

CONFIDENTIAL

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013**

COURSE NAME : SOLID WASTE AND HAZARDOUS
WASTE MANAGEMENT

COURSE CODE : BFA 40303/BFA 4033

PROGRAMME : 4 BFA

EXAMINATION DATE : JUNE 2013

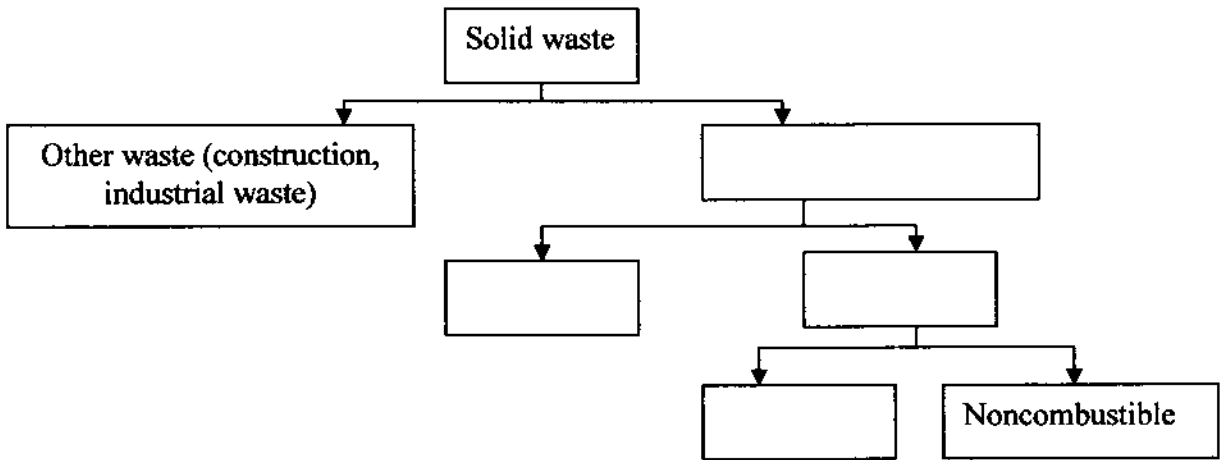
DURATION : 3 HOURS

INSTRUCTION : ANSWER **FOUR** QUESTIONS ONLY
FROM SIX QUESTIONS

THIS QUESTION PAPER CONSISTS OF **ELEVEN (11)** PAGES

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Q1 (a) Complete the flow chart and define the terms for the completed item.



(4 marks)

(b) Briefly explain your understanding on Integrated Solid Waste Management (ISWM) system.

(6 marks)

(c) Based on solid waste management concept, discuss thoroughly on how to implement waste minimization in Malaysia.

(7 marks)

(d) Discuss on how the physical, chemical and biological properties identification of a waste could benefits the waste management system.

(8 marks)

Q2 (a) A town of 100,000 populations generates 0.8 kg/person.day of municipal solid waste. Assume:
 Landfill size : 30 hectares
 Average depth : 20 m
 Volume of waste : 347.8 m³ /day
 Ratio of solid waste : soil cover : 5 : 1

Determine

- (i) Density of solid waste generation per day
- (ii) Volume of landfill
- (iii) Total solid waste with soil cover material
- (iv) Life span of landfill

(5 marks)

- (b) With the aid of a diagram, explain the following collection system in solid waste management and choose the best system with sufficient reason
- (i) Hauled container system (HCS)-conventional
 - (ii) Hauled container system (HCS)-exchange container mode
 - (iii) Stationary container system (SCS)

(10 marks)

- (c) By using the information given below and layout in **Figure Q2**. Assume:

Occupants per resident = 5

Solid waste generation rate = 1.5 kg/person.d

Number of trips per week = 6

Collection crew number = two person

Compacted volume of solid waste in collection vehicle = $108 \frac{\text{kg}}{\text{m}^3} \rightarrow \text{m}^3/\text{week}$

Determine

- (i) Total number of residences which waste are to be collected
- (ii) Compacted density of solid waste collected per week
- (iii) Collection vehicle capacity
- (iv) Average number of residence which waste are to be collected each day
- (v) By assuming that the right side of the residential area is a hilly area and there is U-turn in each street, design collection routes for the residential area in **Figure Q2**.

