



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

**Section / Bahagian A**

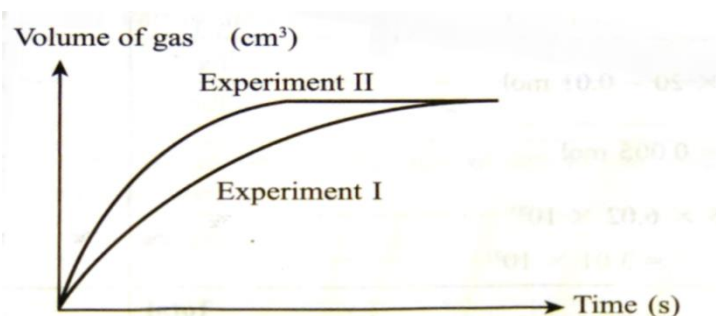
1	(a)	(i)	Group 17 // <i>Kumpulan 17</i>		1
		(ii)	Halogen		1
	(b)		2.8		1
	(c)		NaQ // NaCl		1
	(d)	(i)	P		1
		(ii)	Atomic size of P is smaller than Q. The force of attraction between nucleus toward electrons in atom P is stronger. The ability of atom P to attract electron is higher.  <i>Saiz atom P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

2	(a)	(i)	Hard water is water that contains $\text{Ca}^{2+}$ and $\text{Mg}^{2+}$ . <i>Air liat ialah air yang mengandungi ion <math>\text{Ca}^{2+}</math> dan <math>\text{Mg}^{2+}</math></i>		1
		(ii)	Detergent <i>Detergen</i>		1
		(iii)	Hydrophobic part dissolves in grease while hydrophilic part dissolves in water. Scrubbing/rubbing/agitating loosen and break the grease into smaller droplets. <i>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.</i>	1 1	...2
	(b)	(i)	X : Sugar Y : Vinegar <i>X : Gula Y : Cuka</i>	1 1	...2
		(ii)	Aspartame // Stevia <i>Aspartam // Stevia</i>		1
	(d)	(i)	Paracetamol Aspirin is not suitable because it is acidic. <i>Parasetamol Aspirin tidak sesuai kerana berasid.</i>	1 1	...2
				<b>TOTAL</b>	<b>9</b>

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

	(b)	(i)	$\text{MgCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{CO}_2 + \text{H}_2\text{O}$		1
			1. <u>Number of mole of <math>\text{H}_2\text{SO}_4</math> / Bil. mol <math>\text{H}_2\text{SO}_4</math></u>  $\frac{2.0 \times 5}{1000} // 0.01 \text{ mol}$	1	
			2. <u>Ratio of mole / Nisbah mol</u>  $\text{H}_2\text{SO}_4 : \text{CO}_2$ $1 : 1$ $0.01 : 0.01$	1	
			3. <u>Volume of <math>\text{CO}_2</math> / Isipadu <math>\text{CO}_2</math></u>  $0.01 \times 24 // 0.24 \text{ dm}^3 // 240 \text{ cm}^3$	1	...3
			<b>TOTAL</b>		<b>9</b>

4	(a)	<u>Sample answer:</u> Phenolphthalein // Methyl orange <i>Fenolftalein // Metil jingga</i>		1						
	(b)	<u>Sample answer:</u> Pink to colourless // Yellow to orange. <i>Merah jambu ke tanpa warna // Kuning ke jingga</i>		1						
	(c)	Neutralisation <i>peneutralan</i>		1						
	(d)	HCl + NaOH → NaCl + H <sub>2</sub> O [Chemical formula / <i>Formula kimia</i> ] [Balanced / <i>Seimbang</i> ]	1 1	...2						
	(e)	$\frac{0.4 \times V}{0.5 \times 25} = \frac{1}{1}$ V = 31.25 cm <sup>3</sup>	1  1	...2						
	(f) (i)	Hydrogen ion <i>Ion hidrogen</i>		1						
	(ii)	<table border="1"> <thead> <tr> <th>Experiment I <i>Eksperimen I</i></th> <th>Experiment II <i>Eksperimen II</i></th> </tr> </thead> <tbody> <tr> <td>Shows the acidic property <i>Menunjukkan sifat asid</i></td> <td>Not shows the acidic property <i>Tidak menunjukkan sifat asid</i></td> </tr> <tr> <td>Hydrogen ion exists <i>Ion hidrogen / H<sup>+</sup> wujud</i></td> <td>Hydrogen ion does not exist // Exists as molecules <i>Ion hidrogen / H<sup>+</sup> tidak wujud // Wujud sebagai molekul</i></td> </tr> </tbody> </table>	Experiment I <i>Eksperimen I</i>	Experiment II <i>Eksperimen II</i>	Shows the acidic property <i>Menunjukkan sifat asid</i>	Not shows the acidic property <i>Tidak menunjukkan sifat asid</i>	Hydrogen ion exists <i>Ion hidrogen / H<sup>+</sup> wujud</i>	Hydrogen ion does not exist // Exists as molecules <i>Ion hidrogen / H<sup>+</sup> tidak wujud // Wujud sebagai molekul</i>	1  1	...2
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		<a href="https://cikguadura.wordpress.com/">https://cikguadura.wordpress.com/</a>	<b>TOTAL</b>	<b>10</b>						

