BK3 - PEPERIKSAAN PERCUBAAN 2017
SIJIL PELAJARAN MALAYSIA
4541/2 CHEMISTRY
Paper 2

Section / *Bahagian* A

1	(a)	(i)	Group 17 // *Kumpulan* 17		1
		(ii)	Halogen		1
	(b)		2.8		1
	(c)		NaQ // NaCl		1
	(d)	(i)	P		1
		(ii)	Atomic size of P is smaller than Q. The force of attraction between nucleus toward electrons in atom P is stronger. The ability of atom P to attract electron is higher. *Saiz atom* P *lebih kecil daripada atom* Q. *Daya tarikan antara nukleus terhadap elektron dalam atom* P *lebih kuat.* *Keupayaan atom* P *menarik elektron lebih kuat*	1 1 1	…3
	(e)		Bromine // Iodine *Bromin // Iodin*		1
			TOTAL		**9**

2	(a)	(i)	Hard water is water that contains Ca^{2+} and Mg^{2+}. *Air liat ialah air yang mengandungi ion* Ca^{2+} *dan* Mg^{2+}		1
		(ii)	Detergent *Detergen*		1
		(iii)	Hydrophobic part dissolves in grease while hydrophilic part dissolves in water. Scrubbing/rubbing/agitating loosen and break the grease into smaller droplets. *Bahagian hidrofobik larut dalam gris manakala bahagian hidrofilik larut dalam air.* *Gosokan/kocakan akan melonggarkan dan memecahkan gris kepada titisan-titisan kecil dan tertanggal daripada permukaan kain.*	1 1	…2
	(b)	(i)	X : Sugar Y : Vinegar X : *Gula* Y : *Cuka*	1 1	…2
		(ii)	Aspartame // Stevia *Aspartam* // *Stevia*		1
	(d)	(i)	Paracetamol Aspirin is not suitable because it is acidic. *Parasetamol* *Aspirin tidak sesuai kerana berasid.*	1 1	...2
			TOTAL		**9**

3	(a)	(i)	Formula that shows the actual number of atom of each element in a compound. *Formula yang menunjukkan bilangan atom yang sebenar bagi setiap unsur dalam sesuatu sebatian.*		1
		(ii)	Carbon, Hydrogen and Oxygen. *Karbon*, *Hidrogen dan Oksigen*.		1
		(iii)	2(1) + 12 + 2(16) // 46 g mol^{-1}		1
		(iv)	1. <u>Reactants / *Bahan tindak balas*</u> : Magnesium and ethanoic acid // Mg and CH_3COOH *Magnesium dan asid etanoik* // Mg *dan* CH_3COOH 2. <u>Products / *Hasil tindak balas*</u> : Magnesium ethanoate and hydrogen // $(CH_3COO)_2Mg$ and H_2 *Magnesium etanoat dan hidrogen* // $(CH_3COO)_2Mg$ *dan* H_2 3. <u>Quantitative aspect / *Aspek kuantitatif*</u> : **1** mol of magnesium reacts with **2** mol of ethanoic acid to form **1** mol magnesium ethanoate and **1** mol of hydrogen. **1** *mol magnesium bertindak balas dengan* **2** *mol asid etanoik menghasilkan* **1** *mol magnesium etanoat dan* **1** *mol hidrogen.* 4. <u>Qualitative aspect / *Aspek kualitatif*</u> : Magnesium **solid** reacts with ethanoic acid **aqueous solution** to form magnesium ethanoate **aqueous solution** and hydrogen **gas**. ***Pepejal*** *magnesium bertindak balas dengan* ***larutan akues*** *asid etanoik menghasilkan* ***larutan akues*** *magnesium etanoat dan* ***gas*** *hidrogen.* [Any three // *Mana-mana tiga*]		...3

