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 trend of relative atomic size of elements in the periodic table.
Rajah 1 menunjukkan sziz atom relative untuk unsur-unsur di dalam jadual berkala.

CLO1

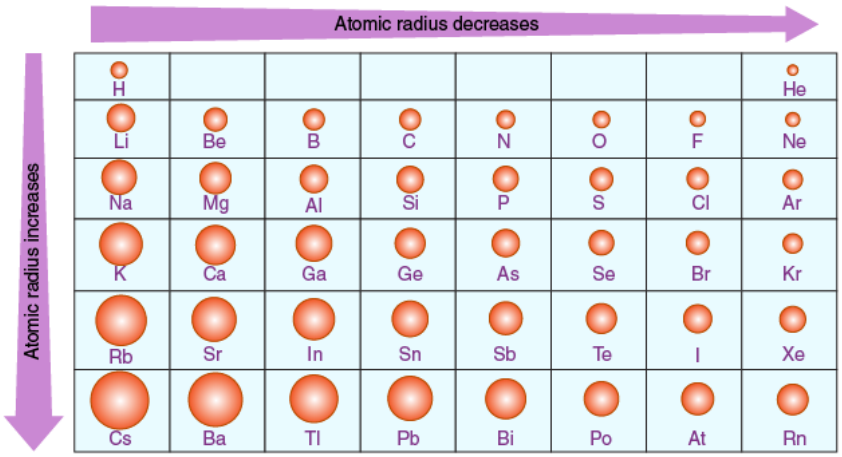

Diagram 1(a) / Rajah 1(a)

i. From diagram 1(a), state **ONE (1)** example of element in s-block and p-block.
*Berdasarkan rajah 1(a), nyatakan **SATU (1)** contoh elemen di dalam blok-s dan blok-p.*

[2 marks]
[*2 markah*]

ii. From Diagram 1(a), describe the ionic radius across the period and down the group.
Berdasarkan Rajah 1(a), huraikan radius ionic merentasi kala dan menuruni kumpulan.

[2 marks]
[*2 markah*]

CLO1

b) The electron configuration is the arrangement of electrons in an atom.
Konfigurasi elektron merupakan susunan electron dalam sebuah atom.

i. An element Ar contain 18 protons number. Express the correct electrons, groups and periods for Ar.
Elemen Ar mengandungi 18 proton. Nyatakan elektron, kumpulan, dan kala bagi Ar.

[3 marks]
[*3 markah*]

ii. Explain **THREE (3)** rules that need to be followed when constructing orbital diagram.
*Terangkan **TIGA (3)** peraturan yang perlu dipatuhi dalam membina rajah orbit.*

[3 marks]
[*3 markah*]

$1s^2\ 2s^2\ 2p^6\ 3s^2$ (a) (b) (c)

Diagram 1(b) / Rajah 1(b)

iii. Based on diagram 1(b), element X contains 24 electrons. Fill in the electron configuration above with the correct energy level.
Berdasarkan rajah 1(b), elemen X mengandungi 24 elektron. Isikan konfigurasi electron di atas dengan tahap tenaga yang betul.

[3 marks]
[*3 markah*]

CLO1

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

$$Al\ (s) + 6HCl\ (aq) \rightarrow 2AlCl_3\ (aq) + H_2\ (g)$$

i. From the reaction above, write the balance chemical reaction.
Berdasarkan tindak balas di atas, tuliskan tindak balas kimia yang stabil.

[2 marks]
[*2 markah*]

ii. From the reaction above, 15.12 g of aluminium reacts with 13.68 g of hydrochloric acid. Calculate the limiting reactant for this reaction. Given atomic mass Al = 27, Cl = 35, H = 1.
Berdasarkan tindak balas di atas, 15.12 g aluminium bertindak balas dengan 13.68 g asid hidroklorik. Kirakan reaktan pengehad bagi tindak balas ini. Diberi jisim atom Al = 27, Cl = 35, H = 1.

[6 marks]
[*6 markah*]

iii. From the limiting reactant above, calculate the mass of excess reactant. Given atomic mass Al = 27, Cl = 35.5, H = 1.
Berdasarkan reaktan pengehad di atas, kirakan berat reaktan berlebihan. Diberi jisim atom Al = 27, Cl = 35.5, H = 1.

[4 marks]
[*4 markah*]

QUESTION 2

SOALAN 2

CLO1

a) The formation of atomic bond is closely related to metal and non-metal elements. The diagram 2(a) below shows two types of atomic bonding.

Pembentukan ikatan atom adalah berkait rapat dengan unsur logam dan bukan logam. Diagram 2(a) di bawah menunjukkan dua jenis ikatan atom.

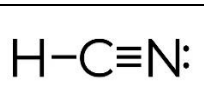	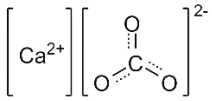	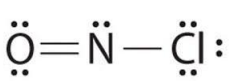	KBr
Structure A/ *Struktur A*	Structure B/ *Struktur B*	Structure C/ *Struktur C*	Structure D/ *Struktur D*

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

i. Identify type of atomic bond for Structure A, Structure B, Structure C and Structure D.

Kenal pasti jenis ikatan atom bagi Struktur A, Struktur B, Struktur C dan Struktur D.

[4 marks]

[*4 markah*]

ii. State **THREE (3)** properties of ionic bond.

*Nyatakan **TIGA (3)** ciri-ciri ikatan ionik.*

[3 marks]

[*3 markah*]

CLO1

b) Formal charge is used to find the most stable Lewis structure.

