INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** of the questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1 (a) Boiler flue gas is the exhaust gas that comes out of a boiler's flue, or chimney and consist of combustion wastes mixture. Identify **THREE (3**) components of boiler flue gas.

*Gas serombong dandang ialah gas ekzos yang keluar dari serombong dandang, atau cerobong, yang terdiri daripada campuran sisa pembakaran. Kenal pasti **TIGA (3)** komponen gas serombong dandang tersebut.*

[3 marks]

[*3 markah*]

CLO2

(b) In manufacturing and processing industries, cyclone separators are used for the removal of particulate matter. Explain the work principle of a cyclone in controlling particles from a polluted processing airstream.

Dalam industri pembuatan dan pemprosesan, pemisah siklon digunakan untuk penyingkiran zarah. Terangkan prinsip kerja siklon untuk mengawal zarah daripada aliran udara pemprosesan tercemar.

[6 marks]

[*6 markah*]

(c) Gravitational settling is an important role in both natural and industrial to solve dust pollution such as in factories and construction sites. This settling occurs when particulate matters settles on a surface due to the influence of gravity.
Pengenapan graviti penting dalam aplikasi semula jadi dan industri bagi menyelesaian masalah pencemaran debu seperti di kilang atau tapak pembinaan. Pengenapan zarah berlaku di atas permukaan dengan pengaruh graviti.

Table 1(c): The gravitational settling process for airborne particulate matters of different physical properties. Note: sg is specific gravity
Jadual 1(c) : Proses pengenapan graviti untuk zarah bawaan udara yang mempunyai sifat fizikal yang berbeza. Note : sg adalah spesifik graviti.

Particle Size (mm)	Particle Size (microns)	Order of Size	Time Required to Settle (sg = 2.65)	Time Required to Settle (sg = 1.2)
10	10000	Gravel	0.4 sec	1.2 sec
1	1000	Coarse Sand	3.0 sec	9 sec
0.1	100	Fine Sand	34 sec	5 min
0.01	10	Silt	56 min	8 hours
0.001	1	Bacteria	4 days	32 days
0.0001	0.1	Colloidal	1 year	9 years
0.00001	0.01	Colloidal	> 50 years	> 50 years
0.000001	0.001	Colloidal	> 50 years	>50 years

CLO1

(i) Examine **TWO (2**) properties of air pollutants particles that can affect the rate of settling on any surface.
*Periksa **DUA (2)** ciri partikel pencemar udara yang memberi kesan terhadap kadar kejatuhan pada permukaan.*

[6 marks]
[*6 markah*]

CLO2

(ii) Write **FOUR (4)** action that can be taken to minimize the impact of airborne particles while enhancing their settling.
*Tuliskan **EMPAT (4)** langkah boleh diambil untuk meminimumkan kesan zarah bawaan udara disamping meningkatkan pengendapan.*

[10 marks]
[*10 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) State **FOUR (4)** sources of water pollution.

*Nyatakan **EMPAT (4)** sumber-sumber pencemaran air.*

[4 marks]

[*4 markah*]

CLO1 (b) Explain the main objectives of the preliminary, primary, secondary and tertiary treatment in a wastewater treatment system.

Jelaskan objektif utama rawatan awal, primer, sekunder dan tertiari untuk sistem rawatan air sisa.

[7 marks]

[*7 markah*]

(c) In conventional wastewater treatment, primary wastewater treatment involves the removal of solids by sedimentation or floatation. The secondary treatment phase involves the microbial decomposition and finally an additional tertiary treatment is applied before water is reused, recycled, or discharged into the environment.

Dalam rawatan air sisa konvensional, rawatan air sisa primer melibatkan penyingkiran pepejal melalui pengenapan atau pengapungan. Fasa rawatan sekunder melibatkan penguraian mikrob dan akhirnya rawatan tertier tambahan sebelum air digunakan semula, dikitar semula atau dibuang ke alam sekitar.

CLO2 (i) Tabulate the advantages and disadvantages of the aerobic digestion process.

Jadualkan kebaikan dan keburukan proses pencernaan aerobik.

[4 marks]

[*4 markah*]

CLO2

(ii) Provide **FOUR (4)** innovative ideas that could be taken to enhance wastewater treatment in the future.

*Sediakan **EMPAT (4)** idea inovasi yang boleh diambil bagi meningkatkan rawatan air sisa pada masa hadapan.*

[10 marks]

[*10 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Describe specific weight and permeability properties of municipal solid wastes.
Huraikan sifat berat spesifik dan ketelapan bagi sisa pepejal perbandaran.