	(b)	(i)	$MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + CO_2 + H_2O$		1
			1. Number of mole of H_2SO_4 / *Bil. mol* H_2SO_4 $\frac{2.0 \times 5}{1000}$ // 0.01 mol 2. Ratio of mole / *Nisbah mol* $H_2SO_4 : CO_2$ 1 : 1 0.01 : 0.01 3. Volume of CO_2 / *Isipadu* CO_2 0.01×24 // 0.24 dm^3 // 240 cm^3	1 1 1	...3
			TOTAL		**9**

<table>
<tr><td>4</td><td>(a)</td><td></td><td><u>Sample answer</u>:
Phenolphthalein // Methyl orange
Fenolftalein // Metil jingga</td><td></td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td><u>Sample answer</u>:
Pink to colourless // Yellow to orange.
Merah jambu ke tanpa warna // Kuning ke jingga</td><td></td><td>1</td></tr>
<tr><td></td><td>(c)</td><td></td><td>Neutralisation
peneutralan</td><td></td><td>1</td></tr>
<tr><td></td><td>(d)</td><td></td><td>$HCl + NaOH \rightarrow NaCl + H_2O$
[Chemical formula / Formula kimia]
[Balanced / Seimbang]</td><td>
1
1</td><td>

...2</td></tr>
<tr><td></td><td>(e)</td><td></td><td>$\frac{0.4 \times V}{0.5 \times 25} = \frac{1}{1}$
$V = 31.25\ cm^3$</td><td>1

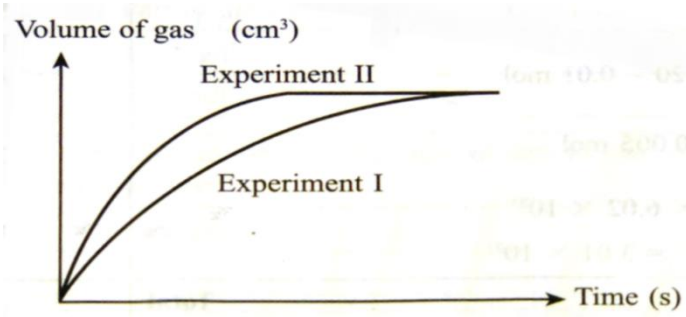
1</td><td>

...2</td></tr>
<tr><td></td><td>(f)</td><td>(i)</td><td>Hydrogen ion
Ion hidrogen</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>
<table>
<tr><th>Experiment I
Eksperimen I</th><th>Experiment II
Eksperimen II</th></tr>
<tr><td>Shows the acidic property
Menunjukkan sifat asid</td><td>Not shows the acidic property
Tidak menunjukkan sifat asid</td></tr>
<tr><td>Hydrogen ion exists

Ion hidrogen / H^+ wujud</td><td>Hydrogen ion does not exist // Exists as molecules
Ion hidrogen / H^+ tidak wujud // Wujud sebagai molekul</td></tr>
</table>
</td><td>1

1</td><td>

...2</td></tr>
<tr><td></td><td></td><td></td><td>TOTAL</td><td></td><td>10</td></tr>
</table>

5	(a)	(i)	Hydrogen gas *Gas hidrogen*		1
		(ii)	Place a lighted splinter into the test tube. 'Pop' sound produced. *Masukkan kayu uji menyala ke dalam tabung uji.* *Bunyi 'pop' terhasil.*	1 1	….2
	(b)	(i)	Experiment / *Eksperimen* **I** $\frac{35}{140} = 0.25\ cm^3\ s^{-1}$ Experiment / *Eksperimen* **II** $\frac{35}{120} = 0.29\ cm^3\ s^{-1}$	1 1	….2
		(ii)	Rate of reaction for Experiment **II** is higher than Experiment I. *Kadar tindak balas Eksperimen* **II** *lebih tinggi daripada Eksperimen* I.		1
		(iii)	In Experiment **II**, total surface area of zinc is bigger. Frequency of collision between zinc atom and hydrogen ion is higher. Frequency of effective collision particles [between zinc atoms and hydrogen ions] is higher. *Dalam Eksperimen* **II**, *jumlah luas permukaan zink lebih besar.* *Frekuensi perlanggaran antara atom zink dan ion hidrogen lebih tinggi* *Frekuensi perlanggaran berkesan antara zarah-zarah* [*atom zink dan ion hidrogen*] *lebih tinggi.*	1 1 1	...3
	(c)		1. Both of axes are labelled and with correct units. 2. Correct shape of graph and label the curve correctly  	1 1	….2
				TOTAL	**11**