5	(a)	(i)	Hydrogen gas <i>Gas hidrogen</i>		1
		(ii)	Place a lighted splinter into the test tube. 'Pop' sound produced. <i>Masukkan kayu uji menyala ke dalam tabung uji. Bunyi 'pop' terhasil.</i>	1 1	....2
	(b)	(i)	<u>Experiment / Eksperimen I</u> $\frac{35}{140} = 0.25 \text{ cm}^3 \text{ s}^{-1}$ <u>Experiment / Eksperimen II</u> $\frac{35}{120} = 0.29 \text{ cm}^3 \text{ s}^{-1}$	1 1	....2
		(ii)	Rate of reaction for Experiment II is higher than Experiment I. <i>Kadar tindak balas Eksperimen II lebih tinggi daripada Eksperimen I.</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. <i>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.</i>	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
<b>TOTAL</b>					<b>11</b>

6	(a)	(i)	Heat released when one mole of a substance is completely burnt in excess oxygen. <i>Haba yang dibebaskan apabila satu mol bahan terbakar dengan lengkap dalam oksigen yang berlebihan.</i>		1
		(ii)	Number of moles of ethanol = $\frac{142.78 - 141.86}{46}$ // 0.02 <i>Bilangan mol etanol</i>  Heat released = $200 \times 4.2 \times 30$ // 25200 J <i>Haba dibebaskan</i>  Heat of combustion, $\Delta H = -1260 \text{ kJ mol}^{-1}$ <i>Haba pembakaran</i>	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. <i>Asid hidroklorik ialah asid kuat / berceraai lengkap dalam air manakala asid etanoik ialah asid lemah / berceraai separa dalam air.</i> <i>Sebahagian haba yang dibebas digunakan untuk penceraian asid etanoik dengan lengkap.</i>	1 1	...2
		(ii)	Heat released = $0.1 \times 57300 \text{ J}$ // 5730 J <i>Haba dibebaskan</i>  Temperature change = $\frac{5730}{100 \times 4.2}$ // 13.6 °C <i>Perubahan suhu</i>		
	(c)	(iii)	<p>Energy <i>Tenaga</i></p> <p>1. Axis arrow labelled with energy and two energy levels <i>Paksi berlabel tenaga dan dua aras tenaga</i> 2. Correct formula of reactants and products <i>Formula bahan dan hasil tindak balas betul</i> 3. The value of <math>\Delta H = -53.7 \text{ kJ mol}^{-1}</math> <i>Nilai <math>\Delta H</math></i></p>		
				<b>TOTAL</b>	<b>11</b>



