

SULIT



**KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI**

**BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI**

JABATAN TEKNOLOGI KIMIA DAN MAKANAN

PEPERIKSAAN AKHIR

SESI I : 2024/2025

DMT40133: INSTRUMENTAL ANALYSIS OF FOOD

TARIKH : 04 DISEMBER 2024

MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas soalan ini mengandungi **SEMBILAN (9)** halaman bercetak.

Subjektif (4 soalan)

Dokumen sokongan yang disertakan : Kertas Graf

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

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INSTRUCTION:

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

ARAHAN:

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

CLO 1

QUESTION 1**SOALAN 1**

- (a) State **FIVE (5)** techniques of analytical chemistry.

Nyatakan LIMA (5) teknik dalam kimia analitikal.

[5marks]

[5 markah]

CLO 1

- (b) Explain **THREE (3)** areas of analysis in analytical chemistry.

Terangkan TIGA (3) bidang analisis dalam kimia analitikal.

[6 marks]

[6 markah]

CLO 1

- (c) A laboratory technician wants to carry out routine tests on the equipment used in the laboratory. The technician wants to check the accuracy and precision of the 4 types of scales used using a 0.2500 g load. A total of 5 readings are repeated for each scale. Table 1 records the scale readings.

Seorang juruteknik makmal ingin menjalankan pengujian rutin ke atas peralatan yang digunakan didalam makmal. Juruteknik ingin memeriksa ketepatan dan kejituan 4 jenis penimbang yang digunakan dengan menggunakan 0.2500 g beban. Sebanyak 5 bacaan diulang bagi setiap penimbang. Jadual 1 merekodkan bacaan penimbang tersebut.

Table 1(c) /Jadual 1(c)

Reading of Scale 1 <i>Bacaan penimbang 1</i>	Reading of Scale 2 <i>Bacaan penimbang 2</i>	Reading of Scale 3 <i>Bacaan penimbang 3</i>	Reading of Scale 4 <i>Bacaan penimbang 4</i>
0.2500	0.2550	0.2400	0.2700
0.2501	0.2510	0.2601	0.2701
0.2500	0.2560	0.2600	0.2705
0.2501	0.2499	0.2501	0.2701
0.2502	0.2499	0.2402	0.2701

- i. Based on Table 1 (c), predict precision and accuracy for weighing balance 1, 2, 3 and 4 with reason.

Berdasarkan Jadual 1 (c), jangkakan kejituan dan ketepatan untuk penimbang 1, 2, 3 dan 4 beserta alasan.

[8 marks]

[8 markah]

- ii. The laboratory technician found that scales 3 and 4 were less accurate compared to the amount of load weight. Find **THREE (3)** ways that can increase the accuracy for balance 3 and 4 with example for each way stated.

*Juruteknik makmal mendapati skala 3 dan 4 adalah kurang tepat berbanding dengan jumlah berat beban. Tentukan **TIGA (3)** cara yang boleh meningkatkan ketepatan bagi penimbang 3 dan 4 beserta contoh bagi setiap cara yang dinyatakan.*

[6 marks]

[6 markah]

CLO 1

QUESTION 2

SOALAN 2

- CLO 1 (a) List **THREE (3)** types of bending vibration in a molecule when the molecule absorb the infrared light.
Senaraikan TIGA (3) jenis getaran lentur dalam molekul apabila molekul menyerap cahaya inframerah.
- [3 marks]
[3 markah]
- CLO 1 (b) Explain **TWO (2)** functions of Atomic Absorption Spectrometry in the food industry with example for each function.
Terangkan DUA (2) fungsi Spektrometer Penyerapan Atom dalam industri makanan beserta contoh bagi setiap fungsi yang dinyatakan.
- [6 marks]
[6 markah]
- (c) When sulfur dioxide (SO_2) is irradiated with infrared light with a total energy is 5.432×10^{-28} J, it absorbs a specific wavelength of infrared radiation corresponding to its vibrational modes.
(Given: Planck's constant = 6.626×10^{-34} J.s, The speed of light = 3.0×10^8 m/s)
*Apabila sulfur dioksida (SO_2) disinari dengan cahaya inframerah dengan jumlah tenaga sebanyak 5.432×10^{-28} J, ia menyerap panjang gelombang tertentu sinaran inframerah sepadan dengan mod getarannya.
(Diberi: pemalar Planck's = 6.626×10^{-34} J.s, Kelajuan cahaya = 3.0×10^8 m/s)*
- CLO 1 i. Draw **TWO (2)** situations of stretching vibration of sulphur dioxide compound when it is irradiated with infrared light.
Lukis DUA (2) situasi regangan getaran sebatian sulfur dioksida apabila ia disinari dengan cahaya inframerah.
- [6 marks]
[6 markah]

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- CLO 1 ii. Calculate the wavenumber and wavelength of infrared radiation
Kirakan nombor gelombang dan panjang gelombang sinaran inframerah.
- [7 marks]
[7 markah]

- CLO 1 iii. Calculate the frequency of infrared radiation
Kirakan frekuensi bagi radiasi inframerah tersebut.
- [3 marks]
[3 markah]

QUESTION 3**SOALAN 3**

- CLO 1 (a) Identify the characteristic of 'stationary phase' in chromatography.
Kenalpasti ciri-ciri bagi 'fasa pegun' dalam kromatografi.
- [3 marks]
[3 markah]

- CLO 1 (b) Explain any **THREE (3)** components in High Performance Liquid Chromatography (HPLC) with their functions.
*Jelaskan mana-mana **TIGA (3)** komponen Kromatografi Cecair Prestasi Tinggi (HPLC) berserta fungsinya.*
- [6 marks]
[6 markah]

- (c) A Food Technology lab assistant is required to analyse the amount of fructose that is present in watermelon peel juice by using High-Performance Liquid Chromatography (HPLC). He needs to prepare 500 ml of fructose stock solution of 200 ppm.

