Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	: SOLID AND HAZARDOUS WASTE MANAGEMENT
COURSE CODE	: BNA 31003
PROGRAMME CODE	: BNA
EXAMINATION DATE	: JULY/AUGUST 2023
DURATION	: 3 HOURS
INSTRUCTION	: 1. ANSWER ALL QUESTIONS

2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.

3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

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Q1 (a) List **FOUR (4)** compositions of residential waste.

(4 marks)

(b) Determine **FIVE (5)** negative consequences of municipal solid waste.

(5 marks)

(c) Explain **FOUR (4)** characteristics of hazardous waste.

(8 marks)

(d) **Table Q1(d)(i)** and **Q1(d)(ii)** show a solid waste component volume and density that is based on a 2000 kg waste sample. Calculate the:

(i) mass percentage of each component.

(ii) total volume of the waste sample.

(8 marks)

Q2 (a) Identify **FIVE (5)** focused areas of waste in Malaysia.

(5 marks)

(b) Determine **FOUR (4)** functions of the Department of Solid Waste Management.

(4 marks)

(c) Integrated Solid Waste Management (ISWM) is a comprehensive waste prevention, recycling, composting, and disposal approach.

(i) Illustrate a diagram showing the hierarchy in ISWM.

(ii) Identify **FIVE (5)** opportunities of reused waste.

(9 marks)

(d) Recycling is the collection of materials that can be broken down and reprocessed in order to manufacture new items.

(i) Show the three steps in recycling.

(ii) Decide the correct waste to be recycled for the following purpose:
1. Compost
2. Paper mill feedstocks
3. Rubber-modified asphalt
4. New automobiles

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(7 marks)

Q3 (a) State **THREE (3)** types of transfer stations.

(3 marks)

(b) Explain the effects of the following factors toward waste generation rate.

(i) Recycling activities

(ii) Public attitudes

(iii) Legislation

(6 marks)

(c) A town consists of 2300 homes generates 0.39 kg/person of municipal solid waste per day. Calculate the generation of municipal solid waste of the town for a day, a week, and a month during December. Assume 1 home with 5 residents

(6 marks)

(d) A layout collection routes for residential areas of Taman Pagoh Jaya is shown in **Figure Q3(d)** with the following data:

Occupants per house= 5
Solid waste generation rate = 1.48 kg/person.d
Compacted density of solid waste in collection vehicle= 380 kg/m3
Collection vehicle capacity = 20/m^3
Route constraints
No U-turns in streets

Based on the layout, estimate the:

(i) total number of residences from which wastes are to be collected.

(ii) compacted volume of solid waste to be collected per day and per week.

(iii) number of trips per week.

(iv) average number of residences from which wastes are to be collected each day.

(10 marks)

Q4 (a) Physical treatment involves changing the waste's physical properties such as its size, shape, density, or state.

(i) Explain the method of physical treatment for hazardous waste.

(ii) Illustrate a sedimentation and centrifugation process in physical treatment.

(8 marks)

(b) Incineration is a thermal waste treatment that involve combustion of organic substance of solid waste. Discuss the drawbacks of the incineration process.

(6 marks)

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(c) A landfill is a site for the disposal of waste materials by burial. Discuss **THREE (3)** methods of landfilling.

(6 marks)

(d) Based on **Figure Q4 (d)**, identify the landfill component of (a), (b), (c), (d), and (e).

(5 marks)

-END OF QUESTIONS –

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Table Q1(d)(i) Solid waste component volume

Component	Volume (m^3)
Food waste	3.24
Paper	2.35
Plastics	3.69
Leather	0.38
Glass	1.13
Tin cans	1.78
Nonferrous metals	1.13

Table Q1(d)(ii) Solid waste component density

Component	Density (kg/m^3) Range	Density (kg/m^3) 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
Nonferrous metals	60-240	160
Ferrous metals	120-1200	320
Dirt, ashes, brick	320-960	480

