

National Examination May 2012

04-Env-A6, Solid Waste Engineering and Management

3 hours duration

NOTES:

1. The total possible examination mark is **100**.
2. This examination is an **CLOSED BOOK EXAM**.
3. Candidates are permitted **ONE** (1) letter sized aid sheet (8.5 "x 11") both sides.
4. One of two calculators is permitted any Casio or Sharp approved models.
5. *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.*
5. All **15** questions constitute a complete paper.

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- 5 1. What are some of the challenges and opportunities for the management of e-waste?
(*e = electronic*)
- 10 2. The management of landfill leachates present challenges and opportunities that vary with the age of a landfill. Prepare a Table showing the differences between “young” and “old” leachates characteristics, challenges to be addressed and opportunities that they represent.
- 8 3. Identify some strategies that are used to minimize landfill leachate generation. In point form, what do they consist of? When do you implement any of these strategies?
- 10 4. Your town is considering establishing a new landfill to manage their solid waste. The citizens have become concerned. In order to address this concern and opposition by the citizens to a landfill in their community, the mayor has called a public meeting where you, as the town engineer, has to address this opposition and attempt to soothe their fears. Identify the steps of your strategy in point form. Your objective is that at end of your talk the audience will have fewer concerns and the opposition has lessened.
- 10 5. What is a bioreactor landfill? Is it different from a conventional landfill? If so, identify the differences. Prepare a sketch showing what a bioreactor landfill looks like.
- 6 6. Identify 4 Composting Techniques and their major advantage(s).
- 5 7. Identify 5 major benefits of a compost.
- 6 8. In the generation of a healthy compost, a number of key process inputs are essential. Name six (6).
- 6 9. Determine the amount (kg and m³) of air required for the complete combustion of one (1) tonne of an organic solid waste. Assume that the composition of the organic waste to be combusted is given by C₄H₁₂ and that the specific weight of air is 1.20 kg/m³ and that the dry air is comprised of 23 % oxygen by weight.
C =14, H =1
- 6 10. Name in 6 important design considerations for an aerobic composting process.
- 4 11. In an aerobic composting operation, what happens:
11.1 if the C:N ratio is < 10, if it is > 40
11.2 when the temperature > 68 deg C
11.3 if the pH > 8.5

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- 5 12. Under what circumstances would you consider the need for Transfer Stations?
- 6 13. Name 3 issues that impact on the implementation of a composting facility (in this case, land availability is not an issue).
- 5 14. Identify some of the concerns that have to be addressed in operating an open composting facility in the winter.
- 8 15. Determine the volume reduction and the volume of residue after combustion of a MSW (see Table below). The specific weight of the residue is 300 kg/m³.

100 -TOTAL

COMPONENT	SOLID WASTE (kg)	INERT RESIDUE (%)
Organic		
Food Wastes	90	5
Paper	340	6
Cardboard	60	5
Plastics	70	10
Textiles	20	6
Rubber	5	10
Leather	5	9
Yard Wastes	185	5
Wood	20	2
Inorganic		
Glass	80	98
Tin Cans	60	98
Aluminum	5	96
Other Metals	30	98
Ash, Dirt, etc	30	68
TOTAL	1,000	