**Section / Bahagian B**

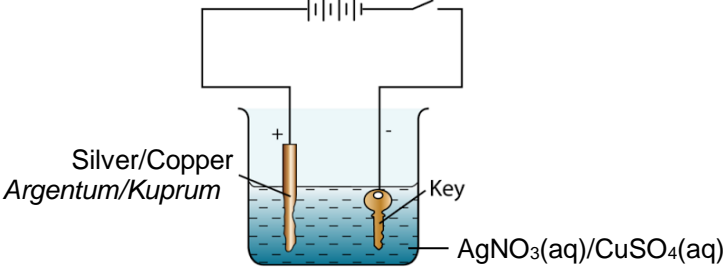
7	(a)		Method I : Magnesium and sulphuric acid <i>Kaedah I : Magnesium dan asid sulfurik</i>	2	
			Method II : Magnesium oxide and sulphuric acid <i>Kaedah II: Magnesium oksida dan asid sulfurik</i>	2	...4
	(b)	(i)	Salt X : Copper(II) carbonate <i>Garam X : Kuprum(II) karbonat</i>	1	...5
			Solid Y : Copper(II) oxide <i>Pepejal Y : Kuprum(II) oksida</i>	1	
			Gas Z : Carbon dioxide <i>Gas Z : Karbon dioksida</i>	1	
			Chemical test for Gas Z: 1. Flow the gas into lime water 2. Lime water turns cloudy	1 1	
			<i>Ujian kimia untuk Gas Z:</i> 1. <i>Alirkan gas ke dalam air kapur</i> 2. <i>Air kapur menjadi keruh</i>		
		(ii)	Copper(II) nitrate <i>Kuprum(II) nitrat</i>	1	...6
			<u>Test for cation</u> (Cu <sup>2+</sup> ): 1. Add sodium hydroxide solution 2. Blue precipitate formed.	1 1	
			<u>Ujian kation</u> (Cu <sup>2+</sup> ): 1. <i>Tambahkan larutan natrium hidroksida.</i> 2. <i>Mendakan biru terbentuk.</i>		
			<u>Test for anion</u> (NO <sub>3</sub> <sup>-</sup> ) 1. Add sulphuric acid followed by of iron(II) sulphate solution. 2. Add slowly and carefully concentrated sulphuric. 3. Brown ring is formed.	1 1 1	
			<u>Ujian anion</u> (NO <sub>3</sub> <sup>-</sup> ) 1. <i>Tambahkan asid sulfurik cair diikuti dengan larutan ferum(II) sulfat.</i> 2. <i>Tambahkan perlahan-lahan dan berhati-hati asid sulfurik pekat</i> 3. <i>Cincin perang terbentuk.</i>		

	(iii)	<p>[Balanced chemical equation]            [Persamaan yang seimbang]            [Correct formula of reactants and products]            [Formula bahan dan hasil yang betul]</p> <p><u>Answer / Jawapan :</u>  <math>\text{CuO} + 2\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{O}</math></p> <p>1. Mole of acid // [Mol asid]            2. Mole ratio // [Nisbah mol]            3. Answer with correct unit // [Jawapan dengan unit]</p> <p><u>Sample answer / Contoh jawapan :</u></p> <p>Mole of <math>\text{HNO}_3 = \frac{1.0 \times 50}{1000} // 0.05</math></p> <p>From the equation,            2 mol of <math>\text{HNO}_3</math> : 1 mol of <math>\text{Cu}(\text{NO}_3)_2</math>            0.05 mol <math>\text{HNO}_3</math> : 0.025 mol of <math>\text{Cu}(\text{NO}_3)_2</math></p> <p>Mass of <math>\text{Cu}(\text{NO}_3)_2 = 0.025 \times 188 // 4.7 \text{ g}</math></p>	1	
			1	
			1	...5
<b>TOTAL</b>				<b>20</b>

