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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2010/2011**

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

**COURSE CODE : BFA 4033**

**PROGRAMME : 4 BFF**

**EXAMINATION DATE : APRIL / MAY 2011**

**DURATION : 3 HOURS**

**INSTRUCTIONS : ANSWER FIVE (5) QUESTIONS**

**THIS PAPER CONSISTS OF TEN (10) PAGES**

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**Q1** (a) Define municipal solid waste (MSW) and Integrated Solid Waste Management (ISWM) (4 marks)

(b) According to **Table Q1**, estimate :-

- (i) Moisture content based on 100 kg solid waste sample
- (ii) Density based on 1000 kg sample of waste sample.

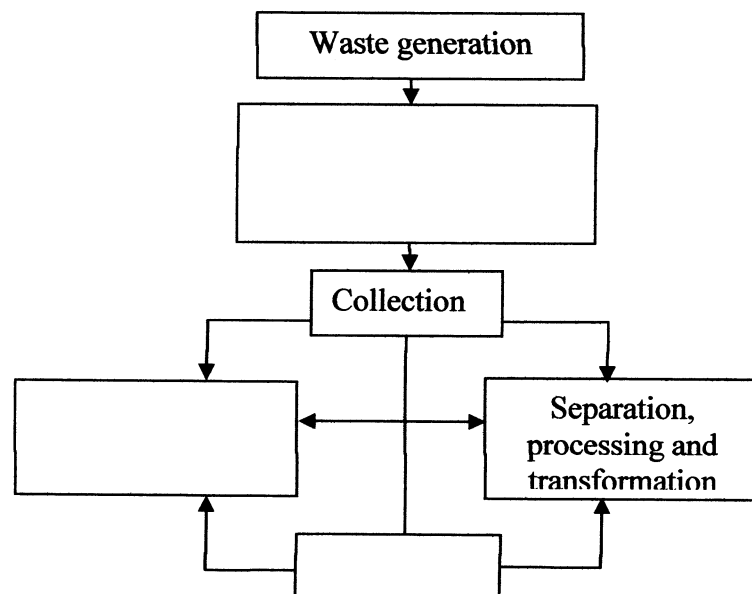
**Table Q1: Typical composition of solid waste**

Component	Percent by mass	Moisture content (%)	Typical density (kg/m <sup>3</sup> )
Food waste	15	70	290
Paper	45	6	85
Cardboard	10	5	50
Plastics	10	2	65
Garden trimmings	10	60	105
Wood	5	20	240
Tin cans	5	3	90

(6 marks)

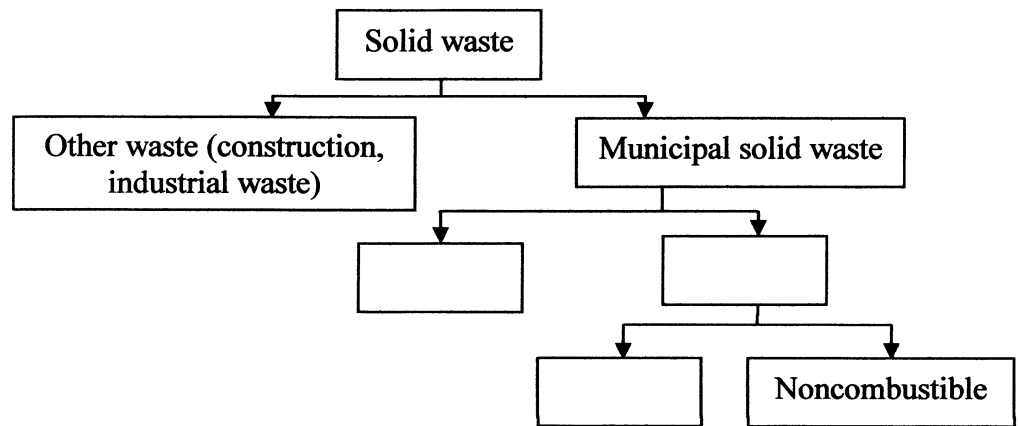
(c) Complete the Integrated Solid Waste Management System (ISWM) flow chart below and :-

- (i) Briefly explain the importance of municipal solid waste separation in ISWM
- (ii) Propose the action that could be taken to promote the waste reduction.