Formal charge digunakan untuk mencari struktur Lewis yang paling stabil.

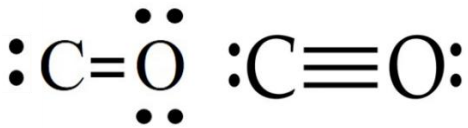

Diagram 2(b) / *Rajah 2(b)*

i. Based on diagram 2(b), compare the formal charge between the two chemical structures above.
Berdasarkan diagram 2(b), bandingkan formal charge diantara dua struktur kimia di atas.

[4 marks]
[*4 markah*]

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*]

CLO1

c) pH is a fundamental topic in chemistry because 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.

$$H_2CO_3 + OH^- \rightleftharpoons HCO_3^- + H_2O$$

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

[4 marks]
[*4 markah*]

ii. Calculate the pOH of 3.85 g sodium hydroxide, NaOH in 1750mL of solution. Given atomic mass Na = 23, O = 16, H = 1.
Kirakan pOH bagi 3.85 g natrium hidroksida, NaOH di dalam 1750mL larutan. Diberi berat atom Na = 23, O = 16, H = 1.

[4 marks]
[*4 markah*]

iii. In an experiment, hydrochloric acid, HCl with a pH of 0.8 was used for titration with potassium hydroxide, KOH. Calculate the concentration of 55.0 mL KOH solution needed to neutralize 25.5 mL of HCl solution.
Dalam satu eksperimen, asid klorida, HCl dengan pH 0.8 digunakan dalam pentitratan bersama kalium hidroksida, KOH. Kirakan kepekatan larutan 55.0 mL KOH yang diperlukan untuk meneutralkan 25.5 mL larutan HCl.

[4 marks]
[*4 markah*]

QUESTION 3
SOALAN 3

CLO2

a) The reaction below shows a redox reaction.
Tindak balas di bawah menunjukkan tindak balas redoks.

$$2Al + 3Cu^{2+} \longrightarrow 2Al^{3+} + 3Cu$$

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 oxygen.
Terangkan pengoksidaan dan penurunan dalam terma perubahan oksigen.

[2 marks]
[*2 markah*]

CLO2

b) Cell notation is a shorthand description of a galvanic cell. The diagram 3(b) below displays an example of cell notation of a magnesium and copper electrode.
Sel notasi merupakan diskripsi ringkas bagi sebuah sel galvanik. Rajah 3(b) di bawah menunjukkan contoh bagi sel notasi bagi magnesium dan kuprum elektrod.

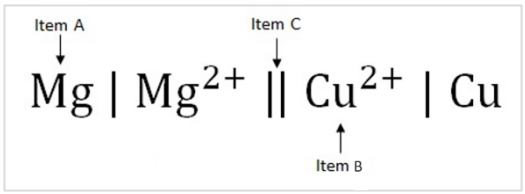

Diagram 3(b) / *Rajah 3(b)*

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*]

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

[4 marks]
[*4 markah*]

CLO2

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 zinc sulfate ($ZnSO_4$)
Electrode: copper bar Cu	*Electrode: zinc* bar Zn
$Cu^{2+}(aq) + 2e \rightarrow Cu(s)$, $E° = +0.34$	$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$, $E° = -0.76$

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. Write the half-cell reaction and the overall chemical reaction that occurs in the cell.
Tuliskan tindak balas sel separuh dan tindak balas keseluruhan kimia yang berlaku pada sel tersebut.

[3 marks]
[*3 markah*]

iii. Calculate the electrode potential from the given standard reduction potentials.
Kirakan keupayaan elektrod daripada keupayaan elektrod piawai yang diberikan.

[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*]

CLO2

b) The equilibrium of a system will be changed if disturbance occurs during the reaction process.
Keseimbangan sesebuah sistem akan berubah jika gangguan berlaku semasa proses tindak balas.

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

From the Haber process above:
Berdasarkan proses Haber di atas:

i. Explain if more N_2 is added to the system.
Terangkan jika lebih banyak N_2 *ditambah kepada sistem.*

[3 marks]
[*3 markah*]

ii. Elaborate if the volume of the system increases.
Huraikan jika isipadu sistem bertambah.

[3 marks]
[*3 markah*]

iii. Discuss if catalyst is added into the system.
Bincangkan jika pemangkin ditambah ke dalam sistem.

[3 marks]
[*3 markah*]

CLO2

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

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

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 di atas 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*]

$$Br_2(g) + Cl_2(g) \rightleftharpoons BrCl(g)$$

ii. From the reaction above, 0.07 M bromine gas Br_2 and 0.04 M chlorine gas Cl_2 is sealed in a 2.00 L reaction vessel and heated at 200 °C. At equilibrium, the concentration of Br_2 has dropped to 0.04 M. By using the ICE table, calculate the concentration of Br_2, Cl_2 and BrCl ions that are present at equilibrium and the value of Kc.

Berdasarkan tindak balas diatas, 0.07 M gas bromin Br_2 dan 0.04 M gas klorin Cl_2 dilekatkan dalam tangki tindak balas 2.00 L dan dipanaskan pada suhu 200 °C. Pada kepekatan keseimbangan, kepekatan Br_2 telah menurun kepada 0.04 M. Dengan menggunakan jadual ICE, hitung kepekatan Br_2, Cl_2 and BrCl yang terdapat pada keseimbangan dan nilai Kc.

[10 marks]
[*10 markah*]

SOALAN TAMAT