4541/1
Kimia
Kertas 1
2023

MODUL GEMILANG SPM

KIMIA

Kertas 2

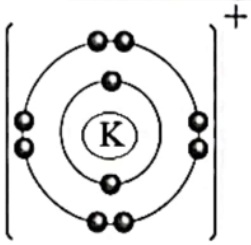
PERATURAN PEMARKAHAN

4541© Hak Cipta MPSM Johor dan JPN Johor 2023

SKEMA JAWAPAN
KERTAS 2
BAHAGIAN A

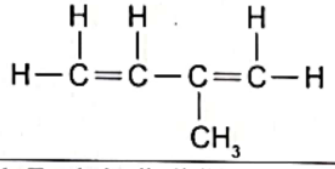
No		Answer scheme	Sub mark	Total mark
1	(a)	Natrium *Sodium*	1	1
	(b)	Logam alkali *Alkali metal*	1	1
	(c)	Elektrostatik *Electrostatic*	1	1
	(d)	Ion *Ionic*	1	1
	(e)	Natrium fluorida *Sodium fluoride*	1	1
			TOTAL	**5**

No			Answer scheme	Sub mark	Total mark
2	(a)	(i)	Sabun ialah garam natrium atau kalium bagi asid lemak. *Soap is a sodium or potassium salts of fatty acid.*	1	1
		(ii)	$RCOO^-Na^+$ // $RCOO^-K^+$	1	1
		(iii)	Air berasid *Acidic water*	1	1
	(b)	(i)	Nanoteknologi ialah pembangunan bahan atau peranti dengan memanfaatkan ciri-ciri zarah nano *Nanotechnology is a development of substances or gadgets using the properties of nanoparticles.*	1	1
		(ii)	Zarah kecil bersaiz 1 – 100 nm *Small size particles of 1 – 100 nm*	1	1
				TOTAL	**5**

No		Answer scheme	Sub mark	Total mark
3	(a)	Proton, neutron, elektron *Proton, neutron, electron*	1	1
	(b)	Kumpulan 1 *Group* 1	1	1
	(c)	 Nukleus dan cas yang betul – 1 *Correct nucleus and charge* Bilangan petala dan bilangan elektron yang betul – 1 *Correct number of shells and number of electrons*	2	2
	(d)	Jisim atom relatif M $= \frac{79(24) + 10(25) + 11(26)}{100}$ *Relative atomic mass* M $= 24.32$	1 1	2
		TOTAL		**6**

No			Answer scheme	Sub mark	Total mark
4	(a)		Unsur-unsur yang terletak di antara Kumpulan 2 dan 13 dalam Jadual Berkala Unsur. *The elements located in between Group 2 and 13 in the Periodic Table of Elements.*	1	1
	(b)		Bertindak sebagai mangkin *Acts as a catalyst*	1	1
	(c)	(i)	Perang *Brown*	1	1
		(ii)	$2Fe + 3Cl_2 \rightarrow 2FeCl_3$ Formula kimia bahan dan tindak balas yang betul – 1 *Correct reactants and products formulae* Persamaan kimia yang seimbang – 1 *Balanced chemical equation*	 1 1	2
		(iii)	2 mol Fe menghasilkan 2 mol $FeCl_3$ // 0.1 mol Fe menghasilkan 0.1 mol $FeCl_3$ 2 mol Fe *forms* 2 mol $FeCl_3$// 0.1 mol Fe *forms* 0.1 mol $FeCl_3$ Jisim $FeCl_3$ = 0.1 x 162.5 g // 16.25 g *Mass of* $FeCl_3$ = 0.1 x 162.5 g // 16.25 g Nisbah mol yang betul – 1 *Correct mole ratio* Jawapan berserta unit yang betul – 1 *Correct answer with unit*	1 1	2
			TOTAL		7

