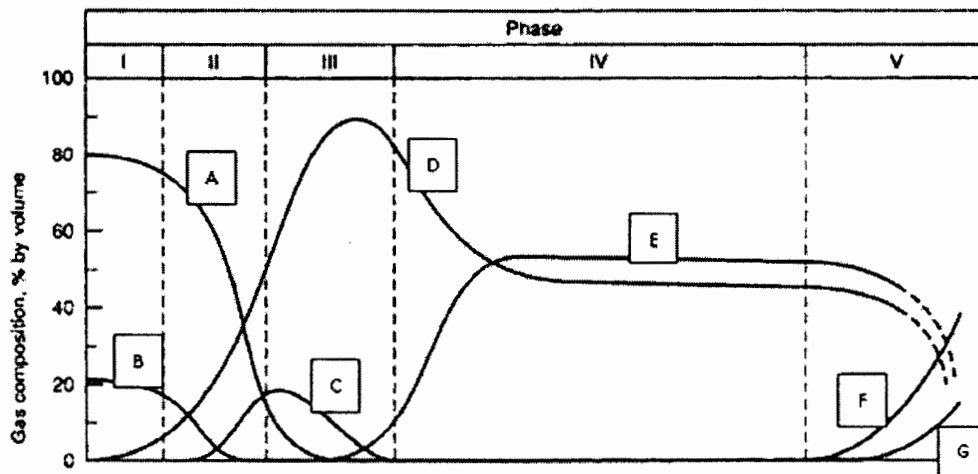
- I. Cell/Trench method
- II. Area method
- III. Canyon/Depression method.....[6 Marks]

B. Explain for each of factors listed below the important considerations to be taken in to account in siting a future solid waste sanitary landfill

- i. Soil
- ii. Geology.[6 Marks]

C. Given below is the generation of landfill gases in a landfill process. Identify the different gases labeled from A to G from the following list of gases: N₂, O₂, H₂, CH₄, CO₂.

Identify the different phases labeled from I to V[6 Marks]



D. For a landfill site, describe the function of a. surface layer b. filter layer c. biotic layer d. drainage layer.[7 Marks]

QUESTION 5 (25 MARKS)

In a certain town it has been determined that the per capita waste generation rate is 1.4 Kg per person per day. Collection is conducted one time per week by the municipality. If the density of municipal solid waste in a typical trash container is 150 kg/m³.

- A. How many 120 Liter containers would be needed for a family of four?[8 marks]

- B. Collection trucks have a capacity of 11.5 m³ capacity which can compact the waste to a density of 420 kg/m³. How many customers can a truck handle in a single run, before departing for the transfer station?[8 marks]

- C. Determine the number of collection vehicles needed if 8250 households must be served once per week. The truck collects wastes 4 days per week, with 1 day for routine truck maintenance and other projects. Assume that an average truck can service 1.4 households per minute and only 5 hours of the working day are actually used for collection (the rest for transporting the waste, traveling to and from waste collection sites and break times).[9 marks]