

**CONFIDENTIAL**



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2018/2019**

**COURSE NAME** : SOLID AND HAZARDOUS WASTE  
MANAGEMENT

**COURSE CODE** : BNA 31003

**PROGRAMME CODE** : BNA

**EXAMINATION DATE** : JUNE/JULY 2019

**DURATION** : 3 HOURS

**INSTRUCTION** : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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- Q1**
- (a) List **THREE (3)** ways to reduce solid wastes. (3 marks)
  - (b) Describe Municipal Solid Waste (MSW). (3 marks)
  - (c) Calculate the density of a solid waste sample with the compositions given in **Table Q1(c)(i)** and **Table Q1(c)(ii)**. (6 marks)
  - (d) The incident of hazardous waste spillage may cause mortality or pose hazard to human health and the environment, as environmental technologist engineer you are required to:
    - (i) Distinguish between acutely toxic and toxic waste. (5 marks)
    - (ii) Plan **FOUR (4)** ways to manage segregation of clinical wastes effectively. (8 marks)
- Q2**
- (a) List **FOUR (4)** characteristics of hazardous waste. (4 marks)
  - (b) Briefly explain Setout-setback and Setout service of residential collection. (4 marks)
  - (c) The layout collection routes for resident of Pagoh Jaya is shown in **Figure Q2(c)**. The waste collection system was done by hauled container system (HCS).
    - (i) Sketch the HCS-exchange container mode (4 marks)
    - (ii) Based on the layout, calculate:
      - (a) The total number of residences/house from which wastes are to be collected.
      - (b) The compacted volume of solid waste to be collected per week.
      - (c) The number of trips per week.
      - (d) The average number of residences from which wastes are to be collected each day.
- Assume the following data is applicable:  
Occupants per house= 5  
Solid waste generation rate = 1.4 kg/person.d  
Compacted density of solid waste in collection vehicle= 320 kg/m<sup>3</sup>  
Collection vehicle capacity = 23/m<sup>3</sup>  
Route constraints  
No U-turns in streets
- (7 marks)

- (d) With the aid of diagram, propose **THREE (3)** types of transfer station. (6 marks)
- Q3**
- (a) List **TWO (2)** final product of incineration. (4 marks)
- (b) Deep well injection is a liquid waste disposal technology. (4 marks)
- (i) Illustrate and label the deep well injection for hazardous waste. (2 marks)
- (ii) Identify **FOUR (4)** advantages of deep well injection for hazardous waste. (6 marks)
- (c) Outlines **SIX (6)** requirements for secured landfill design. (9 marks)
- (d) Plan the emergency response if the discharge of hazardous occurred. (6 marks)
- Q4**
- (a) Describe the concept of 3R below: (6 marks)
- (i) Reduce
- (ii) Reuse
- (iii) Recycle
- (b) Sketch the hierarchy of Integrated Solid Waste Management (ISWM). (4 marks)
- (c) Based on answer **Q4(b)**, apply the concept of 3R to the ISWM model by giving **THREE (3)** examples in each of the 3R components. (9 marks)
- (d) Demonstrate on how to recycle hazardous waste from home by giving appropriate example (6 marks)

**-END OF QUESTIONS –**

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**Table Q1(c)(i)** Components of solid waste by mass percent based on a 1000 kg sample of waste

Component	Percent by mass
Food waste	30
Paper	20
Plastics	15
Garden trimmings	14
Glass	6
Tin cans	5
Misc. organics	10

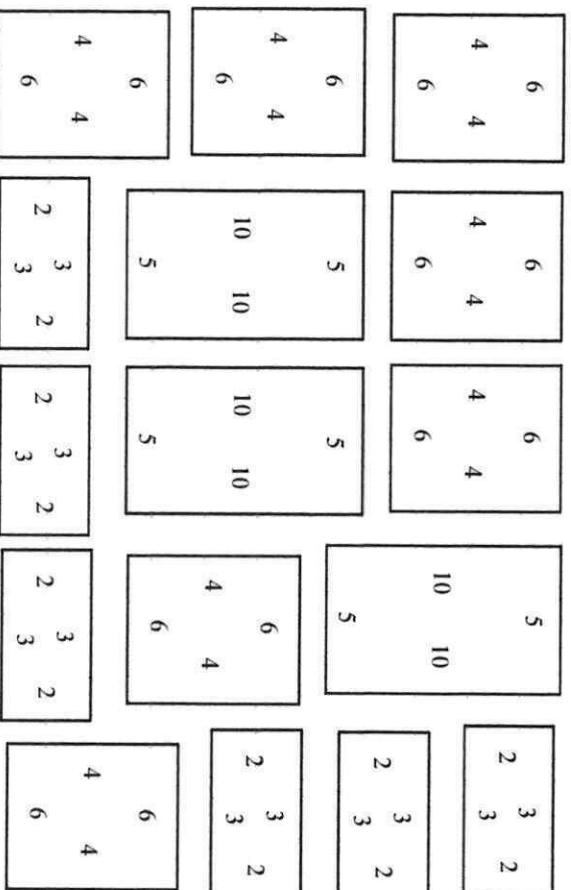
**Table Q1(c)(ii)** Typical data on density of solid waste components

Component	Density (kg/m <sup>3</sup> )	
	Range	Typical
Food wastes	120-480	290
Paper	30-130	85
Cardboard	30-80	50
Plastics	30-130	65
Textiles	30-100	65
Rubber	90-200	130
Leather	90-260	160
Garden trimmings	60-225	105
Wood	120-320	240
Misc. Organics	90-360	240
Glass	160-480	195
Tin cans	45-160	90

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**Figure Q2(c)** Layout collection routes for the residential area