<table>
<tr><th colspan="2">No</th><th>Answer scheme</th><th>Sub mark</th><th>Total mark</th></tr>
<tr><td rowspan="5">5</td><td>(a)</td><td>Formula kimia yang menunjukkan nisbah teringkas atom bagi setiap unsur dalam suatu sebatian.
Chemical formula that shows the simplest ratio of atoms of each element in a compound.</td><td>1</td><td>1</td></tr>
<tr><td>(b)</td><td>Kaedah II
Method II</td><td>1</td><td>1</td></tr>
<tr><td>(c)</td><td>
<table>
<tr><th></th><th>Kuprum
Copper</th><th>Oksigen
oxygen</th></tr>
<tr><td>Jisim (g)
Mass (g)</td><td>6.42</td><td>1.61</td></tr>
<tr><td>Bilangan mol
Number of mole</td><td>$\frac{6.42}{64} = 0.1$</td><td>$\frac{1.61}{16} = 0.1$</td></tr>
<tr><td>Nisbah mol
Mole ratio</td><td>1</td><td>1</td></tr>
</table>
Formula empirik = CuO
Empirical formula</td><td>1
1
1</td><td>3</td></tr>
<tr><td>(d)</td><td>Bilangan unit formula = $0.01 \times 6.02 \times 10^{23}$
Number of formula unit
= 6.02×10^{21}</td><td>1</td><td>1</td></tr>
<tr><td>(e)</td><td>Kaedah I logam dibakar dalam udara/oksigen manakala Kaedah II logam oksida dibakar dalam gas hidrogen.
Method I the metal is burned in air/oxygen whereas Method II metal oxide is burned in hydrogen gas.
Kaedah I melibatkan logam yang lebih reaktif terhadap oksigen manakala Kaedah II melibatkan logam yang kurang reaktif daripada hidrogen.
Method I involves more reactive metal towards oxygen whereas Method II involves less reactive metal than hydrogen.</td><td>1
1</td><td>2</td></tr>
<tr><td colspan="3"></td><td>TOTAL</td><td>8</td></tr>
</table>

No			Answer scheme	Sub mark	Total mark
6	(a)		Aloi merupakan campuran dua atau lebih unsur yang mana unsur yang utama ialah logam. *Alloy is a mixture of two of more elements where the main element is a metal.*	1	1
	b		Keluli *Steel*	1	1
	c			1	1
	d.		P1: Tambah alkali // larutan ammonia *Add alkali // ammonia solution* P2: Alkali // Larutan ammonia mengandungi ion OH^- *Alkali // ammonia solution contains* OH^- *ions.* P3: Boleh meneutralkan ion H^+ yang terhasil daripada bakteria. *Can neutralise the* H^+ *ions produced by bacteria.*	1 1 1	3
	e.		Persamaan: kedua-dua bahan mengandungi unsur kuprum. *Similarity : Both substances contain copper element* Perbezaan: *Differences:* Bahan A terdiri daripada logam tulen manakala bahan B merupakan aloi // *Substance A is made up from pure metal while substance B is alloy //* Bahan A lebih lembut daripada bahan B *Substance A is softer from substance B* Bahan A kelihatan kurang menarik daripada bahan B // *Substance A looks less attractive than substance B //* Bahan A kurang tahan kakisan daripada bahan B *Substance A is less resistance to corrosive than substance B* dan sebaliknya // *vice versa*	1 1+1 mana-mana dua	3
				TOTAL	9

No		Answer scheme	Sub mark	Total mark
7	(a)	Haba yang terbebas/berubah apabila 1 mol logam disesarkan daripada larutan garamnya. *Heat release when 1 mol of metal is displaced from its salt solution*	1	1
	(b)	Kuprum *Copper*	1	1
	(c)(i)	$n = \frac{MV}{1000}$ $n = \frac{0.1(50)}{1000}$ $= 0.005$	1	1
	(c)(ii)	$\Delta H = \frac{4620}{0.005}$ $= 924\ kJmol^{-1}$	1 1	2
	(d)	Logam X: Aluminium // Zink // Ferum *Metal X: Aluminium // zinc // Iron* Aluminium/Zink/Ferum kurang elektropositif daripada magnesium. *Aluminium/Zinc/Iron is less electropositive than magnesium.* Tenaga haba yang dibebaskan lebih rendah. *Less heat energy is released.*	1 1 1	3
	(f)	Boleh // Wajar. *Yes.* Tindak balas ini eksotermik// Haba dibebaskan. *The reaction is exothermic // Heat is released.* Tidak boleh // Tidak wajar. *No.* Haba yang dibebaskan tidak cukup untuk melegakan kesakitan. *The heat released is not enough to reduce pain.*	1 1 Atau 1 1	2
			TOTAL	10

