National Examination May 2015

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

3 hours duration

NOTES:

1. This examination has **EIGHTEEN (18)** 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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3   1. In any waste treatment process selection, what are the 3 most important factors that you must consider?

4   2. Identify 4 basic waste treatment process options.

4   3. When sampling an industrial wastewater name 4 factors that can affect analytical results.

5   4. Name 5 undesirable waste characteristics in a liquid industrial or hazardous waste.

5   5. Name 5 steps you must consider for a realistic in-plant waste survey.

8   6. What are the important information must you collect for the design of an industrial waste management (including treatment) system,

10   7. What is:
          7.1 BOD -
          7.2 COD -
          7.3 TOC -
          7.4 TOD -
          7.5 Zone settling –
          7.6 Specific resistance –
          7.7 a Freundlich isotherm –
          7.8 F/M –
          7.9 a Priority pollutant –
          7.10 Plug flow -

5   8. Calculate the ThOD (Theoretical Oxygen Demand) of 100 grams of phenol (C_6H_5OH).

$$C_6H_5OH + 7 O_2 = 6CO_2 + 3 H_2O$$
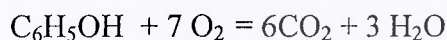
Atomic weight: C = 12; H = 1; O = 16

10   9. An industry manufacturing widgets has engaged you as their consultant to guide and advise them in their management of the liquid waste generated from their operation. This industry represents a new industry in this community. Their production plant has not been built yet. They have no data.
Write (in point form) an index of a report that you will prepare which outlines their waste management options and identify the type of data you have to acquire to write this report.

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3 10. Name 3 unit operations used in concentrating sludges.

10 11. A small municipality of 10,000 has two industries: a cannery producing 5,000 tonnes of whole tomatoes and other canned goods over a 7 month season, and a textile mill which produces 2,000 kg of cotton goods per day. Estimate the BOD_5 and SS content of the municipal wastewater:

  11.1 with and

  11.2 without these industries being served by the municipal system and

  11.3 determine the population equivalent (PE) of the cannery in terms of BOD_5.

  Wastewater: Residential is 400 L/capita/day, BOD_5 is 190 mg/L and SS is 225 mg/L

    Cannery 10,000L/tonne production, 1,200 mg/L BOD_5, 700 mg/L SS

    Textile 100,000L/tonne production, 400 mg/L BOD_5, 100 mg/L SS

7 12. Name:

  12.1 Five (5) industries and the hazardous material(s) in their production process residuals.

  12.2 What hazard reduction strategies would you consider for each of these industies?

6 13. Name 6 objectives of a monitoring system for the land disposal of hazardous waste.

6 14. Identify 3 principles of incinerator design.

2 15. Define biomedical waste.

6 16. Name 3 generators of biomedical waste.

3 17. Name 1 provincial, 1 national and 1 international convention or guideline.

3 18. Give 3 examples of situations where you would consider using flow equalization.

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100 total possible mark