
UNIVERSITI SAINS MALAYSIA

1st Semester Examination
2010/2011 Academic Session

November 2010

EAP 585/4 – Solid and Hazards Waste Management

Duration : 3 hours

Please check that this examination paper consists of **FOUR (4)** printed pages before you begin the examination.

[Instructions: This paper contains **SIX (6)** questions. Answer **FIVE (5)** questions only.

You must answer the questions in English.

All question **MUST BE** answered on a new sheet.

1. Described the focus and scope of Environmental Quality Scheduled Waste Regulations 2005. List and explain all schedules under this regulation.

[10 marks]

2. a) Briefly discuss the current solid waste management practices in Malaysia and what are the challenges in the future?.

[6 marks]

b) Define the following terms: Incineration, Pyrolysis, and Gasification. What is the difference among these processes?.

[4 marks]

c) List and briefly explain the most important factors for proper incinerator design and operation.

[marks]

d) Discuss the characteristics of waste that are favorable for biological treatment, thermal processing, recycling and landfilling.

[4 marks]

3. a) Briefly explain the major public health and environmental issues dealing with incinerators.

[4 marks]

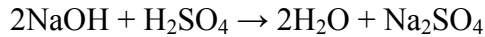
b) Describe any **THREE (3)** of the following methods in hazardous & non-hazardous industrial waste treatment:
 - i. Supercritical wet oxidation
 - ii. Ion Exchange
 - iii. Rotating Biological Contactors
 - iv. Pervaporation
 - v. Disinfection

[6 marks]

- c) What is the difference between waste accumulation and satellite accumulation points?.

[2 marks]

- d) Consider an industrial waste is being neutralized using sulfuric acid and sodium hydroxide. Using the following data:



(MW Na = 40 g/mol; O = 16 g/mol; S = 32 g/mol; H = 1 g/mol)

The flow of NaOH (with concentration of 250 mg/L) is 20 L/min

Determine:

- i. The quantity (in kg/day) of sulfuric acid to neutralize the waste
- ii. Calculate the total dissolved solids (TDS) after neutralization (in mg/L)

[8 marks]

4. a) Describe the source of solid waste generator and type of waste.

[10 marks]

- b) The student population of college is 1500 and has 30 standard classrooms. Assuming a 5-day class week with solid waste pickups on Wednesday and Friday before class starts in the morning, determine the size of storage container required. Assume waste is generated at a rate of 0.11 kg/cap.d plus 3.6 kg per room and that the density of uncompacted waste is 120 kg/m³. Standard container sizes (m³) are as follows: 1.5, 2.3, 3.0, and 4.6.

[10 marks]

5. a) What are the differences between hauled container system and stationary container system?

[6 marks]

- b) A total of 11 apartment complexes and commercial establishments have entered into a contract with a solid waste collection firm to collect their solid waste. A 20 m³ vehicle is available for collection. The discarded volume of solid wastes to be collected is 96 m³/week. If it is decided to have two collections per week, how many trips are to be made on a collection day? Also determine the size of the container to be provided. Assume that $r = 2.5$ and for simplicity, assume that each of the 11 sources contributes the same amount of solid wastes. Make any essential assumptions if necessary.

[14 marks]

6. a) Using the information provided in table below, calculate:
- i. The overall recycling efficiency
 - ii. The composition of the generated and recycled wastes, and
 - iii. The volumetric reduction (%) in disposed wastes due to recycling.

Table 1

Component	Disposed Waste Composition, % by weight	Recycle Efficiency, % by weight	Specific Weight, kg/m³
Misc. Organics	19	25	166
Mixed Paper	30	30	86
Glass	20	50	196
Plastics	11	15	65
Metal	12	10	320
Miscellaneous	8	0	100
sum:	100.0		

[10 marks]

- b) What is the advantage and disadvantage of this solid treatment technique?
- i. Incineration
 - ii. Composting
 - iii. Landfilling
 - iv. RDF

[10 marks]