No			Answer scheme	Sub mark	Total mark
8	(a)	(i)	Butena // but-2-ena *Butene // but-2-ene*	1	1
		(ii)	Larutan kalium manganate(VII) berrasid // Larutan kalium dikromat(VI) berasid *Acidified potassium manganate(VII)solution // Acidified potassium dichromate(VI) solution*	1	1
	(b)		Bil mol P $= \frac{14}{56} = 0.25$ mol *Mole of* P 1 mol P menghasilkan 4 mol CO_2 1 mol P *forms* 4 mol CO_2 0.25 mol P menghasilkan 1 mol CO_2 0.25 mol P *forms* 1 mol CO_2 Isi padu $CO_2 = 1 \times 24 = 24\ dm^3$ *Volume of* $CO_2 = 1 \times 24 = 24\ dm^3$	1 1 1	3
	(c)		Persamaan: *Similarity:* Kedua-dua adalah sebatian hidrokarbon // *Both are hydrocarbons //* Kedua-dua mempunyai 4 atom karbon // *Both contain 4 carbon atoms //* Perbezaan: *Difference:* P ialah sebatian hidrokarbon tak tepu manakala R adalah sebatian hidrokarbon tepu // P *is an unsaturated hydrocarbon whereas* R *is saturated hydrocarbon //* Sebatian P mengandungi ikatan kovalen ganda dua antara atom karbon manakala sebatian R mengandungi ikatan kovalen tunggal antara atom karbon // *Compound* P *contains double covalent bond between carbon atoms whereas compound* R *contains single covalent bond between carbon atoms //* Sebatian P melunturkan warna perang air bromin manakala tiada perubahan kepada sebatian R // *Compound* P *decolourises brown bromine water whereas no changes for compound* R *//*	1 1	2

			Sebatian P melunturkan warna ungu larutan kalium manganat(VII) berasid manakala tiada perubahan kepada sebatian R // *Compound* P *decolourises purple colour of acidified potassium manganate*(VII) *solution whereas no changes for compound* R // Sebatian P menukarkan warna jingga larutan kalium dikromat(VI) berasid kepada hijau manakala tiada perubahan kepada sebatian R // *Compound P turns the orange colour of acidified potassium dichromate(VI) solution to green whereas no changes for compound* R // Pembakaran sebatian P menghasilkan lebih banyak jelaga berbanding sebatian R. // *Combustion of compound* P *produces more soot compared to compound* R		
		(d)	1. Tuangkan 2 cm^3 sebatian P dan sebatian R ke dalam dua tabung uji berlainan. *Pour 2 cm^3 of compound* P *and compound* R *into two different test tubes.* 2. Tambahkan 3 titis air bromin / larutan kalium manganat(VII) berasid ke dalam kedua-dua tabung uji dan goncangkan. *Add* 3 *drops of bromine water / acidified potassium manganate*(VII) *solution into both test tubes and shake.* 3. Sebatian P melunturkan warna perang air bromin manakala tiada perubahan kepada sebatian R. // Sebatian P menukarkan warna ungu larutan kalium manganat(VII) berasid kepada tak berwarna manakala tiada perubahan kepada sebatian R. *Compound* P *decolourises brown bromine water whereas no changes for compound* R *// Compound* P *decolourises the purple colour of acidified potassium manganate*(VII) *solution whereas no changes for compound* R	1 1 1	3
				Total	**10**

BAHAGIAN B

No			Answer scheme	Sub mark	Total mark
9	(a)		1. Kadar tindak balas ialah perubahan kuantiti bahan tindak balas / hasil tindak balas per unit masa. *Rate of reaction is the changes in the quantities of the reactant / product per unit time*	1	1
			2. Faktor: Saiz daging *Factor: Size of meat*	1	1
			3. Sebab: Jumlah luas permukaan lebih besar *Reason: Total surface area is larger*	1	2
			4. Lebih banyak permukaan daging terdedah kepada haba. *More surface of meat exposed to heat*	1	
	(b)	(i)	1. Formula kimia bahan tindak balas dan hasil tindak balas yang betul. *Correct chemical formulae of the reaction's reactants and products*	1	
			2. Persamaan kimia seimbang *Balanced chemical equation* $Zn + 2HCl \rightarrow ZnCl_2 + H_2$	1	
			3. Bil mol HCl $= \frac{2(5)}{1000} = 0.01$ mol *Mole of* HCl	1	
			4. 2 mol HCl menghasilkan 1 mol $ZnCl_2$ 0.01 mol HCl menghasilkan 0.005 mol $ZnCl_2$ 2 mol HCl *produces* 1 mol $ZnCl_2$ 0.01 mol HCl *produces* 0.005 mol $ZnCl_2$	1	
			5. Jisim molar $ZnCl_2$ $= 65 + 35.5(2) = 136$ g mol^{-1} *Molar mass of* $ZnCl_2$	1	
			6. Jisim $ZnCl_2$ $= 0.005 \times 136$ g $= 0.68$ g *Mass of* $ZnCl_2$	1	6