(10 marks)

$\rho = \frac{m}{V}$
 $\frac{108}{1}$

- Q3** (a) List **FOUR (4)** factors to be considered in landfill siting.

(4 marks)

- (b) Explain briefly on **THREE (3)** types of landfilling method and choose the best method with justifications.

(4 marks)

- (c) Calculate the destruction of removal efficiency (DRE) for the waste in **Table Q3** and determine whether the percentage of destruction is complying with RCRA (Resource Conservation and Recovery Act) Incineration Standards.

Table Q3 : Types and mass of waste

Types of waste	Mass in (g/min)	Mass out (g/min)
Trichloroethylene	2952	0.0918
1,1,1 Trichloroethane	2678	0.190
Toulene	1733.8	3.544

- (4 marks)
- (d) Illustrate and explain **FIVE (5)** phases of gas generation in landfill. (5 marks)
- (e) Analyse and propose the best disposal method between landfill, incinerator and composting. Evaluate on the chances of success or failure in disposing the solid waste using the method that you proposed in Malaysia. (8 marks)
- Q4** (a) Define hazardous waste. (5 marks)
- (b) Define the term *cradle to grave* and *manifest system*. (4 marks)
- (c) Explain **FOUR (4)** hazardous waste management techniques. (8 marks)
- (d) Explain **FOUR (4)** characteristics of various type of hazardous waste. (8 marks)
- Q5** (a) Define environmental audit. (5 marks)
- (b) Explain why seismic risk is important in landfill siting. (5 marks)
- (c) Explain the difference between deep well injection and land treatment. (5 marks)
- (d) List **FIVE (5)** Environmental Protection Agency (EPA) requirements for a hazardous waste landfill and sketch a landfill that meets these. (10 marks)
- Q6** A waste mixture of 44% xylene, 32% toluene, 22% *n*-pentane, and 2% water in **Table Q6** is to be combusted in a liquid injection incinerator at a rate of 600 kg/h. There is 25% excess air in the combustion chamber. Properties of the

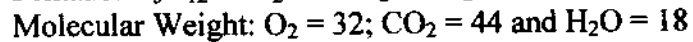
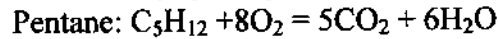
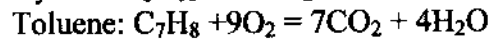
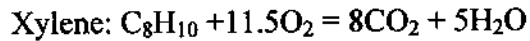
waste constituents are as follows:

Table Q6 : Waste mixture

Compound	Chemical Formula	Molecular Weight (MW)	Heat Content (kJ/kg)
Xylene	$C_6H_4(CH_3)_2$	106.16	42,948
Toluene	$C_6H_5CH_3$	92.13	42,527
Pentane	C_5H_{12}	72.14	49,142
Water	H_2O	18.01	0

- (a) Calculate the total heat release in incinerator. (5 marks)
- (b) Calculate the percent by volume of each component in the flow gas.

Given:



Air is 80% N and 20% O_2

(20 marks)