(10 marks)

**Q2** (a) Complete the flow chart and define the terms for the completed item.



(6 marks)

(b) A town of 2,000 houses generates 0.95 kg/person.day of municipal solid waste. By assuming that 1 house occupied with 10 residents, how much municipal solid waste will be generated in :-

- (i) A day
- (ii) A week.

(4 marks)

(c) Show **SIX (6)** steps in the hierarchy of Integrated Solid Waste Management (ISWM) from the least to the most favoured option and discuss with respect to source reduction, recycling and waste transformation.

(10 marks)

- Q3** (a) 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)
- (b) Determine the average number of residents from which wastes are to be collected each day by using the information given and layout in **Figure Q3**. Assume:-
- Occupants per resident = 5  
 Solid waste generation rate = 1.5 kg/person.d  
 Collection vehicle capacity = 20/m<sup>3</sup>  
 Collection crew number = two person  
 Compacted density of solid waste in collection vehicle = 325kg/m<sup>3</sup>
- (6 marks)
- (c) By assuming there is no U-turn in each street (**Figure Q3**), show the route collection outline in that residential area.
- (4 marks)
- Q4** (a) Differentiate between Excavated trench and Area method.
- (4 marks)
- (b) With the aid of a diagram, discuss the major difference between conventional landfill and sanitary landfill.
- (8 marks)
- (c) A town of 100,000 population generates 0.8 kg/person.day of municipal solid waste. Determine the life span of the landfill site by assuming:-
- |                                  |                             |
|----------------------------------|-----------------------------|
| Landfill size                    | : 30 hectares               |
| Average depth                    | : 20 m                      |
| Volume of waste                  | : 347.8 m <sup>3</sup> /day |
| Ratio solid waste:cover material | : 5:1                       |
- (8 marks)

- Q5**
- (a) Identify **FOUR (4)** characteristics of hazardous waste and briefly explain each. (4 marks)
  - (b) Discuss the effectiveness of treatment technologies use in hazardous waste management. (6 marks)
  - (c) A consultant who has sufficient experience in designing solid waste landfill has decided to use the same design to landfill that contains hazardous waste. Propose on the chances of success or failure of the particular design. (10 marks)
- Q6**
- (a) Differentiate between passive and active remediation systems and give examples for each remediation system. (4 marks)
  - (b) Explain the advantages and disadvantages of incineration method. (6 marks)
  - (c) With the aid of a flow chart, explain step by step the groundwater remediation procedure outlined by Environmental Protection Agency (EPA). (10 marks)

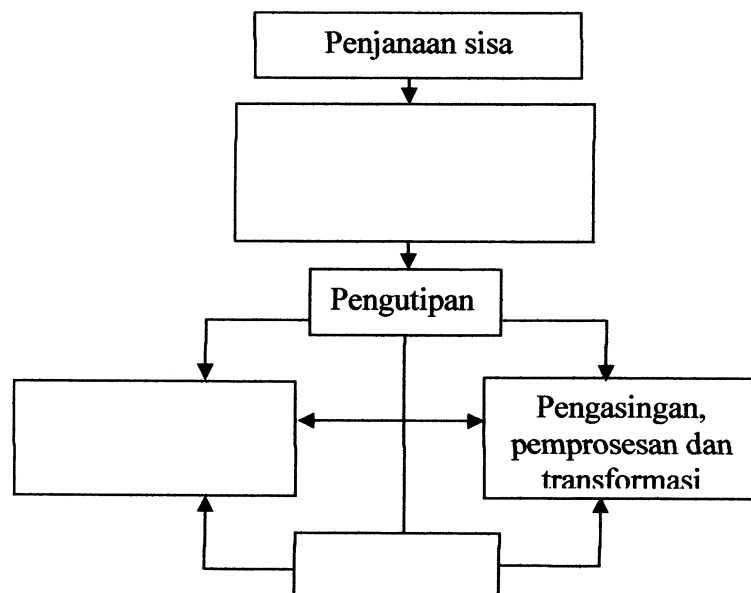
- S1** (a) Definiskan Sisa Pepejal Perbandaran dan Pengurusan Sisa Pepejal Bersepadu. (4 markah)
- (b) Berdasarkan **Jadual S1**, anggarkan :-
- (i) Kandungan kelembapan berdasarkan 100 kg sampel sisa pepejal
  - (ii) Densiti berdasarkan 1000kg sampel sisa pepejal.

