KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

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

JABATAN KEJURUTERAAN PETROKIMIA

PEPERIKSAAN AKHIR

SESI I : 2025/2026

DGP10293 : APPLIED CHEMISTRY

TARIKH : 03 DISEMBER 2025
MASA : 2.30 PETANG – 4.30 PETANG (2 JAM)

Kertas soalan ini mengandungi **SEPULUH (10)** 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)** structured questions. Answer all questions.

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1

(a) Atoms combined to form molecules or compounds.

Atom-atom bergabung membentuk molekul atau sebatian.

i. State the differences between a molecule and a compound.

Nyatakan perbezaan di antara molekul dan sebatian.

[4 marks]

[*4 markah*]

ii. Fill Table 1(a) with the number of electrons for each atom.

Isikan Jadual 1(a) berikut dengan bilangan elektron bagi setiap atom.

Table 1(a) / *Jadual 1(a)*

Element	Electron
$^{28}Ni^{2+}$	
$^{11}B^{3+}$	
$^{31}P^{3-}$	

[3 marks]

[*3 markah*]

CLO1

(b) A compound consisting of 20.15 g of copper, Cu and 79.85 g of iodine, I have a relative molecular mass of 637.86. Given atomic mass of Cu = 64 and I = 127.

Satu sebatian yang mengandungi 20.15 g kuprum, Cu dan 79.85 g iodin, I mempunyai jisim molekul relatif 637.86. Diberikan jisim atom Cu = 64 dan I = 127.

i. Calculate the empirical formula of the compound.
Kirakan formula empirik sebatian tersebut.

[2 marks]
[*2 markah*]

ii. Approximate the molecular formula of the compound.
Anggarkan formula molekul sebatian tersebut.

[3 marks]
[*3 markah*]

CLO1

(c) Paint pigment, titanium dioxide, TiO_2 is prepared by the hydrolysis of titanium tetrachloride, $TiCl_4$ with water. Hydrogen chloride, HCl, is also produced in the reaction.
Pigmen cat, titanium dioksida dihasilkan melalui hidrolisis titanium tetraklorida. Hidrogen klorida juga terhasil di dalam tindakbalas tersebut.

$$TiCl_4 + H_2O \rightarrow TiO_2 + HCl$$

i. Annotate the balance equation for the reaction.
Tuliskan keseimbangan persamaan bagi tindakbalas tersebut.

[3 marks]
[*3 markah*]

ii. Calculate the limiting reactant if 45 g of titanium tetrachloride reacts with 37 g of water. (Atomic mass: Ti = 47.88, Cl = 35.45, H = 1, O = 16)
Kirakan reaktan mengehad jika 45 g titanium tetraklorida bertindakbalas dengan 37 g air. (Jisim atom: Ti = 47.88, Cl = 35.45, H = 1, O = 16)

[6 marks]
[*6 markah*]

iii. Calculate the amount of excess reactant after the reaction is completed.
Kirakan jumlah lebihan reaktan selepas tindakbalas tersebut selesai.

[4 marks]
[*4 markah*]

QUESTION 2

SOALAN 2

CLO1 (a) The Brønsted-Lowry acids and bases concept revolves around the relative abilities of compounds to give up or accept protons.

Konsep asid dan bes Brønsted-Lowry berkisar tentang keupayaan relatif sebatian untuk menyerahkan atau menerima proton.

i. Identify the Brønsted-Lowry acid, Brønsted-Lowry base, conjugate acid and conjugate base for the following reaction.

Tentukan asid Brønsted-Lowry, bes Brønsted-Lowry, asid konjugat dan bes konjugat bagi tindakbalas berikut.

$$H_2C_2O_4 + 2F^- \rightleftharpoons 2HF + C_2O_4^{2-}$$

[4 marks]

[*4 markah*]

ii. State **THREE (3)** characteristics of strong base.

