SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

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

JABATAN ASASI TEKNOLOGI KEJURUTERAAN

PEPERIKSAAN AKHIR

SESI I : 2024/2025

FB10083: CHEMISTRY 1

TARIKH : 20 DISEMBER 2024
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **TIGA BELAS (13)** halaman bercetak.

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Tiada

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:

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

ARAHAN:

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

QUESTION 1

SOALAN 1

CO_3^{2-}

Figure 1(a)

Rajah 1(a)

CLO1 (a) i) Figure 1(a) displays the atomic symbol for CO_3^{2-} ion. Identify the number of protons and electrons in CO_3^{2-} ion.

[Proton number C = 6, O = 8]

Rajah 1(a) menunjukkan simbol atom bagi ion CO_3^{2-}. Tentukan bilangan proton dan elektron dalam ion CO_3^{2-}.

[Nombor proton C = 6, O = 8]

[2 marks]

[2 *markah*]

ii) Explain how hydrogen atoms participate in the formation of diatomic molecules and their role in forming a polyatomic ion (H_3O^+), specifically when combined with oxygen atoms.

[Proton number H = 1, O = 8]

Terangkan bagaimana atom hidrogen terlibat dalam pembentukan molekul diatomik dan peranan mereka dalam membentuk ion poliatomik (H_3O^+) apabila bergabung dengan atom oksigen.

[Nombor proton H = 1, O = 8]

[4 marks]

[*4 markah*]

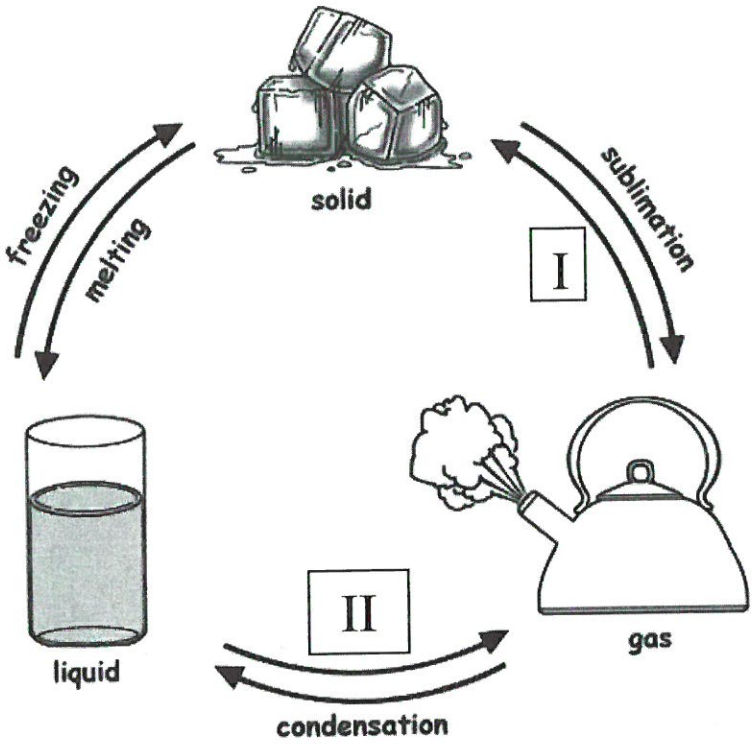


Figure 1(b)

Rajah 1(b)

CLO1 (b) i) Figure 1(b) illustrates the changes in the phases of matter. Name the processes involved for phase I and phase II based on Figure 1(b).

Rajah 1(b) menunjukkan perubahan fasa jirim. Namakan proses yang terlibat untuk fasa I dan fasa II berdasarkan Rajah 1(b).

[2 marks]

[*2 markah*]

ii) Elaborate the change in the condensation process on how the arrangement and the interactions of particles shift by providing a diagram to illustrate these changes.

Huraikan perubahan dalam proses pemeluwapan mengenai bagaimana susunan dan interaksi zarah berubah, dan sertakan rajah untuk menggambarkan perubahan ini.