6	(a)	(i)	Heat released when one mole of a substance is completely burnt in excess oxygen. *Haba yang dibebaskan apabila satu mol bahan terbakar dengan lengkap dalam oksigen yang berlebihan.*		1
		(ii)	Number of moles of ethanol = $\frac{142.78 - 141.86}{46}$ // 0.02 *Bilangan mol etanol* Heat released = 200 × 4.2 × 30 // 25200 J *Haba dibebaskan* Heat of combustion, ΔH = – 1260 kJ mol^{-1} *Haba pembakaran*	1 1 1	...3
	(b)	(i)	Hydrochloric acid is a strong acid / dissociates completely in water whereas ethanoic acid is a weak acid / dissociates partially in water. Some of heat released is used to dissociate ethanoic acid completely. *Asid hidroklorik ialah asid kuat / bercerai lengkap dalam air manakala asid etanoik ialah asid lemah / bercerai separa dalam air.* *Sebahagian haba yang dibebas digunakan untuk penceraian asid etanoik dengan lengkap.*	1 1	...2
		(ii)	Heat released = 0.1 × 57300 J // 5730 J *Haba dibebaskan* Temperature change = $\frac{5730}{100 \times 4.2}$ // 13.6 °C *Perubahan suhu*		
	(c)	(iii)	Energy *Tenaga* $CH_3COOH + NaOH$ ΔH = - 53.7 kJ mol^{-1} $CH_3COONa + H_2O$ 1. Axis arrow labelled with energy and two energy levels *Paksi berlabel tenaga dan dua aras tenaga* 2. Correct formula of reactants and products *Formula bahan dan hasil tindak balas betul* 3. The value of ΔH = - 53.7 kJ mol^{-1} *Nilai* ΔH		
				TOTAL	**11**

Section / *Bahagian* B

7	(a)		Method I : Magnesium and sulphuric acid *Kaedah* I *: Magnesium dan asid sulfurik* Method II : Magnesium oxide and sulphuric acid *Kaedah* II*: Magnesium oksida dan asid sulfurik*	2 2	…4
	(b)	(i)	Salt X : Copper(II) carbonate *Garam* X : *Kuprum*(II) *karbonat* Solid Y : Copper(II) oxide *Pepejal* Y : *Kuprum*(II) *oksida* Gas Z : Carbon dioxide *Gas* Z : *Karbon dioksida* Chemical test for Gas Z: 1. Flow the gas into lime water 2. Lime water turns cloudy *Ujian kimia untuk Gas Z*: 1. *Alirkan gas ke dalam air kapur* 2. *Air kapur menjadi keruh*	1 1 1 1 1	…5
		(ii)	Copper(II) nitrate *Kuprum*(II) *nitrat* <u>Test for cation</u> (Cu^{2+}): 1. Add sodium hydroxide solution 2. Blue precipitate formed. <u>*Ujian kation*</u> (Cu^{2+}): 1. *Tambahkan larutan natrium hidroksida.* 2. *Mendakan biru terbentuk.* <u>Test for anion</u> (NO_3^-) 1. Add sulphuric acid followed by of iron(II) sulphate solution. 2. Add slowly and carefully concentrated sulphuric. 3. Brown ring is formed. <u>*Ujian anion*</u> (NO_3^-) 1. *Tambahkan asid sulfurik cair diikuti dengan larutan ferum*(II) *sulfat*. 2. *Tambahkan perlahan-lahan dan berhati-hati asid sulfurik pekat* 3. *Cincin perang terbentuk.*	1 1 1 1 1 1	...6

