

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
C1

- (a) Quantum numbers specify the properties of atomic orbitals and the properties of electrons in orbitals. Define each quantum number given below.

Nombor kuantum menentukan sifat-sifat orbit atom dan sifat-sifat elektron pada petalanya. Beri definisi setiap nombor kuantum di bawah.

- i. Principle quantum number, n .

Prinsip nombor kuantum, n .

- ii. Angular momentum quantum number, l .

Nombor kuantum momentum sudut, l .

- iii. Magnetic quantum number, m .

Nombor kuantum magnet, m .

- iv. Spin quantum number, s . Give **ONE (1)** example for, s .

*Nombor kuantum spin, s . Beri **SATU (1)** contoh untuk, s .*

[5 marks]

[5 markah]

(b) Diagram 1(b) shows the relative atomic size of elements in periodic table.
Rajah 1(b) menunjukkan saiz atom relatif untuk unsur-unsur di dalam jadual berkala.

53 • H																31 • He	
167 ● Li	112 ● Be											87 ● B	87 ● C	58 ● N	48 ● O	42 ● F	38 ● Ne
190 ● Na	145 ● Mg											118 ● Al	111 ● Si	98 ● P	88 ● S	79 ● Cl	71 ● Ar
243 ● K	194 ● Ca	184 ● Sc	176 ● Ti	171 ● V	166 ● Cr	161 ● Mn	156 ● Fe	152 ● Co	149 ● Ni	145 ● Cu	142 ● Zn	136 ● Ga	125 ● Ge	114 ● As	103 ● Se	94 ● Br	88 ● Kr
265 ● Rb	219 ● Sr	212 ● Y	206 ● Zr	198 ● Nb	190 ● Mo	183 ● Tc	178 ● Ru	173 ● Rh	169 ● Pd	165 ● Ag	161 ● Cd	156 ● In	145 ● Sn	133 ● Sb	123 ● Te	115 ● I	108 ● Xe
298 ● Cs	253 ● Ba	217 ● La	208 ● Hf	200 ● Ta	193 ● W	188 ● Re	185 ● Os	180 ● Ir	177 ● Pt	174 ● Au	171 ● Hg	166 ● Tl	154 ● Pb	143 ● Bi	135 ● Po	127 ● At	120 ● Rn

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

- i. Describe the atomic radius of chemical elements in the periodic table.

Terangkan maksud jejari atom bagi sesuatu unsur kimia di dalam jadual berkala.

[1 mark]

[1 markah]

- ii. Draw how an atomic radius is measured.

Lukiskan bagaimana jejari atom itu diukur.

[2 marks]

[2 markah]

- iii. Explain the trends of atomic radius when going down the group and across the period.

Terangkan perubahan jejari atom sepanjang menuruni kumpulan dalam jadual berkala dan merentas kala.

[2 marks]

[2 markah]

- iv. There are differences between Li atom and ion Li^+ ion sizes. Explain the reason of size differences.

Terdapat perbezaan saiz antara Li dan Li^+ . Terangkan sebab perbezaan saiz itu.

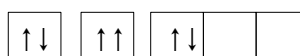
[3 marks]

[3 markah]

CLO1
C3

- (c) The arrangement of electrons in atom is known as the atom's electronic configuration. Shown below is an orbital diagram of an atom that has violated several electronic configuration rules.

Susunan sesuatu elektron pada atom dikenali sebagai konfigurasi elektronik atom. Di bawah adalah rajah orbit bagi atom yang telah melanggar peraturan bagi konfigurasi elektronik.



1s 2s 3p

- i. List **ALL** the rules that have been violated by the above orbital diagram.

*Senaraikan **SEMUA** peraturan yang telah dilanggar oleh rajah orbit di atas.*

[6 marks]

[6 markah]

- ii. If the atomic number of the atom above is 6, write the correct electronic configuration and orbital diagram of the atom.