-END OF QUESTION-

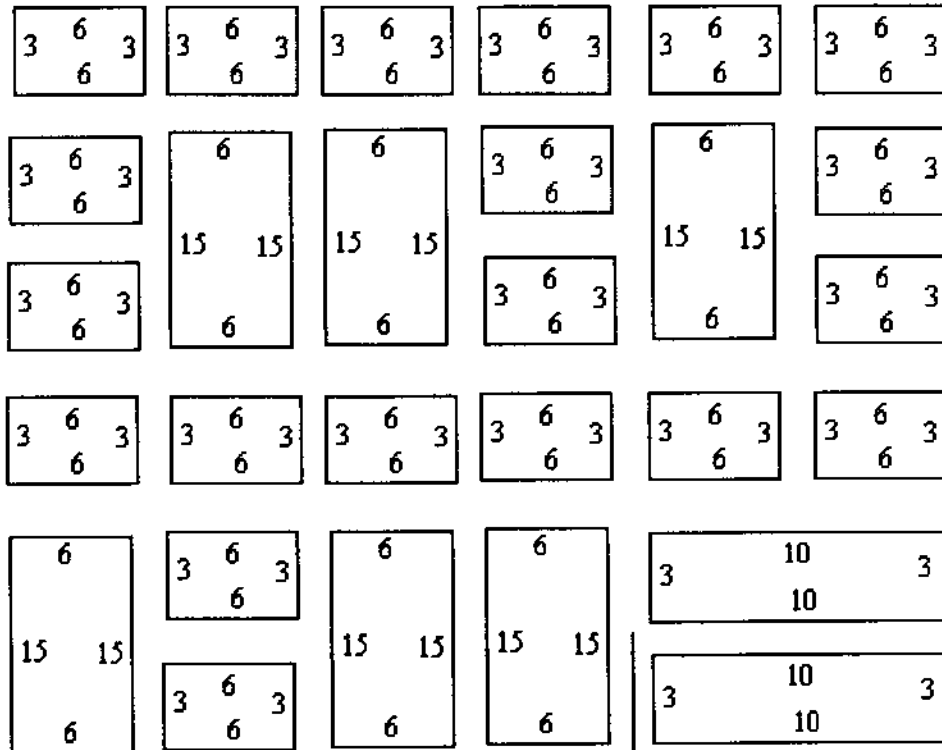
FINAL EXAMINATION

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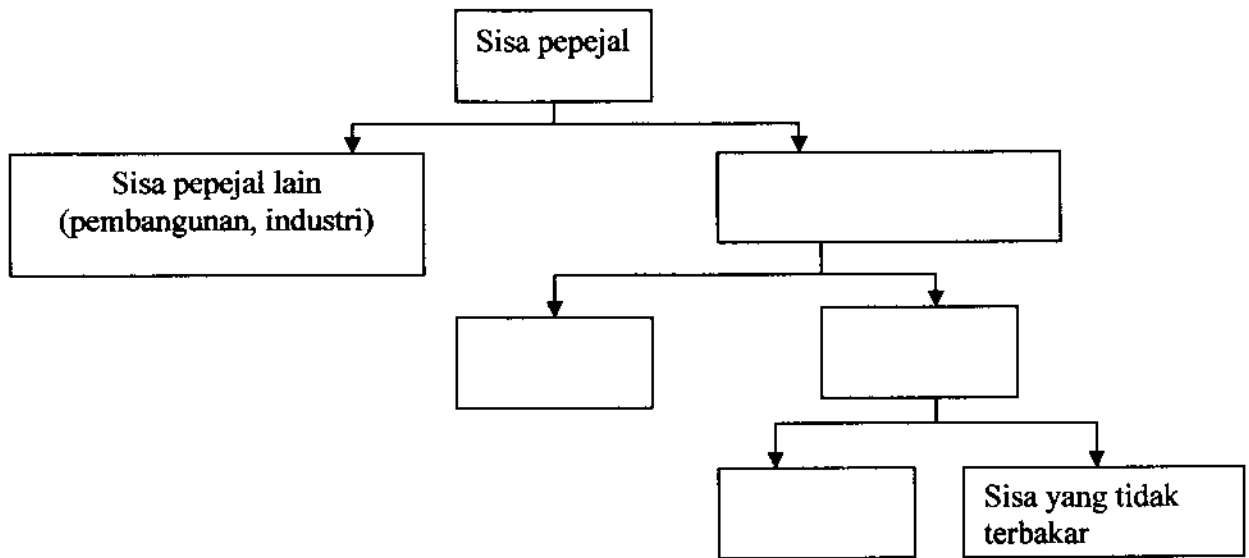


3,6,10,15 = number of residences along each block ∇ To disposal site

*Note : Please attached this figure together with your answer booklet.

FIGURE Q2

S1 (a) Lengkapkan carta alir dan definisikan setiap istilah yang telah dilengkapkan.



(4 markah)

(b) Jelaskan dengan ringkas melalui pemahaman anda tentang sistem Pengurusan Sisa Pepejal Bersepadu.

(6 markah)

(c) Berdasarkan kepada konsep pengurusan sisa pepejal, bincangkan secara terperinci tentang bagaimana pengurangan sisa dapat dilaksanakan di Malaysia.

(7 markah)

(d) Bincangkan bagaimana identifikasi ciri-ciri fizikal, kimia dan biologi sesuatu sisa itu boleh memanfaatkan sistem pengurusan sisa pepejal.

