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

a) Diagram 1 shows the metal and non-metal elements in the periodic table.
Rajah 1 menunjukkan unsur logam dan bukan logam di dalam jadual berkala.

H								He
Li	Be		B	C	N	O	F	Ne
Na	Mg		Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Nh	Fl	Mc	Lv	Ts	Og

Diagram 1(a) / *Rajah 1(a)*

CLO1

i. From diagram 1(a), state **TWO (2)** examples of element in s-block.
*Berdasarkan rajah 1(a), nyatakan **DUA (2)** contoh elemen di dalam blok-s.*

[2 marks]
[2 markah]

Table 1(b) / *Jadual 1(b)*

Element / Unsur
Li or Li^+
O or O^{2-}

CLO1

ii. From Table 1(b), identify which elements have the biggest atomic radius.
Berdasarkan Jadual 1(b), kenal pasti unsur mana dengan radius atomik yang lebih besar.

[2 marks]
[2 markah]

b) Electron configuration is the distribution of electrons of an atom.
Konfigurasi elektron merupakan susunan elektron dalam sebuah atom.

CLO1

i. An element aluminium, Al contains 13 protons. Express the correct number of electrons, groups and periods for Al.
Elemen aluminium, Al mengandungi 13 proton. Nyatakan jumlah elektron, kumpulan, dan kala yang tepat bagi Al.

[3 marks]
[3 markah]

CLO1

ii. Explain **THREE (3)** rules violated by the orbital diagram in diagram 1(b) has and its reasons.
*Terangkan **TIGA (3)** peraturan yang tidak dipatuhi oleh rajah orbit dalam rajah 1(b) dan sebabnya.*

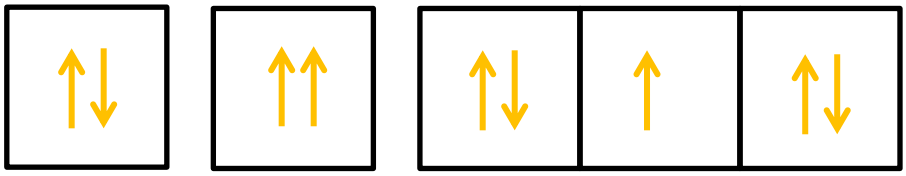

Diagram 1(b) / *Rajah 1(b)*

[6 marks]
[6 markah]

c) Limiting reactants can determine the number of products formed.
Reaktan mengehad dapat menentukan jumlah produk yang akan terhasil.

$$2Al(s) + 3S(s) \rightarrow Al_2S_3\ (s)$$

CLO1

i. Based on the chemical reaction above, 0.15 mol *aluminum* reacts with 2.75 mol sulphur. Calculate the limitting reactant and excess reactant. Given atomic mass Al =27, S = 32.
Berdasarkan tindak balas kimia di atas, 0.15 mol aluminum *bertindak balas dengan 2.75 mol sulfur. Kirakan bahan tindak balas terhad dan bahan tindak balas berlebihan. Diberi berat atom Al =27, S = 32.*

[8 marks]
[8 markah]

$$CO(g) + H_2(g) \rightarrow CH_3OH(l)$$

CLO1

ii. From the chemical reaction above, 0.05 mol of CH_3OH was produced during the reaction. The reaction only achieved 75% of yield. Calculate the theoretical yield, given the atomic mass C = 12, O = 16, H = 1.
Daripada tincak balas kimia di atas, 0.05 mol CH_3OH dihasilkan semasa tindak balas. Tindak balas tersebut hanya menghasilkan 75% hasil. Kirakan hasil teori, diberi berat atom C = 12, O = 16, H = 1.

[4 marks]
[4 markah]

QUESTION 2

SOALAN 2

a) The formation of chemical bond is closely related to metal and non-metal elements. Diagram 2(a) below shows two types of chemical bonding.
Pembentukan ikatan kimia adalah berkait rapat dengan unsur logam dan bukan logam. Diagram 2(a) dibawah menunjukkan dua jenis ikatan kimia.