8	(a)	Ethanol // <i>Etanol</i> Butanoic acid // <i>Asid butanoik</i>  $C_3H_7COOH + C_2H_5OH \rightarrow C_3H_7COOC_2H_5 + H_2O$  Mol of ethyl butanoate = $\frac{1.16}{116}$ // 0.01 mol  Mass of ethanol = $0.01 \times 46$ // 0.46 g	1 1 2 1 1	...6																	
	(b) (i)	<table border="1" style="width: 100%;"> <thead> <tr> <th style="width: 50%;"><b>Compound X // Propane</b> <b><i>Sebatian X // Propana</i></b></th> <th style="width: 50%;"><b>Compound W // Propene</b> <b><i>Sebatian W // Propena</i></b></th> </tr> </thead> <tbody> <tr> <td>Saturated hydrocarbon <i>Hidrokarbon tepu</i></td> <td>Unsaturated hydrocarbon <i>Hidrokarbon tidak tepu</i></td> </tr> <tr> <td>Contains single covalent bond <i>Mengandungi ikatan kovalen tunggal</i></td> <td>Contains double covalent bond <i>Mengandungi ikatan kovalen ganda dua</i></td> </tr> <tr> <td colspan="2" style="text-align: center;">Same physical properties <i>Sifat-sifat fizik yang sama</i></td> </tr> <tr> <td colspan="2" style="text-align: center;">Weak inter molecular forces <i>Daya antara molekul yang lemah</i></td> </tr> <tr> <td>Not react with bromine water <i>Tidak bertindak balas dengan air bromin</i></td> <td>React with bromine water <i>Bertindak balas dengan air bromin</i></td> </tr> <tr> <td>Saturated hydrocarbon <i>Hidrokarbon tepu</i></td> <td>Unsaturated hydrocarbon <i>Hidrokarbon tidak tepu</i></td> </tr> <tr> <td>Less soot <i>Kurang jelaga</i></td> <td>More soot <i>Lebih jelaga</i></td> </tr> <tr> <td>Percentage of carbon by mass is lower than W <i>Peratus karbon mengikut jisim lebih rendah</i></td> <td>Percentage of carbon by mass is higher than X <i>Peratus karbon mengikut jisim lebih tinggi</i></td> </tr> </tbody> </table>	<b>Compound X // Propane</b> <b><i>Sebatian X // Propana</i></b>	<b>Compound W // Propene</b> <b><i>Sebatian W // Propena</i></b>	Saturated hydrocarbon <i>Hidrokarbon tepu</i>	Unsaturated hydrocarbon <i>Hidrokarbon tidak tepu</i>	Contains single covalent bond <i>Mengandungi ikatan kovalen tunggal</i>	Contains double covalent bond <i>Mengandungi ikatan kovalen ganda dua</i>	Same physical properties <i>Sifat-sifat fizik yang sama</i>		Weak inter molecular forces <i>Daya antara molekul yang lemah</i>		Not react with bromine water <i>Tidak bertindak balas dengan air bromin</i>	React with bromine water <i>Bertindak balas dengan air bromin</i>	Saturated hydrocarbon <i>Hidrokarbon tepu</i>	Unsaturated hydrocarbon <i>Hidrokarbon tidak tepu</i>	Less soot <i>Kurang jelaga</i>	More soot <i>Lebih jelaga</i>	Percentage of carbon by mass is lower than W <i>Peratus karbon mengikut jisim lebih rendah</i>	Percentage of carbon by mass is higher than X <i>Peratus karbon mengikut jisim lebih tinggi</i>	1 1 1 1 1 1 1 1
<b>Compound X // Propane</b> <b><i>Sebatian X // Propana</i></b>	<b>Compound W // Propene</b> <b><i>Sebatian W // Propena</i></b>																				
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	(ii)	$  \begin{array}{ccccccc}  & H & & H & & H & \\  &   & &   & &   & \\  H & - C & - & C & - & C & - OH \\  &   & &   & &   & \\  & H & & H & & H &   \end{array}  $ Propanol  300°C, 60 atm H <sub>3</sub> PO <sub>4</sub> as catalyst / <i>sebagai mangkin</i>	1 1 1 1	...4																	
<b>TOTAL</b>				<b>20</b>																	