*Nyatakan **TIGA (3)** sifat bes kuat.*

[3 marks]

[*3 markah*]

CLO1 (b) In an experiment, 350 g of urea pallet is used to prepare a standard solution of 7000 ml concentrated urea solution, $(NH_2)_2CO$. (Atomic mass: N = 14, H = 1, C = 12, O = 16)

Dalam satu eksperimen, 350 g palet urea telah digunakan untuk penyediaan 7000 ml larutan urea pekat, $(NH_2)_2CO$. (Atomic mass: N = 14, H = 1, C = 12, O = 16)

i. Approximate the molarity of the concentrated urea solution.
Anggarkan kemolaran larutan urea pekat tersebut.

[4 marks]
[4 *markah*]

ii. Approximate the amount of concentrated urea solution required (in litres) to prepare 80.0 ml of 17.0 M urea solution.
Anggarkan jumlah larutan urea pekat yang diperlukan (dalam liter) bagi penyediaan 80.0 ml larutan urea 17.0 M.

[4 marks]
[4 *markah*]

CLO1 (c) Acetic acid, CH_3COOH is a weak acid found in vinegar.
Asid asetik CH_3COOH adalah asid lemah yang terkandung di dalam cuka.

i. Calculate the pH of CH_3COOH solution with an $[H^+]$ concentration of 1.5 x 10^{-4} mol dm^{-3}.
Kirakan nilai pH bagi larutan CH_3COOH dengan kepekatan $[H^+]$ 1.5 x 10^{-4} mol dm^{-3}.

[2 marks]
[*2 markah*]

ii. Calculate the pH of 6.7 g of acetic acid in 3500 ml of solution. Given the atomic mass C = 12, H = 1 and O = 16.
Kirakan pH bagi 6.7 g asid asetik di dalam larutan 3500 ml. Diberi jisim atom C = 12, H = 1 and O = 16.

[4 marks]
[4 *markah*]

iii. Calculate the concentration of 70 ml NaOH needed to neutralize 40 ml of acetic acid with a pH of 2.5.
Kirakan kepekatan larutan 70 ml NaOH yang diperlukan untuk meneutralkan 40 ml larutan asid asetik dengan pH 2.5.

[4 marks]
[*4 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) The reaction below shows a redox reaction.

Tindak balas di bawah menunjukkan tindak balas redoks.

$$H_2 + Cl_2 \rightleftharpoons S + 2HCl$$

i. State the oxidizing agent and reducing agent from the reaction above.

Nyatakan agen pengoksidaan dan ajen penurunan daripada tindak balas diatas.

[2 marks]

[*2 markah*]

ii. Explain oxidation and reduction in terms of changes of electron.

Terangkan pengoksidaan dan penurunan dalam terma perubahan elektron.

[2 marks]

[*2 markah*]

CLO1 (b) Cell notation is a shorthand description of a galvanic cell. Diagram 3(b) below displays a galvanic cell between a copper and zinc electrode.

Sel notasi merupakan diskripsi ringkas bagi sebuah sel galvanik. Rajah 3(b) di bawah menunjukkan satu sel galvanik antara kuprum dan zink.

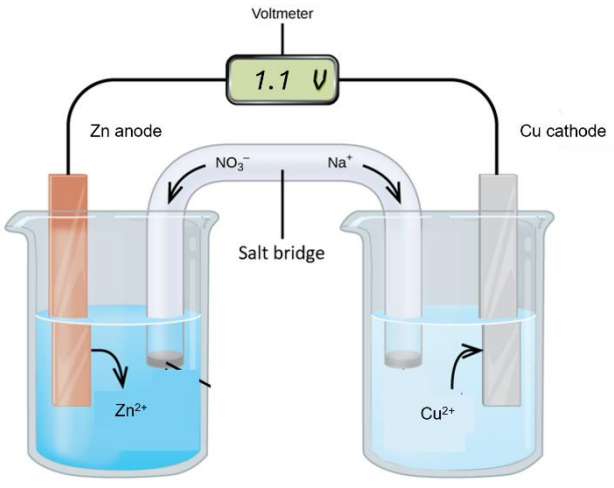

Diagram 3(b) / *Rajah 3(b)*

i. From Diagram 3(b), annotate the half-cell reaction and overall chemical reaction that occurs at the galvanic cell.
Berdasarkan Rajah 3(b), tuliskan tindak balas sel separuh dan tindak balas keseluruhan kimia yang berlaku pada sel galvanik tersebut.