[4 marks]

[*4 markah*]

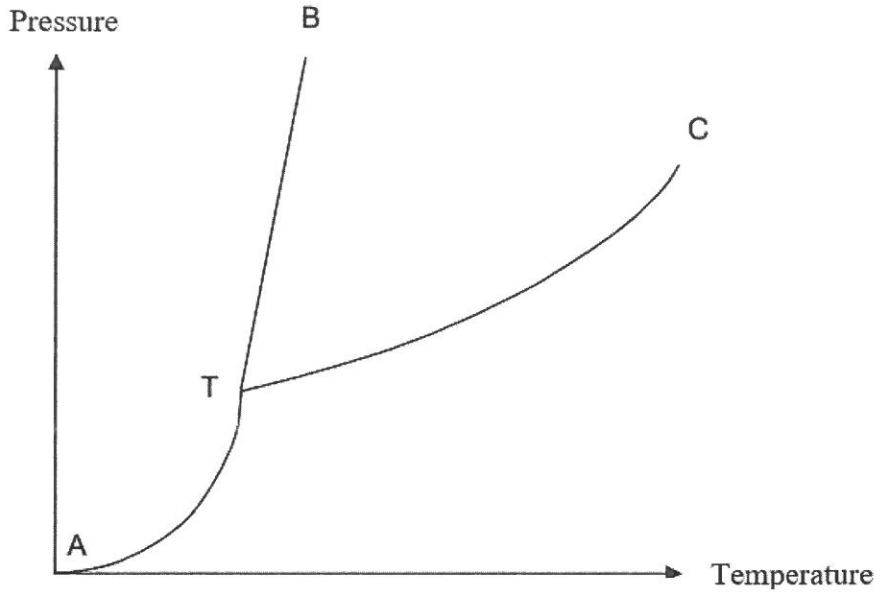


Figure 1c (i)

Rajah 1c (i)

CLO1 (c) i) Figure 1c (i) illustrates the general form of a phase diagram for a substance. List the states that are represented by the regions enclosed by curves ATB and BTC.

Rajah 1c (i) menggambarkan bentuk umum rajah fasa bagi suatu bahan. Nyatakan keadaan yang diwakili oleh kawasan yang dikelilingi oleh lengkung ATB dan BTC.

[2 marks]

[*2 markah*]

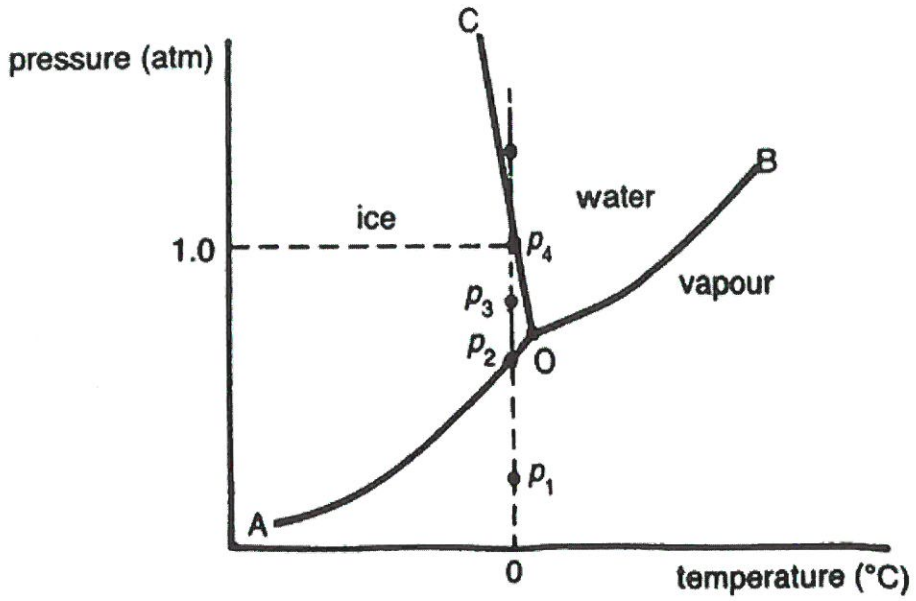


Figure 1 c(ii)

Rajah 1 c(ii)

ii) Using the phase diagram of water in Figure 1 c(ii), discuss the behavior of water molecules when the pressure is increased from 0.001 atm (point P_1) to 1.0 atm (point P_4) while maintaining a constant temperature of 0 °C.