## Section / Bahagian C

9	(a)	1. Experiment I: Zinc displaced Cu from CuSO <sub>4</sub> solution. 2. Experiment II: Ag cannot displace Cu from CuSO <sub>4</sub> 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: $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$	1 1 1 1	...4
	(b)	X : Carbon // Copper X : <i>Karbon // Kuprum</i>  Y : Copper Y : <i>Kuprum</i>  <u>Sample Answer :</u>  <u>Set I :</u> 1. Ions move to the anode; SO <sub>4</sub> <sup>2-</sup> , OH <sup>-</sup> . 2. Ion selected to be discharged; OH <sup>-</sup> . 3. Position of OH <sup>-</sup> ion is lower than SO <sub>4</sub> <sup>2-</sup> ion in the Electrochemical Series. 4. Half equation; $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$ // Oxygen gas produced  1. <i>Ion-ion bergerak ke anod; SO<sub>4</sub><sup>2-</sup>, OH<sup>-</sup>.</i> 2. <i>Ion yang dipilih untuk dinyahcas; OH<sup>-</sup>.</i> 3. <i>Kedudukan ion OH<sup>-</sup> di bawah ion SO<sub>4</sub><sup>2-</sup> dalam Siri Elektrokimia.</i> 4. <i>Setengah persamaan; <math>4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-</math> // Gas oksigen terhasil</i>  OR / ATAU  <u>Set II :</u> 1. Ions move to anode; SO <sub>4</sub> <sup>2-</sup> , OH <sup>-</sup> . 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; $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ // Copper(II) ion formed  1. <i>Ion-ion bergerak ke anod; SO<sub>4</sub><sup>2-</sup>, OH<sup>-</sup>.</i> 2. <i>Tiada ion dipilih untuk dinyahcas kerana elektrod tidak lengai digunakan digunakan.</i> 3. <i>Atom kuprum mengion.</i> 4. <i>Setengah persamaan; <math>\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-</math> // Ion kuprum(II) terhasil.</i>	1  1  1 1 1  1	...6

9	(c)	<p><b>Diagram / Gambar rajah :</b>          [Functional apparatus set-up / GR berfungsi]          [Label : Silver/Copper plate, AgNO<sub>3</sub> /CuSO<sub>4</sub> solution, iron key]</p>  <p><b>Procedure / Prosedur :</b></p> <ol style="list-style-type: none"> <li>1. Pour silver nitrate/copper(II) sulphate* solution into a beaker.  <i>Tuangkan larutan kuprum(II) sulfat/argentum nitrat* ke dalam sebuah bikar.</i></li> <li>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.  <i>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.</i></li> <li>3. Dip both electrodes into the electrolyte [iron key immersed completely into the electrolyte].  <i>Celupkan kedua-dua elektrod ke dalam elektrolit [kunci besi mesti tenggelam sepenuhnya di dalam elektrolit]</i></li> <li>4. The circuit is completed.  <i>Lengkapkan litar.</i></li> </ol> <p><b>Observation / Pemerhatian :</b>          Iron key: Brown/Shiny-silvery solid is deposited  <i>Kunci besi: Pepejal perang/kelabu berkilat terenap</i>          Cu/Ag electrode: Becomes thinner / smaller  <i>Elektrod Cu/Ag: Menipis / Mengecil</i></p> <p><b>Half equation / Setengah persamaan :</b>          Anode/Anod : <math>Cu \rightarrow Cu^{2+} + 2e</math> // <math>Ag \rightarrow Ag^{+} + e</math>          Cathode/Katod : <math>Cu^{2+} + 2e \rightarrow Cu</math> // <math>Ag^{+} + e \rightarrow Ag</math></p>	<p>1 1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>...10</p>
		<b>TOTAL</b>	<b>20</b>	

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

(c)		<p><u>Sample answer :</u></p> <p><b>Diagram / Rajah</b></p> <p>1. [Set up of apparatus must be functional] [Susunan radas berfungsi]</p> <p>2. [Label of electrolytes and electrodes] [Elektrolit dan elektrod dilabel]</p> <p><b>Procedure / Prosedur</b></p> <p>3. Fill the U-tube half full with sulphuric acid. <i>Isikan tiub-U separuh penuh dengan asid sulfurik.</i></p> <p>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.</p> <p>5. Dipped a carbon rod into each arm and connect the carbon rods to the galvanometer using wires // Complete the circuit. <i>Celupkan rod karbon ke dalam setiap lengan dan sambungkan rod karbon kepada galvanometer menggunakan wayar // Lengkapkan litar.</i></p> <p><b>Observation / Pemerhatian</b></p> <p>6. Galvanometer needle is deflected <i>Jarum galvanometer terpesong.</i></p> <p>7. The purple solution becomes colourless <i>Larutan ungu menjadi tanpa warna</i></p> <p>8. The pale green solution turns brown/yellow <i>Larutan hijau pucat bertukar perang / kuning</i></p> <p><b>Half equation</b> <b>Setengah persamaan</b></p> <p>9. <math>\text{MnO}_4^- + 8\text{H}^+ + 5\text{e} \longrightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}</math></p> <p>10. <math>\text{Fe}^{2+} \longrightarrow \text{Fe}^{3+} + \text{e}</math></p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	
		<p><a href="https://cikguadura.wordpress.com/">https://cikguadura.wordpress.com/</a></p>	<p><b>TOTAL</b></p>	<p><b>20</b></p>