[4 marks]

[*4 markah*]

CLO1 (b) Modern landfills are located, designed, operated and monitored to ensure compliance with federal regulations and protect the environment from contaminants. Discuss **TWO (2)** byproduct from reactions that occurs inside a landfill.
*Tapak pelupusan sampah moden direka letak dan bentuk, dikendalikan dan dipantau untuk memastikan pematuhan dengan peraturan berkuatkuasa. serta melindungi alam sekitar daripada bahan cemar. Bincangkan **TWO (2)** bahan sampingan daripada tindakbalas yang berlaku di dalam tapak pelupusan sampah.*

[7 marks]

[*7 markah*]

(c) Table 3(c) shows a typical composition of domestic wastes for Malaysia, China and United Kingdom. The data are used to design landfill and incineration.
Jadual 3(c) menunjukkan komposisi tipikal sisa domestik untuk Malaysia, China dan United. Data ini digunakan untuk merekabentuk tapak pelupusan sampah dan kebukpembakaran.

Table 3(c): Typical composition of domestic waste for Malaysia, China and United Kingdom

Jadual 3(c) : Komposisi tipikal sisa domestic bagi Malaysia, China dan United Kingdom

Composition/*Komposisi* (%) / %	Malaysia	China	United Kingdom
Food Wastes/ *Sisa makanan*	44	36	25
Paper, cardboard / *Kertas*	10	2	29
Plastics / *plastik*	13	1.5	7
Glass / *kaca*	3.3	1	10
Metals/ *Logam*	2.5	1	8
Clothing/textiles / *Pakaian*	3.1	1.5	3
Ashes, dust / *Abu/ habuk*	5.6	57	14
Unclassified wastes / *Sisa bercampur*	17.7	-	4

CLO2

(i) Write the disposal methods for highest solid waste generation of three countries.

Tuliskan kaedah pelupusan penjanaan sisa pepejal tertinggi bagi ketiga-tiga negara.

[6 marks]

[*6 markah*]

CLO2

(ii) Show a modern landfill technology by sketching a cross-sectional diagram with complete labels.

Tunjukkan teknologi tapak pelupusan moden dengan melakar gambar rajah keratan rentas lengkap dengan label.

[8 marks]

[*8 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Hazardous wastes are classified based on their biological, chemical, and physical properties. Describe **FOUR (4)** characteristics of reactivity.

*Sisa berbahaya dikelaskan berdasarkan sifat biologi, kimia dan fizikalnya. Huraikan **EMPAT (4)** ciri kereaktifan.*

[4 marks]

[*4 markah*]

CLO1 (b) In Malaysia, hazardous waste or scheduled waste and is governed by the Environmental Quality (Scheduled Wastes) Regulations 2005 under the Environmental Quality Act 1974, which require to manage the scheduled waste according to these regulations. Discuss **THREE (3)** rules that must be followed under this law.

*Di Malaysia, sisa berbahaya atau sisa terjadual dan dikawal oleh Peraturan-Peraturan Kualiti Alam Sekeliling (Buangan Terjadual) 2005 di bawah Akta Kualiti Alam Sekeliling 1974, yang mana tanggungjawab menguruskan sisa terjadual mengikut peraturan ini. Bincangkan **TIGA (3)** peraturan yang mesti dipatuhi di bawah undang-undang ini.*

[7 marks]

[7 *markah*]

CLO2 (c) The Hazardous waste can enter the human body through several mechanisms which are known as exposure routes.

Sisa berbahaya boleh memasuki tubuh manusia melalui beberapa mekanisme dimana ia dikenali sebagai laluan pendedahan.

(i) Write **THREE (3)** ways of hazardous waste enter the human and animal bodies.

*Tuliskan **TIGA (3)** cara bahan buangan berbahaya boleh memasuki badan manusia dan haiwan.*

[6 marks]

[*6 markah*]

(ii) Conduct **FOUR (4)** prevention and mitigation strategies to reduce contamination level of hazardous waste exposure based on Hierarchy of Hazardous Control.

*Kendalikan **EMPAT (4)** strategi pencegahan dan mitigasi untuk mengurangkan aras pencemaran daripada sisa berbahaya yang terdedah berdasarkan Hierarchy of Hazardous Control.*

[8 marks]

[*8 markah*]

SOALAN TAMAT