[3 marks]
[*3 markah*]

ii. From Diagram 3(b), annotate the cell notation.
Berdasarkan Rajah 3(b), nyatakan sel notasi.

[4 marks]
[*4 markah*]

CLO1 (c) Redox reaction can be used to generate chemical energy to electrical energy.
Tindak balas redoks boleh digunakan untuk menghasilkan tenaga kimia kepada tenaga elektrik.

Table 3(c) / *Jadual 3(c)*

Solution: 1M aqueous solution of copper (II) sulfate ($CuSO_4$)	Solution: 1M aqueous solution of silver nitrate $AgNO_3$
Electrode: copper bar Cu	*Electrode:* silver bar Ag
$Cu^{2+}(aq) + 2e \rightarrow Cu(s)$, $E° = + 0.34$ V	$Ag^{+}(aq) + e^{-} \rightarrow Ag(s)$, $E° = + 0.80$ V

i. Draw the galvanic cell including anode, cathode, electrolyte and electron flow according to Table 3(c).
Lukiskan sel galvanik termasuk anod, katod, elektrolit dan pergerakan electron berpandukan Jadual 3(c).

[8 marks]
[*8 markah*]

ii. Calculate the electrode potential from the given standard reduction potential.

Kirakan keupayaan elektrod daripada keupayaan elektrod piawai yang diberikan.

[3 marks]

[*3 markah*]

iii. Calculate the new electrode potential if Cu is replaced by Zn with the electrode potential of - 0.76 V.

Kirakan keupayaan elektrod yang baru jika Cu digantikan oleh Zn dengan keupayaan elektrod - 0.76 V.

[3 marks]

[*3 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) State **TWO (2)** factors that influenced the rate of reaction.

*Nyatakan **DUA (2)** faktor yang mempengaruhi kadar tindak balas.*

[2 marks]

[*2 markah*]

CLO1 (b) Explain the equilibrium system if the stated disturbances occurred during the Haber process in the following reaction.

Terangkan sistem keseimbangan jika gangguan dinyatakan berlaku semasa proses Haber dalam tindak balas berikut.

$$N_2\,(g) + 3H_2\,(g) \rightleftharpoons 2NH_3\,(g)$$

i. Decrease N_2 from the system.

Mengurangkan N_2 *daripada sistem*

[3 marks]

[*3 markah*]

ii. Decrease the volume of the system.

Mengurangkan isipadu sistem

[3 marks]

[*3 markah*]

iii. Add catalyst into the system.

Menambahkan pemangkin k edalam sistem.

[3 marks]

[*3 markah*]

CLO1 (c) Dynamic equilibrium can be achieved when the concentration of reactant and product stops changing.

Keseimbangan dinamik akan dapat dicapai apabila kepekatan reaktan dan produk berhenti berubah.

$$C_3H_8\,(g) + 5O_2\,(g) \rightleftharpoons 3CO_2\,(g) + 4HO_2\,(g)$$

i. Write the equilibrium constant of the chemical equation above.

Nyatakan pemalar keseimbangan bagi tindak balas kimia di atas.

[4 marks]

[*4 markah*]

$$H_2\,(g) + I_2\,(g) \rightleftharpoons 2HI\,(g)$$

ii. From the reaction above, 0.05 M hydrogen gas, H_2 and 0.04 M Iodine gas, I_2 is sealed in a 2.00 L reaction vessel and heated at 200 °C. At equilibrium, the concentration of H_2 has dropped to 0.03 M. By using the ICE table, calculate the concentration of H_2, I_2 and HI ions that are present at equilibrium and the value of Kc.

Berdasarkan tindak balas di atas, 0.05 M gas hidrogen H_2 dan 0.04 M gas iodin I_2 dilekatkan dalam bejana tindak balas 2.00 L dan dipanaskan pada suhu 200 °C. Pada kepekatan keseimbangan, kepekatan H_2 telah menurun kepada 0.03 M. Dengan menggunakan jadual ICE, hitung kepekatan H_2, I_2 and HI yang terdapat pada keseimbangan dan nilai Kc.

[10 marks]

[*10 markah*]

SOALAN TAMAT