		(ii)	**Eksperimen I dan II** ***Experiment* I *and* II**		10
			1. Kadar tindak balas Eksperimen II lebih tinggi berbanding Eksperimen I *Rate of reaction of Experiment* II *is higher than Experiment* I	1	
			2. Suhu larutan dalam Eksperimen II lebih tinggi berbanding Eksperimen I *Temperature of the solution in Experiment* II *is higher than Experiment* I	1	
			3. Tenaga kinetik zarah-zarah/ion hidrogen dalam Eksperimen II lebih tinggi berbanding Eksperimen I // Lebih banyak zarah bertenaga untuk mengatasi tenaga pengaktifan *Kinetic energy of the particles/hydrogen ion in Experiment* II *is higher than in Experiment* I *// More energetic particles to overcome the activation energy*	1	
			4. Frekuensi perlanggaran di antara atom zink dan ion hidrogen dalam Eksperimen II lebih tinggi berbanding Eksperimen I *Frequency of collision between zinc atoms and hydrogen ions in Experiment* II *is higher than in Experiment* I	1	
			5. Frekuensi perlanggaran berkesan di antara zarah-zarah dalam Eksperimen II lebih tinggi berbanding Eksperimen I *Frequency of effective collision between the particles in Experiment* II *is higher than in Experiment* I	1	
			Eksperimen II dan III ***Experiment* II *and* III**		
			1. Kadar tindak balas Eksperimen III lebih tinggi berbanding Eksperimen II *Rate of reaction of Experiment* III *is higher than Experiment* II	1	
			2. Kehadiran mangkin / kuprum(II) sulfat dalam Eksperimen III *The presence of catalyst / copper*(II) *sulphate in Experiment* III	1	

			3. Mangkin menyediakan lintasan alternatif dengan merendahkan tenaga pengaktifan dalam Eksperimen III. *Catalyst provides an alternative path by lowering the activation energy in Experiment* III	1	
			4. Lebih banyak zarah-zarah berlanggar dapat mencapai tenaga pengaktifan yang lebih rendah dalam Eksperimen III *More colliding particles able to achieve the lower activation energy in Experiment* III	1	
			5. Frekuensi perlanggaran berkesan di antara atom zink dan ion hidrogen dalam Eksperimen III lebih tinggi berbanding Eksperimen II *Frequency of effective collision between zinc atoms and hydrogen ions in Experiment* III *is higher than Experiment* II	1	
				Total	**20**

No			Answer scheme	Sub mark	Total mark
10	(a)	(i)	1. Tenaga elektrik kepada tenaga kimia. // *Electrical energy to chemical energy.*	1	1
			2. Karbon P. // *Carbon* P	1	
			3. Karbon P disambung kepada terminal positif Sel II // Tindak balas pengoksidaan berlaku di karbon P. *Carbon* P *is connected to the positive terminal of Cell* II // *Oxidation reaction occurs at carbon* P	1	2
		(ii)	1. Setengah persamaan di anod: $2Cl^- \rightarrow Cl_2 + 2e$ *Half equation at anode:*	1	1
			2. Setengah persamaan di katod: $2H^+ + 2e \rightarrow H_2$ *Half equation at cathode:*	1	1
			3.		

Anod / *Anode*	Katod / *Cathode*	
Gelembung gas terhasil // Gas kuning-kehijauan terbebas // Gas berbau sengit terbebas // *Gas bubbles released // Greenish-yellow gas released // Gas with a pungent smell is released*	Gelembung gas tak berwarna terhasil *Colourless gas bubbles released*	1 + 1
Ion klorida dan ion hidroksida bergerak/tertarik ke anod *Chloride ion and hydroxide ion move / are attracted to anode*	Ion hidrogen bergerak / tertarik ke katod *Hydrogen ion move / are attracted to cathode*	1 + 1
Kepekatan ion klorida lebih tinggi berbanding ion hidroksida. *The concentration of chloride ion is higher than hydrogen ion*	Hanya ion hidrogen hadir di katod *Only hydrogen ions are present at cathode*	1 + 1