**END OF MARKING SCHEME**

**BAHAN KECEMERLANGAN (BK3) – PEP. PERCUBAAN SPM 2017**  
**4541/3 KIMIA**  
**KERTAS 3**

Question	Rubric	Score
1(a)	Able to record the pH value accurately with <b>one decimal place</b> .  <u>Answer :</u>  Set I : 9.0 Set II : 8.7 Set III : 8.5 Set IV : 8.0	3
	Able to record any <b>three</b> pH value accurately with one decimal place // Able to record <b>all</b> pH value correctly  <u>Sample answer :</u> Set I : 9 // 9.00 Set II : 8.68 Set III : 8.53 Set IV : 8.01	2
	Able to record any <b>two</b> pH value correctly	1
	No response or wrong response	0

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Question	Rubric	Score										
1(b)	Able to construct a table to record the data that contain: 1. Correct heading 2. Correct pH value // ecf from 1(a) 3. Unit  <u>Sample answer:</u>	3										
	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>Set // Concentration Set// Kepekatan (mol dm<sup>-3</sup>)</th> <th>pH value Nilai pH</th> </tr> </thead> <tbody> <tr> <td>I // 0.1</td> <td>9.0</td> </tr> <tr> <td>II // 0.01</td> <td>8.7</td> </tr> <tr> <td>III // 0.001</td> <td>8.5</td> </tr> <tr> <td>IV // 0.0001</td> <td>8.0</td> </tr> </tbody> </table>		Set // Concentration Set// Kepekatan (mol dm <sup>-3</sup> )	pH value Nilai pH	I // 0.1	9.0	II // 0.01	8.7	III // 0.001	8.5	IV // 0.0001	8.0
	Set // Concentration Set// Kepekatan (mol dm <sup>-3</sup> )		pH value Nilai pH									
	I // 0.1		9.0									
II // 0.01	8.7											
III // 0.001	8.5											
IV // 0.0001	8.0											
Able to construct a less accurate table that contains: 1. Titles 2. pH value	2											
Able to construct a table with at least one title / pH value	1											
No response or wrong response	0											



Question	Rubric	Score
1(c)	Able to calculate the number of moles with correct unit	3
	<u>Answer:</u> Number of moles of hydrogen ion = $MV/1000$ <i>Bilangan mol ion hidrogen</i> $= \frac{0.01 \times 50}{1000}$ $= 0.0005 \text{ mol}$	
	Able to calculate the number of moles without unit/wrong unit	2
	Able to show an idea of calculation	1
	<u>Sample answer:</u> $0.01 \times 50$	
No response or wrong response	0	

Question	Rubric	Score
1(d)	Able to state the relationship correctly	3
	<u>Sample answers:</u> The higher/lower the concentration of <b>hydroxide ion</b> , the higher /lower the pH value // The higher/lower the pH value, the higher/lower the concentration of <b>hydroxide ion</b>  <i>Semakin tinggi/rendah kepekatan ion hidroksida, semakin tinggi/rendah nilai pH //</i> <i>Semakin tinggi/rendah nilai pH, semakin tinggi/rendah kepekatan ion hidroksida</i>	
	Able to state the relationship less accurately.	
	<u>Sample answer:</u> The higher/lower the concentration, the higher/lower the pH value // The higher/lower the pH value, the higher/lower the concentration  <i>Semakin tinggi/rendah kepekatan, semakin tinggi/rendah nilai pH //</i> <i>Semakin tinggi/rendah nilai pH, semakin tinggi/rendah kepekatan</i>	2
	Able to give an idea of relationship	
<u>Sample answer:</u> Different concentration, different pH value // Concentration affect the pH value  <i>Kepekatan berbeza, nilai pH berbeza//</i> <i>Kepekatan mempengaruhi nilai pH</i>	1	
No response given / wrong response	0	