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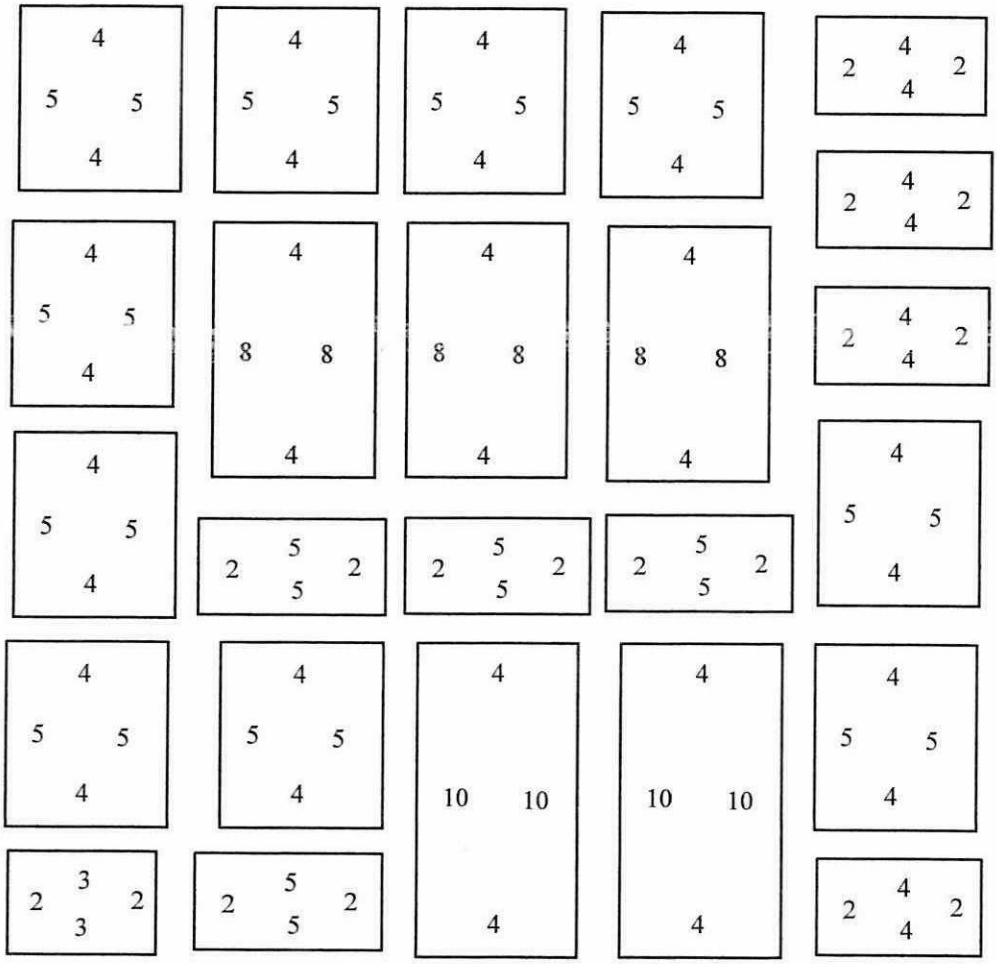

Figure Q3(d) Layout collection routes for Taman Pagoh Jaya residential area

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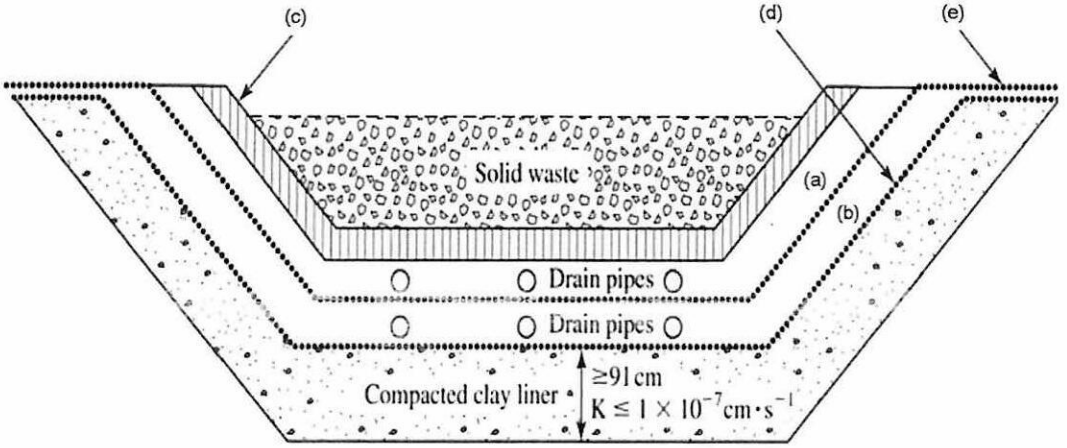

Figure Q4 (d)

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