Berdasarkan rajah fasa air dalam Rajah 1 c(ii), bincangkan tingkah laku molekul air apabila tekanan dinaikkan dari 0.001 atm (titik P_1) ke 1.0 atm (titik P_4) pada suhu kekal pada 0 °C.

[4 marks]

[*4 markah*]

Table 1(d)

Jadual 1(d)

	Triple Point *Titik Tripel*	Critical Point *Titik kritikal*	Sublimation *Pemejalwapan*
Temperature/^{0}C *Suhu/^0C*	-57	374	-78
Pressure/atm *Tekanan/atm*	5.1	217	1

CLO1 (d) i) Table 1(d) above refers to a phase diagram for carbon dioxide. Based on the table, define the term triple point and critical point.
Jadual 1(d) di atas merujuk kepada rajah fasa untuk karbon dioksida. Berdasarkan jadual tersebut, berikan definisi istilah titik tripel dan titik kritikal.

[3 marks]
[*3 markah*]

ii) Explain in detail the sublimation curve, accompanied by a sketch diagram, as referenced in Table 1(d).
Terangkan secara terperinci lengkung pemejalwapan, disertakan dengan gambar rajah lakaran, seperti yang dirujuk dalam Jadual 1(d).

[4 marks]
[*4 markah*]

QUESTION 2
SOALAN 2

CLO2 (a) i) Convert the following equation into a balanced equation.
Tukarkan persamaan berikut kepada persamaan yang seimbang.

$$NH_3 + O_2 \rightarrow NO + H_2O$$

[2 marks]
[*2 markah*]

ii) Calculate the volume of carbon dioxide (CO_2) produced at room temperature by decomposing 15 grams of calcium carbonate ($CaCO_3$).
(Relative atomic mass C = 12, O = 16, Ca = 40)
Hitungkan isipadu karbon dioksida (CO_2) yang dihasilkan pada suhu bilik daripada penguraian 15 gram kalsium karbonat ($CaCO_3$).
(Jisim atom relatif C = 12, O = 16, Ca = 40)

$$CaCO_3 \rightarrow CaO + CO_2$$

[4 marks]
[*4 markah*]

CLO2 (b) i) Silicon tetrachloride ($SiCl_4$) reacts with water (H_2O) to form orthosilicic acid (H_4SiO_4) and hydrochloric acid (HCl). Express the details into a balanced chemical equation.
Klorida tetrasilikon ($SiCl_4$) bertindak balas dengan air (H_2O) untuk membentuk asid ortosilikik (H_4SiO_4) dan asid hidroklorik (HCl). Nyatakan maklumat ini dalam bentuk persamaan kimia yang seimbang.

[2 marks]
[*2 markah*]

ii) Calculate the relative atomic mass of M when an aqueous solution containing 1606.5g of MNO_3 is added to an excess of aluminum, resulting in the precipitation of 670.95 g of aluminum nitrate.
(Relative atomic mass N = 14, O = 16, Al = 27)
Hitung jisim atom relatif bagi M apabila larutan akueus yang mengandungi 1606.5 g MNO_3 ditambahkan kepada aluminium berlebihan, menghasilkan pemendakan 670.95 g aluminium nitrat.
(Jisim atom relatif N = 14, O = 16, Al = 27)

$$3MNO_3 + Al \rightarrow 3M + Al(NO_3)_3$$

[4 marks]
[*4 markah*]

CLO2 (c) i) Explain the difference between empirical formula and molecular formula.

Terangkan perbezaan antara formula empirikal dan formula molekul.

[2 marks]

[*2 markah*]

ii) An oxide of the type X_2SO_3 contains 38.1% of oxygen and 25.4% sulphur. Calculate the relative atomic mass of X.

(Relative atomic mass O = 16, S = 32)

Satu oksida jenis X_2SO_3 mengandungi 38.1% oksigen dan 25.4% sulfur. Kira jisim atom relatif X.