Sekiranya nombor atom bagi atom di atas ialah 6, tuliskan konfigurasi elektronik yang betul dan rajah orbit bagi atom tersebut.

[3 marks]

[3 markah]

- iii. Based on your answer in 1(c) (ii), identify the group, period and block of the atom.

Berdasarkan jawapan anda pada 1(c) (ii), kenal pasti kumpulan, kala unsur dan block bagi atom tersebut.

[3 marks]

[3 markah]

QUESTION 2

SOALAN 2

CLO1
C1

- (a) Covalent and ionic bonding can be formed from sharing or accepting/donating electrons. Diagram 2(a) below shows two types of atomic bonding.

Kovalen dan ikatan ion dapat dihasilkan daripada perkongsiaan atau penerimaan/pendermaan elektron. Rajah 2(a) di bawah menunjukkan dua jenis ikatan atom.

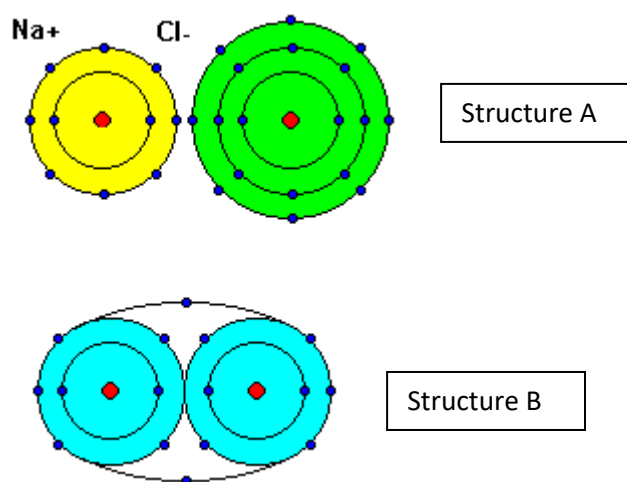


Diagram 2(a) / Rajah 2(a)

- i. Identify which structure is covalent and ionic bond.

Kenal pasti struktur manakah ikatan kovalen dan ionik.

[2 marks]

[2 markah]

- ii. Give **THREE(3)** reason(s) for your answer in question 2(a)(i) above.

Beri TIGA (3) sebab untuk jawapan ada pada soalan 2(a)(i) di atas.

[3 marks]

[3 markah]

CLO1
C2

- (b) Over the years, chemists have developed experiments that allow determination of shapes of molecules and polyatomic ions. This results in molecules having different three – dimensional shapes and these shapes greatly influences their physical and chemical properties.

Selama beberapa tahun ini, ahli kimia telah membangunkan eksperimen yang membolehkan penentuan bentuk molekul dan ion poliatom. Keputusan molekul ini menghasilkan tiga bentuk dimensi yang berbeza dan bentuk-bentuk ini amat mempengaruhi sifat-sifat fizikal dan kimia mereka.

- i. Determine the Lewis dot structure for carbon and chlorine. (atomic number: C = 6, Cl = 17)

Tentukan struktur dot Lewis untuk karbon dan klorin. (nombor atom: C = 6, Cl = 17)

[4 marks]

[4 markah]

- ii. Draw the Lewis dot structure for CCl_4 and CO_2 . (atomic number: C = 6, O = 8, Cl = 17)

Lukiskan struktur dot lewis untuk CCl_4 dan CO_2 . (nombor atom: C = 6, O = 8, Cl = 17)

[4 marks]

[4 markah]

CLO1
C3

- (c) Boron trifluoride is an inorganic compound with the formula BF_3 . This pungent colourless toxic gas forms white fumes in moist air. Diagram 2(c) below shows the geometry of BF_3 .

Boron triflorida adalah sebatian tak organik dengan formula BF_3 . Gas hancing toksik tidak berwarna ini menghasilkan wasap putih di dalam udara yang lembap. Rajah 2(c) di bawah menunjukkan geometri untuk BF_3 .

