

National Examination, December 2015

**04-Env-B5 Industrial & Hazardous Waste Management**

3 hours duration

**NOTES:**

1. The total possible examination mark is **100**.
2. This is a **CLOSED BOOK EXAM**. An 8 ½" x 11" aid sheet (both sides) and any non-communicating calculator are permitted.
3. *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.*
4. All **18** questions constitute a complete paper.
5. Clarity and organization of the answers are important.

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- 5 1. Name 5 strategies you could use to reduce liquid industrial waste strength.
- 5 2. How would you handle (remove) emulsified oils from an industrial wastewater?
- 10 3.a) Name 5 industries and the hazardous material(s) in their production process residuals.  
3.b) What hazard reduction strategies would you consider for each of these industries?
- 7 4. In point form outline the steps you would take to conduct an Industrial Waste Survey.
- 5 5. Name 5 methods of disposing (removing/managing) hazardous waste.
- 8 6. Given the following data, calculate the gas production rate from a chicken farm:  
*chickens = 200,000*  
*each chicken produces an average of 0.00019 m<sup>3</sup>/d of manure*  
*COD, C<sub>i</sub> = 150,000 g/m<sup>3</sup>*  
*HRT of anaerobic reactor = 12 days*  
*Growth rate, r<sub>g</sub> = 600 g/m<sup>3</sup>.d*  
*fraction of COD removed = 0.79*  
*CH<sub>4</sub> produced/kg COD destroyed = 0.37 m<sup>3</sup>*
- 2 7. What is one of the critical issues in the long term management of hazardous compounds?
- 6 8. A pharmaceutical product production company has asked you to advise on a management strategy for their waste pharmaceutical products. In point form, list the steps you would take. Are there any treatment options? If so, identify them in point form.
- 4 9. How do you manage biomedical wastes? Differentiate between liquid and solid wastes.
- 3 10. How do you define a hazardous waste?
- 4 11. What are 4 properties of a hazardous waste?

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- 15 12. A large industry wishes to locate in your community. A process wastewater will be produced from their widget manufacturing process. You have been engaged by this industry to come up with a cost-effective wastewater management strategy.
- 12.1 Outline the steps you would take for your assignment.
  - 12.2 Write an index to your report that you will prepare for your client.
  - 12.3 Once you have an index, write one brief sentence giving information about the content of what you will present under that report heading.
- 2 13. What is the most effective way to eliminate the small quantities of hazardous wastes now generally found in municipal solid waste?
- 2 14. What is considered to be the key to the elimination of all discharges of hazardous wastes from commercial activities?
- 6 15. A particular industrial waste contains a bio-inhibitory compound. You have determined that biological treatment would be the best process option if this bio-inhibitory compound were not present. Identify, and discuss briefly how you would handle this challenge.
- 10 16. Identify in tabular form the important process design variables for:
- 16.1 an incinerator
  - 16.2 a membrane separator
  - 16.3 a conventional activated sludge process
  - 16.4 an anaerobic digester
  - 16.5 an aerobic digester
- State why each parameter is important.*
- 4 17. Name 4 critical components of a hazardous waste plan.
- 2 18. What is the biggest challenge in the management of bio-medical waste?