(8 markah)

S2 (a) Sebuah bandar yang mempunyai populasi sebanyak 100,000 menjana sisa pepejal perbandaran sebanyak 0.8 kg/seorang dalam sehari. Dengan anggapan bahawa:

Saiz tapak pelupusan : 30 hektar

Purata kedalaman : 20 m

Isipadu sisa : 347.8 m³/hari

Nisbah sisa pepejal:bahan penutup : 5:1

Tentukan

- (i) Ketumpatan sisa pepejal yang terjana sehari
- (ii) Isipadu tapak pelupusan sampah
- (iii) Jumlah sisa pepejal bersama bahan penutup
- (iv) Jangka hayat tapak pelupusan

(5 markah)

- (b) Dengan bantuan gambarajah, jelaskan sistem pengutipan di dalam pengurusan sisa pepejal seperti yang berikut dan pilih sistem yang terbaik diantaranya dengan memberikan alasan yang kukuh

- (i) *Hauled container system (HCS)-conventional*
- (ii) *Hauled container system (HCS)-exchange container mode*
- (iii) *Stationary container system (SCS)*

(10 markah)

- (c) Dengan menggunakan informasi yang diberikan dan rangka laluan pada **Rajah S2**. Dengan anggapan bahawa:

Isi rumah per penduduk = 5

Kadar janaan sisa pepejal = 1.5 kg/orang.hari

Bilangan kutipan setiap minggu = 6

Bilangan pekerja pungutan = dua orang

Ketumpatan isipadu sisa pepejal di dalam kenderaan pungutan = 108 kg/m³

Tentukan

- (i) Jumlah penduduk yang akan dikutip sampahnya
- (ii) Ketumpatan densiti sisa pepejal yang akan dikutip sampahnya setiap minggu
- (iii) Kapasiti kenderaan pungutan
- (iv) Purata jumlah penduduk yang akan dikutip sampahnya pada setiap hari
- (v) Dengan anggapan bahawa di bahagian kanan taman perumahan tersebut adalah kawasan bukit dan ada pusingan U di setiap laluan, lakarkan rangka laluan untuk kawasan perumahan tersebut di dalam **Rajah S2**.

(10 markah)

- S3** (a) Senaraikan **EMPAT (4)** faktor yang perlu di ambil kira untuk menempatkan tapak pelupusan sisa pepejal.

(4 markah)

- (b) Terangkan dengan ringkas **TIGA (3)** jenis tapak pelupusan dan pilih kaedah yang paling baik dengan alasan.

(4 markah)

- (c) Kirakan *destruction of removal efficiency (DRE)* untuk sisa yang dinyatakan

dalam **Jadual S3** dan tentukan sama ada peratusan pemusnahannya menepati Piawaian Penunuan iaitu *RCRA (Resource Conservation and Recovery Act)*.

Jadual S3 : Jenis dan berat sisa

Jenis sisa	Berat masuk (g/min)	Berat keluar (g/min)
<i>Trichloroethylene</i>	2952	0.0918
<i>1,1,1 Trichloroethane</i>	2678	0.190
<i>Toulene</i>	1733.8	3.544

(4 markah)

- (d) Lakar dan terangkan **LIMA (5)** fasa penjanaan gas di tapak pelupusan sisa pepejal.

(5 markah)

- (e) Analisa dan cadangkan kaedah pelupusan yang terbaik di antara tapak pelupusan, insinerator dan kompos. Pertimbangkan tentang peluang kejayaan dan kegagalan kaedah pelupusan yang dicadangkan itu di Malaysia.

(8 markah)

- S4** (a) Takifkan sisa berbahaya.

(5 markah)

- (b) Takrifkan *cradle to grave* dan *manifest system*.

(4 markah)

- (c) Terangkan **EMPAT (4)** teknik pengurusan sisa berbahaya.

(8 markah)

- (d) Terangkan **EMPAT (4)** ciri-ciri pelbagai jenis sisa berbahaya,

(8 markah)

- S5** (a) Takrifkan audit persekitaran.

(5 markah)

- (b) Terangkan kenapa risiko gempa bumi amat penting semasa pemilihan tapak kambus tanah.

(5 markah)

- (c) Terangkan perbezaan di antara sistem tusukan telaga dalam dan olahan tanah.

(5 markah)

- (d) Senaraikan **LIMA (5)** syarat yang ditetapkan oleh Agensi Pencegahan Alam Sekitar (EPA) untuk tapak kabus tanah sisa berbahaya dan lakarkan tapak kabus tanah yang memenuhi syarat tersebut.