		(iii)	[Balanced chemical equation] [*Persamaan yang seimbang*] [Correct formula of reactants and products] [*Formula bahan dan hasil yang betul*] <u>Answer / *Jawapan* :</u> $CuO + 2HNO_3 \rightarrow Cu(NO_3)_2 + H_2O$ 1. Mole of acid // [*Mol asid*] 2. Mole ratio // [*Nisbah mol*] 3. Answer with correct unit // [*Jawapan dengan unit*] <u>Sample answer / *Contoh jawapan* :</u> Mole of $HNO_3 = \frac{1.0 \times 50}{1000}$ // 0.05 From the equation, 2 mol of HNO_3 : 1 mol of $Cu(NO_3)_2$ 0.05 mol HNO_3 : 0.025 mol of $Cu(NO_3)_2$ Mass of $Cu(NO_3)_2$ = 0.025 × 188 // 4.7 g	1 1 1 1 1	...5
			TOTAL		**20**

<table>
<tr><td>8</td><td>(a)</td><td></td><td>Ethanol // Etanol
Butanoic acid // Asid butanoik

$C_3H_7COOH + C_2H_5OH \rightarrow C_3H_7COOC_2H_5 + H_2O$

Mol of ethyl butanoate $= \frac{1.16}{116}$ // 0.01 mol
Mass of ethanol = 0.01 × 46 // 0.46 g</td><td>1
1

2

1

1</td><td>...6</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>
<table>
<tr><th>Compound X // Propane
Sebatian X // Propana</th><th>Compound W // Propene
Sebatian W // Propena</th></tr>
<tr><td>Saturated hydrocarbon
Hidrokarbon tepu</td><td>Unsaturated hydrocarbon
Hidrokarbon tidak tepu</td></tr>
<tr><td>Contains single covalent bond
Mengandungi ikatan kovalen tunggal</td><td>Contains double covalent bond
Mengandungi ikatan kovalen ganda dua</td></tr>
</table>
<table>
<tr><td>Same physical properties
Sifat-sifat fizik yang sama</td></tr>
<tr><td>Weak inter molecular forces
Daya antara molekul yang lemah</td></tr>
</table>
<table>
<tr><td>Not react with bromine water
Tidak bertindak balas dengan air bromin</td><td>React with bromine water
Bertindak balas dengan air bromin</td></tr>
<tr><td>Saturated hydrocarbon
Hidrokarbon tepu</td><td>Unsaturated hydrocarbon
Hidrokarbon tidak tepu</td></tr>
</table>
<table>
<tr><td>Less soot
Kurang jelaga</td><td>More soot
Lebih jelaga</td></tr>
<tr><td>Percentage of carbon by mass is lower than W
Peratus karbon mengikut jisim lebih rendah</td><td>Percentage of carbon by mass is higher than X
Peratus karbon mengikut jisim lebih tinggi</td></tr>
</table>
</td><td>1

1

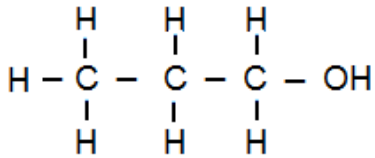
1

1

1

1

1

1</td><td>...8</td></tr>
<tr><td></td><td></td><td>(ii)</td><td> 

Propanol

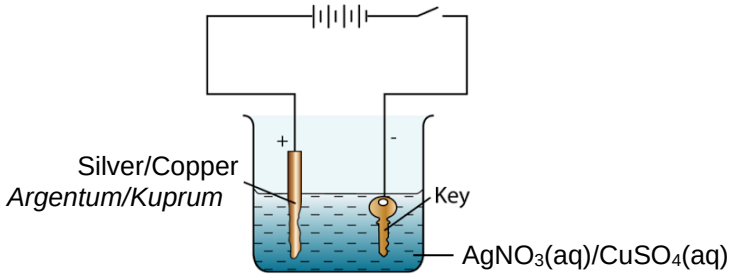
300°C, 60 atm
H_3PO_4 as catalyst / sebagai mangkin</td><td>1