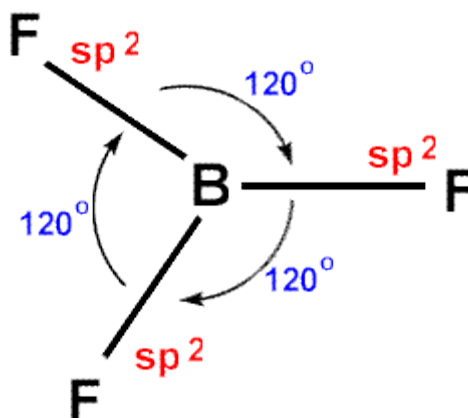


Diagram 2 (c)/ Rajah 2(c)

- i. From the above diagram, calculate the number of sigma bond and pi bond.

Daripada rajah di atas, kirakan bilangan ikatan sigma dan ikatan pi.

[2 marks]

[2 markah]

- ii. Show that the structure above is a sp^2 hybridized structure by drawing the orbital diagram of the hybridization process. (Atomic number: B = 5, F = 9)

Tunjukkan bahawa struktur di atas adalah struktur hybrid sp^2 dengan melukis rajah orbit untuk proses penghybridan. (Nombor atom: B = 5, F = 9)

[8 marks]

[8 markah]

- iii. Classify the molecular geometry of a sp^2 hybridized structure.

Kelaskan geometri molekul untuk struktur hybrid sp^2 .

[2 mark]

[2 markah]

QUESTION 3

SOALAN 3

CLO1
C1

- (a) Although most people think of acid and base as acrid and corrosive liquids, these compounds have an amazingly range of properties. These includes, aspirin (used to fight pain), cocaine (an anesthetic), amino acids (building blocks of proteins) and many more.

Walaupun kebanyakan manusia memikirkan bahawa asid dan bes sebagai akrid dan cecair yang menghakis, namun sebatian ini mempunyai pelbagai sifat yang menarik. Ini termasuklah aspirin (sebagai tahan sakit), kokain (anestetik), asid amino (membina protien-protein) dan banyak lagi.

- i. According to Brownsted – Lowry acid – base system, define acid and base.

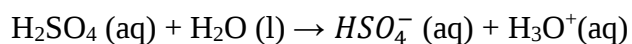
Beri definisi asid dan bes berdasarkan sistem asid - bes Brownsted – Lowry.

[2 marks]

[2 markah]

- ii. From the chemical equation shown below, identify which species are acid and conjugate base. Give **ONE (1)** reason for your answer.

*Berdasarkan persamaan kimia di bawah, kenal pasti yang manakah asid dan bes konjugat. Beri **SATU (1)** alasan bagi jawapan anda itu.*



[3 marks]

[3 markah]

CLO1
C2

- (b) pH is a great topic in chemistry because we can usually relate to it. Almost everyone has used some form of cleaning solution or had a carbonated beverage that covers a wide range of pH.

pH adalah salah satu topik kimia yang hebat kerana kita biasanya boleh mengaitkannya. Hampir semua orang menggunakan baham cucian ataupun minuman berkarbonat yang merangkumi pelbagai pH.

- i. Calculate the pH of $[H^+] = 1 \times 10^{-13}$ and $[OH^-] = 2.7 \times 10^{-7}$.

Kirakan pH untuk $[H^+] = 1 \times 10^{-13}$ dan $[OH^-] = 2.7 \times 10^{-7}$.

[4 marks]

[4 markah]

- ii. From your answer in 3(b) (i), determine whether each species is a neutral solution or weak or strong acid/base.

Daripada jawapan anda pada 3(b)(i), tentukan samaada setiap spesis adalah larutan neutral ataupun asid/base kuat atau lemah.

[2 marks]

[2 markah]

CLO1
C3

- (c) For a particular voltaic or galvanic cell, one half – cell consist of silver metal in a silver nitrate solution, the other half – cell has a piece of copper metal immersed in a copper(II) sulphate solution. A salt bridge that contains a potassium chloride solution connects the two half-cells.