(10 markah)

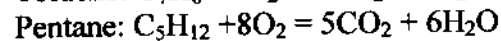
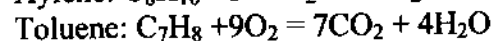
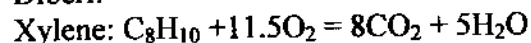
- S6** Campuran sisa yang terdiri dari 44% xylene, 32% toluene, 22% *n*-pentane, dan 2% air di dalam **Jadual S6** akan dibakar di dalam insinerator pancutan cecair pada kadar 600 kg/h. Terdapat 25% lebihan udara di dalam kebuk pembakaran. Ciri-ciri sisa adalah seperti berikut:

Jadual S6 : Campuran sisa

Kompoun	Formula Kimia	Berat Molekul (MW)	Kandungan Haba (kJ/kg)
Xylene	$C_6H_4(CH_3)_2$	106.16	42,948
Toluene	$C_6H_5CH_3$	92.13	42,527
Pentane	C_5H_{12}	72.14	49,142
Air	H_2O	18.01	0

- (a) Kira jumlah haba yang dibebaskan di dalam insinerator. (5 markah)
- (b) Kira peratus secara isipadu bagi setiap komponen di dalam udara mengalir.

Diberi:

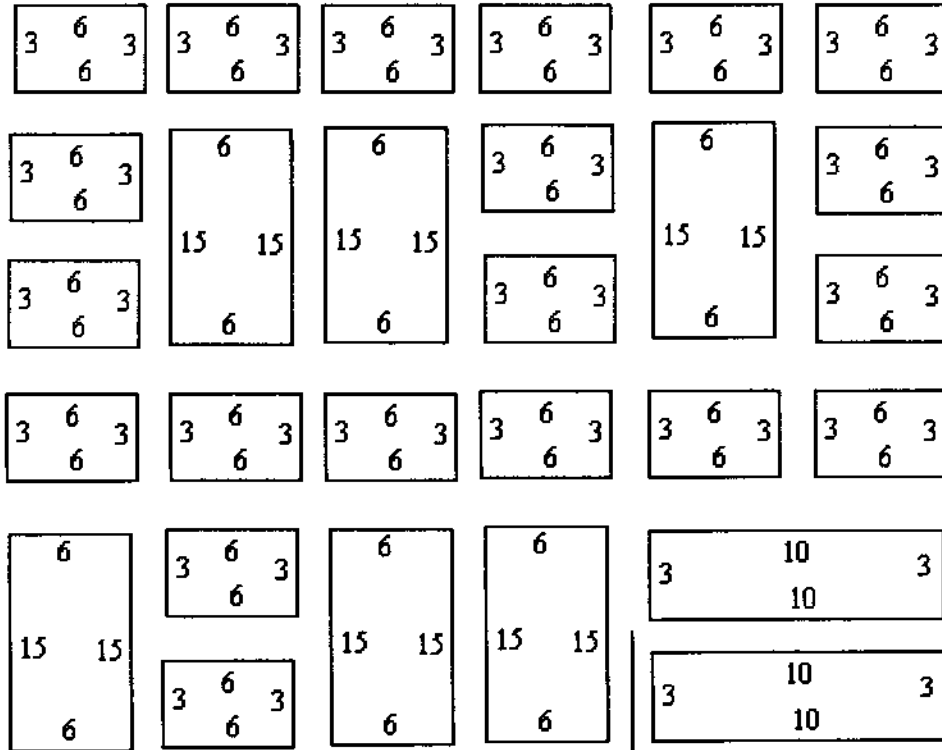
Molecular Weight: $O_2 = 32$; $CO_2 = 44$ and $H_2O = 18$ Udara is 80% N dan 20% O_2

(20 markah)

-SOALAN TAMAT-

PEPERIKSAAN AKHIR

SEMESTER / SESI : SEM II / 2012/2013 PROGRAM : 4 BFA
 NAMA KURSUS : PENGURUSAN SISA PEPEJAL KOD KURSUS : BFA40303/BFA4033
 DAN SISA BERBAHAYA



3,6,10,15=jumlah kediaman di setiap blok ▽ Ke tapak pelupusan sampah

*Nota : Sila lampirkan rajah ini bersama dengan buku jawapan anda.

RAJAH S2