**Jadual S1: Tipikal komposisi sisa pepejal**

Komponen	Peratus dalam berat	Kandungan kelembapan (%)	Tipikal densiti (kg/m <sup>3</sup> )
Sisa makanan	15	70	290
Kertas	45	6	85
Kadbod	10	5	50
Plastik	10	2	65
Sisa tanaman	10	60	105
Kayu	5	20	240
Tin	5	3	90

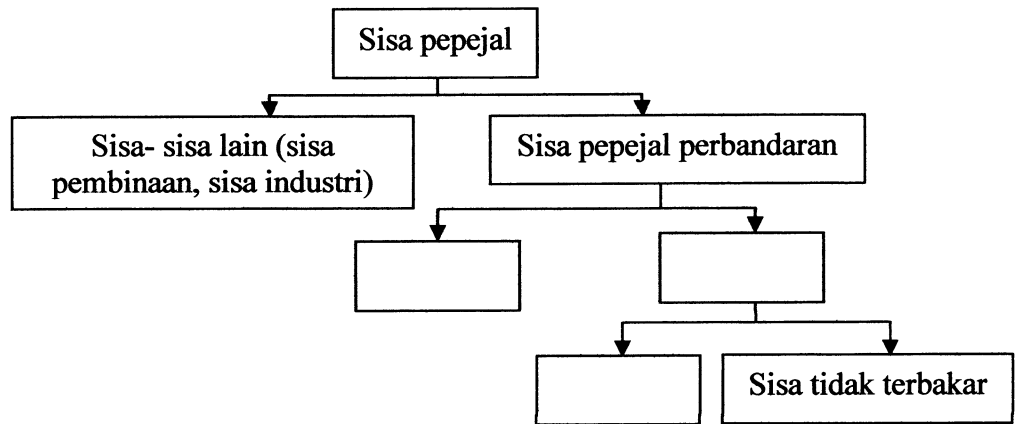
(6 markah)

- (c) Lengkapkan carta alir Pengurusan Sisa Pepejal Bersepadu berikut dan :-
- (i) Jelaskan dengan ringkas kepentingan pengasingan sisa pepejal perbandaran di dalam Pengurusan Sisa Pepejal Bersepadu
  - (ii) Cadangkan tindakan yang boleh diambil untuk mengurangkan penjanaaan sisa pepejal.



(10 markah)

- S2 (a) Lengkapkan carta alir berikut dan berikan definisi kepada terma yang telah dilengkapkan.



(6 markah)

- (b) Sebuah bandar yang mempunyai 2,000 buah rumah menghasilkan sisa pepejal perbandaran sebanyak 0.95 kg/seorang dalam sehari. Beranggarkan bahawa 1 rumah mempunyai 10 orang, berapakah jumlah sisa pepejal yang dihasilkan di bandar itu dalam :-

- (i) Sehari  
(ii) Seminggu.

(4 markah)

- (c) Tunjukkan ENAM (6) langkah di dalam hirarki Pengurusan Sisa Pepejal Bersepadu daripada turutan yang paling tidak digemari kepada yang paling digemari dan bincangkan dari aspek pengurangan sisa, kitar semula dan transformasi sisa pepejal.

(10 markah)