1

1
1</td><td>...4</td></tr>
<tr><td></td><td></td><td></td><td>TOTAL</td><td></td><td>20</td></tr>
</table>

Section / *Bahagian* C

9	(a)		1. Experiment **I**: Zinc displaced Cu from $CuSO_4$ solution. 2. Experiment **II**: Ag cannot displace Cu from $CuSO_4$ solution. 3. Zn is more electropositive than Cu // Position of Zn is higher than Cu in the Electrochemical Series // Ag is less electropositive than Cu / Position of Cu is higher than Ag in the Electrochemical Series. 4. Chemical Equation: $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$	1 1 1 1	...4
	(b)		X : Carbon // Copper X : *Karbon* // *Kuprum* Y : Copper Y : *Kuprum* <u>*Sample Answer* :</u> <u>Set **I**</u> : 1. Ions move to the anode; SO_4^{2-}, OH^-. 2. Ion selected to be discharged; OH^-. 3. Position of OH^- ion is lower than SO_4^{2-} ion in the Electrochemical Series. 4. Half equation; $4OH^- \rightarrow 2H_2O + O_2 + 4e$ // Oxygen gas produced 1. *Ion-ion bergerak ke anod*; SO_4^{2-}, OH^-. 2. *Ion yang dipilih untuk dinyahcas*; OH^-. 3. *Kedudukan ion* OH^- *di bawah ion* SO_4^{2-} *dalam Siri Elektrokimia.* 4. *Setengah persamaan*; $4OH^- \rightarrow 2H_2O + O_2 + 4e$ // *Gas oksigen terhasil* OR / *ATAU* <u>Set **II**</u> : 1. Ions move to anode; SO_4^{2-}, OH^-. 2. No ion selected to be discharged because non-inert electrode (Cu) is used. 3. Copper atom ionises to form copper(II) ion. 4. Half equation; $Cu^{2+} + 2e \rightarrow Cu$ // Copper(II) ion formed 1. *Ion-ion bergerak ke anod*; SO_4^{2-}, OH^-. 2. *Tiada ion dipilih untuk dinyahcas kerana elektrod tidak lengai digunakan digunakan.* 3. *Atom kuprum mengion.* 4. *Setengah persamaan*; $Cu \rightarrow Cu^{2+} + 2e$ // *Ion kuprum*(II) *terhasil.*	1 1 1 1 1	...6

9	(c)		**Diagram / *Gambar rajah*** : [Functional apparatus set-up / *GR berfungsi*] [Label : Silver/Copper plate, $AgNO_3$ /$CuSO_4$ solution, iron key]  **Procedure / *Prosedur*** : 1. Pour silver nitrate/copper(II) sulphate* solution into a beaker. *Tuangkan larutan kuprum*(II) *sulfat/argentum nitrat* ke dalam sebuah bikar*. 2. Iron key is connected to the negative terminal of the battery while the copper/silver plate is connected to the positive terminal of the battery // Iron key is made as cathode while silver plate is made as anode. *Kunci besi disambungkan ke terminal negatif bateri manakala kepingan kuprum/argentum disambungkan ke terminal positif bateri // Kunci besi dijadikan katod manakala kepingan kuprum/argentum dijadikan anod.* 3. Dip both electrodes into the electrolyte [iron key immersed completely into the electrolyte]. *Celupkan kedua-dua elektrod ke dalam elektrolit* [*kunci besi mesti tenggelam sepenuhnya di dalam elektrolit*] 4. The circuit is completed. *Lengkapkan litar.* **Observation / *Pemerhatian*** : Iron key: Brown/Shiny-silvery solid is deposited *Kunci besi: Pepejal perang/kelabu berkilat terenap* Cu/Ag electrode: Becomes thinner / smaller *Elektrod* Cu/Ag: *Menipis / Mengecil* **Half equation / *Setengah persamaan* :** Anode/*Anod* : $Cu \rightarrow Cu^{2+} + 2e$ // $Ag \rightarrow Ag^{+} + e$ Cathode/*Katod* : $Cu^{2+} + 2e \rightarrow Cu$ // $Ag^{+} + e \rightarrow Ag$	1 1 1 1 1 1 1 1 1 1 1	...10
				TOTAL	**20**