Diagram 2(a) / *Rajah 2(a)*

CLO1

i. Identify type of chemical bond for Structure A, Structure B, Structure C and Structure D.
Kenal pasti jenis ikatan kimia bagi Struktur A, Struktur B, Struktur C dan Struktur D.

[4 marks]
[4 markah]

CLO1

ii. Highlight the Lewis structure of magnesium fluoride, MgF_2. Given atomic mass Mg = 12, F = 19.
Tunjukkan struktur Lewis bagi magnesium florida, MgF_2. Diberi berat atom Mg = 12, F = 19.

[3 marks]
[3 markah]

b) Formal charge is used to find the most stable Lewis structure.
Formal charge digunakan untuk mencari struktur Lewis yang paling stabil.

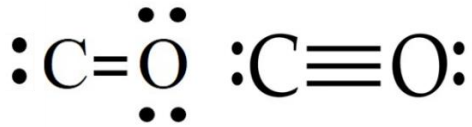

Diagram 2(b) / Rajah 2(b)

CLO1

i. Based on diagram 2(b), compare the formal charge between the two chemical structures above. Given atomic mass C = 6, O = 8.
Berdasarkan diagram 2(b), bandingkan 'formal charge' diantara dua struktur kimia di atas. Diberi berat atom C = 6, O = 8.

[4 marks]
[4 markah]

CLO1

ii. Based on diagram 2(b), draw the best chemical structures based on the calculated formal charge.
Berdasarkan diagram 2(b), lukis struktur kimia terbaik berdasarkan 'formal charge' yang telah dikira.

[2 marks]
[2 markah]

c) pH is a fundamental topic in chemistry as it is used in basic experiment such as titration and dilution.
pH adalah topik asas dalam kimia kerana ianya digunakan dalam eksperimen asas seperti pentitratan dan pencairan.

$$CH_3COOH + H_2O \rightleftharpoons H_3O^+ + CH_3COO^-$$

CLO1

i. Based on the reaction in above, express acid, base, conjugate acid and conjugate base referring to Bronsted Lowry theory.
Berdasarkan tindak balas di atas, nyatakan asid, bes, konjugat asid dan konjugat bes merujuk kepada teori 'Bronsted Lowry'.

[4 marks]
[4 markah]

$$KOH\ (aq) + HCl\ (aq) \rightarrow KCl\ (aq) + H_2O\ (l)$$

CLO1

ii. Based on the reaction above, calculate the pOH and pH of 10.4 g potassium hydroxide, KOH in 1750 mL of solution. Given atomic mass K = 39, O = 16, H = 1.
Berdasarkan tindak balas di atas, kirakan pOH dan pH bagi 10.4 g kalium hidroksida, KOH di dalam 1750mL larutan. Diberi berat atom K = 39, O = 16, H =1.

[4 marks]
[4 markah]

CLO1

iii. In an experiment, hydrochloric acid, HCl with the pH of 1.5 was titrated with sodium hydroxide, NaOH. Calculate the concentration of 55.0mL NaOH solution needed to neutralize 25.5mL of HCl solution.
Dalam satu eksperimen, asid klorida, HCl dengan pH 1.5 dititrat bersama natrium hidroksida, NaOH. Kirakan kepekatan larutan 55*.0 mL NaOH yang diperlukan untuk meneutralkan 25.5mL larutan HCl.*

[4 marks]
[4 markah]

QUESTION 3

SOALAN 3

a) The reaction in **3(a)** shows a redox reaction.
Tindak balas di bawah menunjukkan tindak balas redoks.

$$Cu\ (s) + 2\ Ag^{+}\ (aq) \rightarrow Cu^{2+}\ (aq) + 2\ Ag\ (s)$$

CLO2

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]

CLO2

ii. Explain oxidation and reduction in terms of changes of hydrogen.
Terangkan pengoksidaan dan penurunan dalam terma perubahan hidrogen.

[2 marks]
[2 markah]

b) Cell notation is a shorthand description of a galvanic cell. Diagram 3(b) below displays an example of cell notation.
Sel notasi merupakan diskripsi ringkas bagi sebuah sel galvanik. Rajah 3(b) di bawah menunjukkan contoh bagi sel notasi.

