

National Examination May 2016

04-Env-B5 Industrial & Hazardous Waste Management

3 hours duration

NOTES:

1. This examination has **twenty-four (24)** 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**. An 8 ½" x 11" aid sheet (both sides) and any non-communicating calculator are permitted.
4. **If doubt exists as to the interpretation of any examination question, the candidate is urged to submit with the answer paper, a clear statement of any assumption made for the solution of the examination question.**
5. Clarity and organization of the answers are important.

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- 2 1. What are Hazardous wastes?
- 2 2. Why are we concerned with hazardous wastes?
- 4 3. Hazardous wastes can be classified:
Cite an example of a source and the associated hazardous waste for the 4 identified Sectors below:

Sector	Source	Hazardous waste
1. Commerce		
2. Agriculture		
3. Small scale industry		
4. Large scale industry		

- 3 4. Name 3 pathways of hazardous waste release.
- 4 5. There are many components required in the development of a hazardous waste management system. Name 4 that come to mind.
- 5 6. What are some unit processes that can be used to manage hazardous wastes.
- 6 7. What are some key strategies in hazardous waste management? Name 6.
- 2 8. What is the greatest challenge in managing industrial wastewaters?
- 5 9. Define liquid industrial wastes, and give 3 examples which have widely varying characteristics.
- 3 10. How can a municipality's services control industrial waste waters?
- 7 11. A new pharmaceutical industry wishes to locate in your city. Outline the information that you as the city engineer must have from the applicant in order to make some intelligent comments on the forthcoming liquid waste discharge application.
- 5 12. Name 5 factors which control the aerobic digestion process.
- 5 13. Describe what happens during the process of biological nitrification. What controls the rate of nitrification?
- 8 14. You are the wastewater process consultant for an industry. The industry is generating a wastewater as the result of their production operation. There is a municipal wastewater treatment plant in the community. You have been retained to advise your client on what the most cost-effective wastewater management option is available to them. Outline in some detail (but point form) the steps you would take to fulfill this assignment.

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- 5 15. How would you conduct an industrial waste survey? What are the components of such a survey?
- 5 16. Describe in point form and sketch a secure landfill. What is meant by a secure landfill?
- 3 17. Name 3 management options for landfill leachate.
- 4 18. An industry produces $800 \text{ m}^3/\text{day}$ of organic waste with BOD_5 of 635 mg/L . If wastes with BOD_5 less than 300 mg/L are covered by basic sewer charges, through taxes or as part of the water bill, what annual surcharge would this industry pay if the operating cost for removing BOD_5 is $\$0.25/\text{kg BOD}_5$ removed?
- 6 19. Construct a table that shows the differences between a municipal, an industrial (cannery) and a hazardous wastewater. Make assumptions as needed. How would your waste management differ? State in point form what they would be and why?
- 5 20. An industry is being established and they must treat their wastewater generated from their product production process. Since the industry has not been built yet, there are no waste generation data. How would you go about getting the information you need to arrive at waste generation and liquid flow rates?
- 2 21. Give an example when:
21.1 Plug-flow for a biological treatment process would be a good process choice.
21.2 Complete-mix for a biological treatment process would be a good process choice.
- 3 22. In any treatment process design what are the 3 most important factors that you must consider?
- 3 23. What is the biggest challenge in managing biomedical wastes? Differentiate between liquid and solid wastes.
- 3 24. How do you manage the treatment and ultimate disposal of liquid radioactive wastes?

100 TOTAL POSSIBLE MARK