(Jisim atom relatif O = 16, S = 32)

[4 marks]

[*4 markah*]

CLO2 (d) i) Compound Y has the molecular mass of 116.208 grams. It is composed of 62.02% carbon, 13.88% hydrogen, and 24.10% nitrogen. Express the molecular formula of compound Y.

(Relative atomic mass C = 12, H = 1, N = 14)

Sebatian Y mempunyai jisim molekul 116.208 grams. Ia terdiri daripada 62.02% karbon, 13.88% hidrogen, dan 24.10% nitrogen. Ungkapkan formula molekul sebatian Y.

(Jisim atom relatif C = 12, H = 1, N = 14)

[3 marks]

[*3 markah*]

ii) Compound T with a relative molecular mass of 120 is made up of carbon, hydrogen and nitrogen. The mass composition of compound T are 39.7 % carbon, 13.1 % hydrogen and 47.2 % nitrogen. Derive the empirical formula and the molecular formula of compound T.

[Relative atomic mass: C = 12, H = 1, N = 14]

Sebatian T dengan jisim molekul relatif 120 terdiri daripada karbon, hidrogen, dan nitrogen. Komposisi jisim sebatian T adalah 39.7%

karbon, 13.1% hidrogen, dan 47.2% nitrogen. Terbitkan formula empirik dan formula molekul sebatian T.
[Jisim atom relatif: C = 12, H = 1, N = 14]

[4 marks]
[*4 markah*]

QUESTION 3
SOALAN 3

CLO1 (a) i) State the group, period, block and electronic configuration of calcium atom.
(Proton number Ca = 20)
Nyatakan kumpulan, kala, blok, dan konfigurasi elektronik atom kalsium.
(Nombor proton Ca = 20)

[4 marks]
[*4 markah*]

ii) Explain the trend in increasing atomic radius based on atom aluminium, sodium, argon, and sulphur in terms of period.
(Proton number aluminium = 13, sodium = 11, argon = 18, sulphur = 16)
Terangkan 'trend' peningkatan jejari atom berdasarkan atom aluminium, natrium, argon, dan sulfur dari segi kala.
(Nombor proton: aluminium = 13, natrium = 11, argon = 18, sulfur = 16)

[4 marks]
[*4 markah*]

CLO1 (b) i) Identify the block group of phosphorus, magnesium and calcium atom.
(Proton number phosphorus = 15, magnesium = 12, calcium = 20)
Kenal pasti kumpulan blok bagi atom fosforus, magnesium, dan kalsium.

(Nombor proton fosforus = 15, magnesium = 12, kalsium = 20)

[3 marks]

[*3 markah*]

ii) Explain the trend in increasing electronegativity based on atom lithium, sodium, hydrogen, and potassium in terms of group.
(Proton number lithium = 3, sodium = 11, hydrogen = 1, potassium = 19)
Jelaskan 'trend' peningkatan keelektronegatifan berdasarkan atom litium, natrium, hidrogen, dan kalium dari segi kumpulan.
(Nombor proton: litium = 3, natrium = 11, hidrogen = 1, kalium = 19)

[4 marks]

[*4 markah*]

CLO2 (c) i) Elaborate the details on which element, phosphorus or chlorine, has the higher ionization energy and support your argument accordingly.
(Proton number phosphorus = 15, chlorine = 17)
Huraikan butiran mengenai unsur yang mempunyai tenaga ionisasi yang lebih tinggi antara fosforus atau klorin, dan sokong hujah anda dengan alasan yang sesuai.
(Nombor proton fosforus = 15, klorin = 17)

[2 marks]

[*2 markah*]

ii) Use the atoms fluorine, bromine, chlorine, and iodine to explain the trend changes in electronegativity.
(Given fluorine = period 2, bromine = 4, chlorine = 3, and iodine = 5)
Gunakan atom fluorin, bromin, klorin, dan iodin untuk menerangkan 'trend' perubahan dalam keelektronegatifan.
(Diberi: fluorin = kala 2, bromin = kala 4, klorin = kala 3, dan iodin = kala 5)

[3 marks]

[*3 markah*]