Pembantu makmal Teknologi Makanan perlu menjalankan analisis menentukan kuantiti fruktosa yang ada di dalam jus kulit tembikai menggunakan Kromatografi Cecair Prestasi Tinggi (HPLC). Dia perlu menyediakan 500 ml larutan stok fruktosa dengan kepekatan 200ppm.

CLO 1

- i) Calculate the volume needed to prepare a 500 ml fructose stock solution and the volumes required to prepare 60 ppm and 120 ppm standard solution, each with a volume of 15 ml.

Kira jumlah isipadu yang diperlukan untuk menyediakan larutan stok fruktosa 500ml dan isipadu yang diperlukan bagi menyediakan larutan piawai 60 ppm dan 120 ppm, setiap dengan isipadu sebanyak 15ml.

[6 marks]

[6 markah]

- ii) Draw the calibration curve of the data in Table 3 (c)ii by using graph paper.

Lukiskan keluk kalibrasi menggunakan data dalam Jadual 3 (c)ii dengan menggunakan kertas graf.

Table 3 (c)ii /Jadual 3 (c)ii

Standard solution (ppm) <i>Larutan piawai</i>	Peak area <i>Luas puncak</i>
30	17040
60	36520
90	50100
120	70400
150	85010

[8 marks]

[8 markah]

- CLO 1 iii) From the graph plotted at 3 (c) ii, find the value of the concentration reading of fructose in the sample if the peak area is 44000.
Berdasarkan graf yang diplot di 3 (c) ii, carikan nilai kepekatan bacaan fruktosa dalam sampel jika luas puncak adalah 44000.

[2 marks]

[2 markah]

QUESTION 4**SOALAN 4**

- CLO 1 (a) State **FIVE** types of contaminants that may present in untreated water.
*Senaraikan **LIMA** jenis bahan pencemar yang mungkin ada di dalam air yang tidak dirawat.*

[5marks]

[5 markah]

- CLO 1 (b) pH measurement is one of the important water quality parameters to ensure that the water is safe. Explain **THREE (3)** factors that cause a change in the pH value of water.
*Pengukuran nilai pH adalah parameter penting dalam kualiti air untuk memastikan air adalah selamat digunakan. Terangkan **TIGA (3)** faktor yang menyebabkan perubahan nilai pH air.*

[6 marks]

[6 markah]

- (c) An environmental officer was asked to test the water quality parameters of two different rivers located in a rapidly industrialized area. Both of these rivers are believed to be polluted with the waste products of nearby industries.

Seorang pegawai alam sekitar diminta untuk menguji parameter kualiti air dua buah sungai berbeza yang terletak di kawasan perindustrian yang pesat. Kedua-dua sungai ini dipercayai tercemar dengan hasil buangan industri berdekatan.

CLO 1

- i. From the situation given, find **TWO (2)** water analysis tests that might be performed to know the water quality of the river.

*Daripada situasi yang diberi, carikan **DUA (2)** ujian analisis air yang boleh dilakukan untuk mengetahui kualiti sungai tersebut.*

[2 marks]

[2 markah]

CLO 1

- ii. Table 4(c).i shows the results of the water analysis test for Dissolved Oxygen on the 1st day and the 5th day for the river's water. Calculate the value of Biochemical Oxygen Demand (BOD) for both samples of river water. *Jadual 4(c).i menunjukkan keputusan ujian analisis air untuk Oksigen Terlarut pada hari pertama dan hari ke lima untuk kedua-dua air sungai tersebut. Kirakan nilai keperluan oksigen biokimia (BOD) untuk kedua-dua sampel air sungai.*

Table 4(c)i /Jadual 4(c)i

Sources of water <i>Sumber air</i>	Dissolved Oxygen (mg/L) Day 1	Dissolved Oxygen (mg/L) Day 5
River water A <i>Air Sungai A</i>	10.3	7.5
River Water B <i>Air Sungai B</i>	10.6	4.8

[6 marks]

[6 markah]

CLO 1

- iii. From the BOD results calculated in question 4(c)ii, predict **TWO (2)** activities that can be carried out in the lakes with the description of the class of water quality index by referring to Table 4(c)ii and 4(c)iii.

*Berdasarkan keputusan ujian BOD yang telah dikira di soalan 4(c)ii, jangkakan **DUA (2)** aktiviti yang boleh dijalankan di tasik-tasik tersebut. Jawapan anda perlu disertakan dengan penerangan berkaitan kelas indeks kualiti air merujuk Jadual 4(c)ii dan 4(c)iii.*

Table 4(c)ii/Jadual 4(c)ii

parameter	Class				
	Class I	Class II	Class III	Class IV	Class V
BOD	<0.1	1-3	3-6	6-12	>12

Table 4(c)iii/ Jadual 4(c)iii

Quality class	Description and treatment process
Class I	Conservation of natural environment. Water supply I – Practically no treatment necessary (except by disinfection or boiling only). Fishery I- Very sensitive aquatic species.
Class IIA	Water supply II – Conventional treatment required. Fishery II – Sensitive aquatic species
Class IIB	Recreational use with body contact
Class III	Water supply III – Extensive treatment required. Fishery III – Common of economic value and tolerant species; livestock drinking
Class IV	Irrigation
Class V	None of the above

[6 marks]

[6 markah]

SOALAN TAMAT