

National Examination, December 2010

04-Env-A6 – Solid Waste Engineering and Management

3 hours duration

NOTES:

1. There are a total **SIXTEEN** (16) examination questions on 2 pages.
2. Each question is of the value indicated. There are **100 possible** marks for the examination.
3. This is a **CLOSED BOOK EXAM.**
4. Candidates are permitted **ONE** (1) letter sized aid sheet (8.5 “x 11”) both sides.
5. One non-communicating calculator.
6. **If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made for the solution of the examination questions.**
7. Clarity and organization of the answers are important.

National Examination, December 2010
04-Env-A6 – Solid Waste Engineering and Management

- 2 **Q1** What is the greatest deterrent to reclaim materials in the solid waste?
- 5 **Q2** List in point form the steps involved in composting.
- 10 **Q3** List **10** (ten) factors to be considered in a landfill site selection.
- 9 **Q4** In point form, develop a design and an operational plan for landfill.
- 6 **Q5** Identify the advantages and disadvantages of sanitary landfills.
- 5 **Q6** 6.1 Why is compacted density an important consideration in MSW management?
 6.2 How would you calculate it?
- 5 **Q7** 7.1 What does the moisture content of municipal solid waste depend on?
 7.2 Why is it important?
- 5 **Q8** 8.1 What are the benefits of conducting a Life-Cycle Analysis?
 8.2 List the variables would you include in a life-cycle analysis of MSW composting facilities.
- 5 **Q9** Name 4 (four) issues you have to address when you wish to implement a Composting Facility.
- 10 **Q10** Develop a process flow diagram to process source-separated mixed paper and mixed recyclables composed of plastics, glass, tin cans and aluminium cans.
- 10 **Q11** You are about to set up a water balance for a landfill. Draw a definition sketch for a water balance to be used to assess leachate formation in a landfill.
- 3 **Q12** Name 3 (three) types of leachate control methods.
- 5 **Q13** Definitions
 13.1 The Perfect Gas Law
 13.2 Darcy's Law
 13.3 Breakthrough time
 13.4 Life-cycle analysis
 13.5 Soil porosity

National Examination, December 2010
04-Env-A6 – Solid Waste Engineering and Management

- 3 Q14 Identify 3 (three) factors that limit growth of vegetation on landfills.
- 10 Q15 You have been retained by a municipality to determine by how much the lifespan of their existing landfill can be expanded if a waste combustion facility was to be set up next existing landfill. Given the following

<i>Component</i>	<i>Typical, % by weight</i>
<i>Organic</i>	
Wood wastes	9.0
Paper	34.0
Cardboard	6.0
Plastics	7.0
Textiles	2.0
Rubber	0.5
Leather	0.5
Yard wastes	18.5
Wood	2.0
<i>Inorganic</i>	
Glass	8.0
Tin cans	8.0
Aluminum	0.5
Other metal	3.0
Dirt, ash, etc	3.0

information, determine how much the life span of the landfill is increased by waste combustion. Typical physical composition of residential MSW excluding recycled materials and food wastes discharged with wastewater is shown in the adjacent Table.

Estimated landfill capacity remaining = **230,000 m³**
 Capacity of combustion facility = **50 tons waste/h**
 Effective on-line combustion time per day = **22 h**
 Initial specific weight of waste = **170 kg/m³**
 Final specific weight of waste (MSW + ash) in landfill = **710 kg/m³**

- 7 Q16 The maximum amount of solid waste collected per day for a six-day work week is presented in the following Table. All the solid wastes are to be burned at a municipal waste-to-energy combustion facility at a constant rate of **100 tons/d**. What is the required capacity of the storage pit that should be designed to accommodate **1.15** times the required capacity?

DAY	Solid Waste Collected, tons/d
Monday	150
Tuesday	130
Wednesday	120
Thursday	120
Friday	100
Saturday	80