			Ion klorida dinyahcas dengan membebaskan elektron membentuk molekul klorin. *Chloride ions are discharged by releasing electrons to form chlorine molecules*	Ion hidrogen dinyahcas dengan menerima elektron membentuk molekul hidrogen *Hydrogen ions are discharged by accepting electrons to form hydrogen molecules*	1 + 1 8
	(b)	(i)	Membenarkan ion-ion mengalir *To allow the flow of ions*		1 1
		(ii)	$Zn_{(p)} \mid Zn^{2+}{}_{(ak)} \mid\mid Cu^{2+}{}_{(ak)} \mid Cu_{(p)}$ Elektrod dan elektrolit yang betul *Correct electrode and electrolyte* Susunan anod dan katod serta tanda | *Anode and cathode arrangement and the | symbol* Voltan sel, $E^0{}_{sel}$ = +0.34 – (-0.76) *Sel voltage*, $E^0{}_{cell}$ = +1.10 V		 1 1 1 1 2
		(iii)	Voltan sel, $E^0{}_{sel}$ = +0.34 – (-2.38) *Sel voltage*, $E^0{}_{cell}$ = +2.72 V // Lebih besar daripada +1.10 V // *Higher than* +1.10 V Semakin besar perbezaan nilai keupayaan elektrod di antara magnesium dan kuprum/pasangan logam, semakin besar nilai voltan // *The larger the difference in value of electrode potential between magnesium and copper/pair of metals, the larger the voltage value*		1 1 2
				TOTAL	**20**

BAHAGIAN C

No			Answer scheme	Sub mark	Total mark
11	(a)		Nilai pH alkali P lebih rendah daripada alkali Q *The* pH *value of alkali* P *is lower than alkali* Q	1	
			P ialah alkali lemah manakala Q ialah alkali kuat. *P is a weak alkali whereas Q is a strong alkali.*	1	
			Alkali P mengion separa dalam air manakala alkali Q mengion lengkap dalam air. *Alkali* P *ionizes partially in water whereas alkali* Q *ionizes completely in water*	1	
			Kepekatan ion hidroksida dalam alkali P lebih rendah manakala kepekatan ion hidroksida dalam alkali Q lebih tinggi *The concentration of hydroxide ion in alkali* P *is lower whereas the concentration of hydroxide ion in alkali* Q *is higher.*	1	
			Semakin rendah kepekatan ion hidroksida dalam alkali P, semakin rendah nilai pH // Semakin tinggi kepekatan ion hidroksida dalam alkali Q, semakin tinggi nilai pH. *The lower the concentration of hydroxide ion in alkali* P, *the lower the* pH *value. // The higher the concentration of hydroxide ion in alkali* Q, *the higher the* pH *value.*	1	5
	(b)	(i)	Tindak balas di antara asid dan alkali untuk menghasilkan garam dan air. *The reaction between an acid and an alkali to produce salt and water.*	1	1
		(ii)	Formula kimia bahan tindak balas dan hasil tindak balas yang betul. *Correct chemical formula for the reactants and the products*	1	
			Persamaan kimia seimbang *Balanced chemical equation* $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$	1	
			Bil mol NaOH = $\frac{(1.0)(25)}{1000}$ = 0.025 mol *Mole of* NaOH	1	
			2 mol NaOH → 1 mol H_2SO_4 0.025 mol NaOH → 0.0125 mol H_2SO_4	1	

			M H_2SO_4 = $\frac{0.0125\ (1000)}{20}$ = 0.625 mol dm^{-3} Jawapan alternatif: *Alternative answer:* $\frac{M_a\ (20)}{(1)(25)} = \frac{1}{2}$ M_a = 0.625 mol dm^{-3}	1	5
	(c)		Garam X: kuprum(II) karbonat *Salt X: copper(II) carbonate* Pepejal hitam: kuprum(II) oksida *Black solid: copper(II) oxide*	1 1	2
	(d)		1. Larutan kalsium nitrat / kalsium klorida *Calcium nitrate solution / calcium chloride solution* 2. Larutan natrium sulfat / kalium sulfat *Sodium sulphate solution / potassium sulphate solution* 3. Sukat dan tuangkan 50 cm^3 larutan kalsium nitrat / kalsium klorida ke dalam sebuah bikar. *Measure and pour 50 cm^3 of calcium nitrate solution / calcium chloride solution into a beaker* 4. Sukat dan tuangkan 50 cm^3 larutan natrium sulfat / kalium sulfat ke dalam bikar yang sama. *Measure and pour 50 cm^3 of sodium sulphate solution / potassium sulphate solution into the same beaker* 5. Kacaukan campuran menggunakan rod kaca *Stir the mixture using a glass rod* 6. Turaskan campuran *Filter the mixture* 7. Bilaskan baki turasan dengan air suling *Rinse the residue/precipitate using distilled water* 8. Tekankan kalsium sulfat / mendakan di antara dua kertas turas. *Press calcium sulphate/the precipitate between two filter papers*	1 1 1 1 1 1 1 1	8
				Total	**20**

– SKEMA JAWAPAN TAMAT –