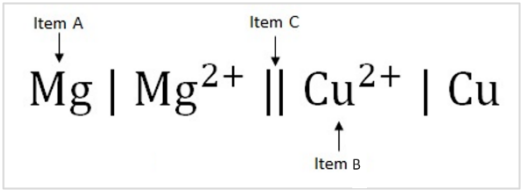

Diagram 3(b) / *Rajah 3(b)*

CLO2

i. From Diagram 3(b), explain Item A, Item B and Item C in the cell notation.
Berdasarkan Rajah 3(b), terangkan Item A, Item B dan Item C dalam sel notasi.

[3 marks]
[3 markah]

CLO2

ii. Explain **TWO (2)** differences between galvanic cells and electrolytic cells.
*Nyatakan **DUA (2)** perbezaan antara sel galvanic dan sel elektrolisis.*

[4 marks]
[4 markah]

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.

CLO2

i. Draw a galvanic cell that includes anode, cathode, electrolyte and electron flow by using $ZnSO_4$ and $CuSO_4$ as electrolytes.
Lukiskan sel galvanik yang mengandungi anod, katod, elektrolit dan pergerakan electron dengan menggunakan $ZnSO_4$ dan $CuSO_4$ sebagai elektrolit.

[8 marks]
[8 markah]

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
$Cu^{2+}(aq) + 2e \rightarrow Cu(s)$, $E° = +0.34$	$Ag^{+}(aq) + e^{-} \rightarrow Ag(s)$, $E° = +0.80$

CLO2

ii. According to Table 3(c), write the half-cell reactions and overall reaction.
Berdasarkan Table 3(c), tuliskan tindak balas sel separuh dan tindak balas keseluruhan.

[3 marks]
[3 markah]

CLO2

iii. According to Table 3(c), calculate the electrode potential from the redox reaction.
Berdasarkan Jadual 3(c), kirakan keupayaan elektrod daripada tindak balas redoks.

[3 marks]
[3 markah]

QUESTION 4

SOALAN 4

CLO2

a) State **TWO (2)** factors that influenced the rate of reaction.
*Nyatakan **DUA (2)** faktor yang mempengaruhi kadar tindak balas.*

[2 marks]
[2 markah]

b) Explain the equilibrium system if the stated disturbances occurred during the Haber process in reaction below.
Terangkan sistem keseimbangan jika gangguan dinyatakan berlaku semasa proses Haber dalam tindak balas dibawah.

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

CLO2

i. Decrease N_2 from the system.
Mengurangkan N_2 daripada sistem. [3 marks]
[3 markah]

CLO2

ii. Decrease the volume of the system.
Mengurangkan isipadu sistem [3 marks]
[3 markah]

CLO2

iii. Add catalyst into the system.
Menambahkan pemangkin k edalam sistem. [3 marks]
[3 markah]

c) Dynamic equilibrium can be achieved when concentration of reactant and product stop changing.
Keseimbangan dinamik akan dapat dicapai apabila kepekatan reaktan dan produk berhenti berubah.

$$HCN\ (aq) \rightleftharpoons H^+\ (aq) + CN^-\ (aq)$$

CLO2

i. K_C for reaction above is 2.3×10^3. If the equilibrium concentrations of HCN and CN^- are 0.015 M and 2.00 M respectively, calculate the equilibrium concentrations of H^+.
Kc untuk tindak balas diatas adalah 2.3×10^3. Jika kepekatan keseimbangan bagi HCN dan CN^- ialah 0.015 M and 2.00 M. Kirakan kepekatan keseimbangan bagi H^+.

[4 marks]
[4 markah]

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

CLO2

ii. From the reaction above, 0.05M hydrogen gas, H_2 and 0.04M Iodine gas, I_2 is sealed in a 2.00L reaction vessel and heated at 200°C. At equilibrium, the concentration of H_2 has dropped to 0.03M. 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 diatas, 0.05M gas hidrogen H_2 dan 0.04M 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 0.03M. 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