CLO2 (d) i) Choose the largest atom among O^{2-}, F^{-} and P^{3-}.
(Proton number O = 8, F = 9, P = 15)
Pilih atom yang terbesar di antara O^{2-}, F^{-}, dan P^{3-}.
(Nombor proton O = 8, F = 9, P = 15)

[2 marks]
[*2 markah*]

ii) Demonstrate the arrangement of the atoms or ions (Cu, Cu^{2+}, Cu^{3+}) in the ascending order of ionization energy, along with an explanation.
Tunjukkan susunan atom atau ion (Cu, Cu^{2+}, Cu^{3+}) mengikut urutan meningkat tenaga ionisasi, berserta penjelasan.

[3 marks]
[*3 markah*]

QUESTION 4
SOALAN 4

CLO2 (a) i) Outline the possible values of the angular momentum quantum number, l for a principal quantum number, n equal to 2.
Gariskan nilai-nilai yang mungkin bagi nombor kuantum momentum sudut, l untuk nombor kuantum utama, n yang sama dengan 2.

[2 marks]
[*2 markah*]

ii) Write the possible values of n, l, m and s for an electron in orbital of 3p subshell.
Tuliskan nilai-nilai bagi n, l, m dan s untuk elektron dalam subkulit 3p.

[4 marks]
[*4 markah*]

CLO2 (b) i) Expand the electronic configuration of Cr^{3+} using spdf notation.
(Proton number Cr = 24)

Kembangkan konfigurasi elektronik Cr^{3+} menggunakan notasi spdf.
(Nombor proton Cr = 24)

[2 marks]
[*2 markah*]

ii) Show the hybridization of methane CH_4.
[Proton number C = 6, H = 1]
Tunjukkan hibridisasi metana CH_4.
[Nombor proton C = 6, O = 8]

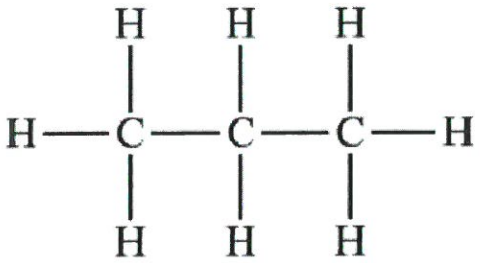
[4 marks]
[*4 markah*]

CLO2 (c) i) Explain the formation of sodium hydroxide (NaCl) based on ionic bonding.
[Proton number Na = 11, Cl = 17]
Jelaskan pembentukan natrium hidroksida (NaOH) berdasarkan ikatan ion.
[Nombor proton Na = 11, Cl = 17]

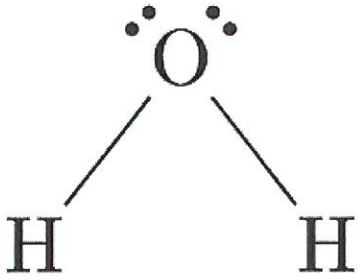
[2 marks]
[*2 markah*]

ii) Demonstrate how aluminium chloride forms through the transfer of electrons between atoms.
(Proton number Al = 13, Cl = 17)
Tunjukkan bagaimana klorida aluminium terbentuk melalui pemindahan elektron antara atom.
(Nombor proton Al = 13, Cl = 17)

[4 marks]
[*4 markah*]



Compound A
Sebatian A



Compound B
Sebatian B

Figure 4(d)
Rajah 4(d)

CLO2 (d) i) Figure 4(d) presents the structural formula of compound A and compound B. Discuss the types of forces present in each compound and indicate which compound has the highest boiling point.
Rajah 4(d) menunjukkan formula struktur bagi sebatian A dan sebatian B. Bincangkan jenis-jenis daya yang terdapat dalam setiap sebatian dan nyatakan sebatian mana yang mempunyai takat didih tertinggi.

[3 marks]
[*3 markah*]

ii) Draw the Lewis structure of carbon dioxide (CO_2).
(Proton number C = 6, O = 8)
Lukiskan struktur Lewis bagi karbon dioksida (CO_2).
(Nombor proton C = 6, O = 8)

[4 marks]
[*4 markah*]

SOALAN TAMAT