10	(a)		Reaction II // *Tindak balas* II Oxidation number of magnesium increases from 0 to +2, magnesium undergoes oxidation. *Nombor pengoksidaan magnesium bertambah daripada* 0 *kepada* +2, *magnesium mengalami pengoksidaan.* Oxidation number of hydrogen decreases from +1 to 0, hydrogen undergoes reduction. *Nombor pengoksidaan hidrogen berkurang daripada* +1 *kepada* 0, *hidrogen mengalami penurunan.* No change in oxidation number for each element in Reaction I. *Tiada perubahan nombor pengoksidaan setiap unsur dalam Tindak balas* I.	1 1 1 1	...4
	(b)		<u>*Sample Answer*</u> : Substance P : Bromine water *Bahan* P : *Air bromin* Substance Q : Zinc *Bahan* Q : *Zink* Fe^{2+} ion loses electron and oxidised to Fe^{3+} ion. *Ion* Fe^{2+} *kehilangan elektron dan dioksidakan kepada ion* Fe^{3+}. Bromine molecule gains electron and is reduced to bromide ion/ Br^-. *Molekul bromin menerima elektron dan diturunkan kepada ion bromida/* Br^-. Zinc atom loses electron and oxidised to zinc ion/ Zn^{2+}. *Atom zink kehilangan elektron dan dioksidakan kepada ion zink/* Zn^{2+}. Fe^{3+} ion accept electron and reduced to Fe^{2+} ion. *Ion* Fe^{3+} *menerima elektron dan diturunkan kepada ion* Fe^{2+}.	1 1 1 1 1 1	...6

	(c)		*Sample answer* : **Diagram / *Rajah*** 1. [Set up of apparatus must be functional] [*Susunan radas berfungsi*] 2. [Label of electrolytes and electrodes] [*Elektrolit dan elektrod dilabel*] **Procedure / *Prosedur*** 3. Fill the U-tube half full with sulphuric acid. *Isikan tiub*-U *separuh penuh dengan asid sulfurik.* 4. [Using a dropper] fill one arm of the U-tube with acidified potassium manganate(VII) solution and the other arm with iron(II) sulphate solution. [*Dengan menggunakan penitis*] *isi satu lengan tiub*-U *dengan larutan kalium manganat* (VII) *berasid dan lengan satu lagi dengan larutan* ferum(II) *sulfat.* 5. Dipped a carbon rod into each arm and connect the carbon rods to the galvanometer using wires // Complete the circuit. *Celupkan rod karbon ke dalam setiap lengan dan sambungkan rod karbon kepada galvanometer menggunakan wayar // Lengkapkan litar.* **Observation / *Pemerhatian*** 6. Galvanometer needle is deflected *Jarum galvanometer terpesong*. 7. The purple solution becomes colourless *Larutan ungu menjadi tanpa warna* 8. The pale green solution turns brown/yellow *Larutan hijau pucat bertukar perang / kuning* **Half equation** **Setengah persamaan** 9. $MnO_4^- + 8H^+ + 5e \longrightarrow Mn^{2+} + 4H_2O$ 10. $Fe^{2+} \longrightarrow Fe^{3+} + e$	1 1 1 1 1 1 1 1 1 1	
				TOTAL	**20**

END OF MARKING SCHEME