Untuk satu jenis sel voltan atau galvanic, separuh sel terdiri daripada logam perak dalam larutan nitrat perak, separuh sel lagi mempunyai satu keping logam tembaga yang direndam pada larutan tembaga (II) sulfat. Satu titian garam yang mengandungi larutan kalium klorida yang menghubungkan kedua-dua sel separuh tersebut.

Standard Reduction Potential

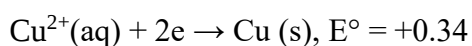


Diagram 3 (c)/ Rajah 3 (c)

- i. Sketch the galvanic cell including the anode, cathode, electron and ion movement according to Diagram 3(c).

Lukiskan sel galvanik termasuk anod, katod, elektron dan pergerakan ion berpandukan Rajah 3(c).

[8 marks]

[8markah]

- ii. Predict the half – cell reaction and overall chemical reaction that occurs in the cell.

Ramalkan tindak balas sel separuh dan tindak balas keseluruhan kimia yang berlaku di dalam sel.

[3 marks]

[3 markah]

- iii. Calculate the electrode potential from the given standard reduction potential.

Kirakan keupayaan elektrod daripada keupayaan elektrod piawai yang diberikan.

[3 marks]

[3 markah]

QUESTION 4

SOALAN 4

CLO2
C1

- (a) The most remarkable feature of a system at equilibrium is its ability to return to equilibrium after a change in conditions moves it away from that state.

Ciri paling luar biasa pada sesuatu keseimbangan sistem ialah keupayaannya untuk kembali seimbang selepas berlaku perubahan pada keadaan yang memindahkannya dari keadaan itu.

- i. Define Le Chatelier's principle.

Berikan definisi prinsip Le Chatelier.

[2 mark]

[2 markah]

- ii. State **THREE (3)** disturbances that can occur within a system.

*Nyatakan **TIGA (3)** gangguan yang boleh berlaku di dalam sistem.*

[3 marks]

[3 markah]

CLO2
C2

(b) Describe the equilibrium system if the stated disturbances occurred.

Terangkan sistem keseimbangan jika gangguan dinyatakan berlaku.

- i. Instead of adding Cl_2 , PCl_3 was removed in the system: $\text{PCl}_3 + \text{Cl}_2 \rightleftharpoons \text{PCl}_5$.

Daripada menambahkan Cl_2 , PCl_3 telah dikeluarkan daripada sistem:

[3 marks]

[3 markah]

- ii. In the system: $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$, the volume of reaction vessel increase.

Pada sistem: $\text{CaCO}_3(\text{p}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$, isipadu pada bekas tindak balas meningkat.

[3 marks]

[3 markah]

- iii. In the same reaction in 4(b)(i), a substance that shortens the time to reach equilibrium has been added.

Tindak balas yang sama pada 4(b)(i), satu bahan yang memendekkan masa untuk mencapai keseimbangan telah ditambah.

[1 marks]

[1 markah]

CLO2
C3

- (c) Calculate the equilibrium concentrations of hydrogen and iodine when 0.050 mol HI is sealed in a 2.00 L reaction vessel and heated at 700°C. At this temperature, K_c is 2.2×10^{-2} for $2\text{HI (g)} \rightleftharpoons \text{H}_2 \text{(g)} + \text{I}_2 \text{(g)}$. Write the ICE table and algebraic expression in your answer.

Kirakan kepekatan seimbang bagi hidrogen dan iodin apabila 0.050 mol HI telah disendalkan pada 2.00 L bekas tindak balas dan dipanaskan pada 700 °C. Suhu, K_c ialah 2.2×10^{-2} untuk $2\text{HI (g)} \rightleftharpoons \text{H}_2 \text{(g)} + \text{I}_2 \text{(g)}$. Tuliskan jadual ICE dan ungkapan algebra pada jawapan anda.

[13 marks]
[13 markah]

SOALAN TAMAT