Question	Rubric	Score
1(e)	Able to predict the pH value correctly  <u>Sample answer:</u> [9.0 < pH value ≤14.0]  [9.0 < <i>nilai</i> pH ≤14.0]	3
	Able to predict the pH value less accurately  <u>Sample answer:</u> Higher than 9.0 but less than 14  <i>Lebih tinggi dari 9.0 tetapi kurang dari 14</i>	2
	Able to state an idea of pH value of alkali  <u>Sample answer:</u> [7.0 < pH value ≤ 9.0] //Higher than 9.0 //Lower than 14.0  [7.0 < <i>nilai</i> pH ≤9.0] // <i>Lebih tinggi dari 9.0</i> // <i>Kurang dari 14.0</i>	1
	No response given / wrong response	0

Question	Rubric	Score								
2(a)	Able to state <b>two</b> observations correctly	3								
	<u>Sample answer:</u>									
	<table border="1" data-bbox="350 436 1224 982"> <thead> <tr> <th data-bbox="350 436 695 474">Experiment</th> <th data-bbox="695 436 1224 474">Observation / <i>Pemerhatian</i></th> </tr> </thead> <tbody> <tr> <td data-bbox="350 474 695 646">Experiment I</td> <td data-bbox="695 474 1224 646">Copper(II) sulphate dissolves// Blue solution formed.  <i>Kuprum(II) sulfat larut // Larutan biru terhasil</i></td> </tr> <tr> <td data-bbox="350 646 695 814">Experiment II</td> <td data-bbox="695 646 1224 814">Zinc carbonate does not dissolve/ remains unchanged // No change.  <i>Zink karbonat tidak larut/ kekal sama // Tiada perubahan</i></td> </tr> <tr> <td data-bbox="350 814 695 982">Experiment III</td> <td data-bbox="695 814 1224 982">Lead(II) nitrate dissolves // Colourless solution formed.  <i>Plumbum(II) nitrat larut // Larutan tidak berwarna terhasil</i></td> </tr> </tbody> </table>		Experiment	Observation / <i>Pemerhatian</i>	Experiment I	Copper(II) sulphate dissolves// Blue solution formed.  <i>Kuprum(II) sulfat larut // Larutan biru terhasil</i>	Experiment II	Zinc carbonate does not dissolve/ remains unchanged // No change.  <i>Zink karbonat tidak larut/ kekal sama // Tiada perubahan</i>	Experiment III	Lead(II) nitrate dissolves // Colourless solution formed.  <i>Plumbum(II) nitrat larut // Larutan tidak berwarna terhasil</i>
	Experiment		Observation / <i>Pemerhatian</i>							
	Experiment I		Copper(II) sulphate dissolves// Blue solution formed.  <i>Kuprum(II) sulfat larut // Larutan biru terhasil</i>							
	Experiment II		Zinc carbonate does not dissolve/ remains unchanged // No change.  <i>Zink karbonat tidak larut/ kekal sama // Tiada perubahan</i>							
	Experiment III		Lead(II) nitrate dissolves // Colourless solution formed.  <i>Plumbum(II) nitrat larut // Larutan tidak berwarna terhasil</i>							
Able to state any <b>2</b> observations correctly.	2									
Able to state any <b>1</b> observation correctly.	1									
No response given or wrong response	0									

Question	Rubric	Score				
2(b)	Able to state an inference correctly	3				
	Sample answer:					
	<table border="1"> <tr> <td><i>Observation/Pemerhatian</i></td> <td><i>Inference/Inferen</i></td> </tr> <tr> <td>Copper(II) sulphate dissolves</td> <td><b>Copper(II) sulphate is a soluble salt</b> <b><i>Kuprum(II) sulfat adalah garam terlarutkan</i></b></td> </tr> </table>		<i>Observation/Pemerhatian</i>	<i>Inference/Inferen</i>	Copper(II) sulphate dissolves	<b>Copper(II) sulphate is a soluble salt</b> <b><i>Kuprum(II) sulfat adalah garam terlarutkan</i></b>
	<i>Observation/Pemerhatian</i>		<i>Inference/Inferen</i>			
	Copper(II) sulphate dissolves		<b>Copper(II) sulphate is a soluble salt</b> <b><i>Kuprum(II) sulfat adalah garam terlarutkan</i></b>			
	Or /atau					
<table border="1"> <tr> <td><i>Observation/Pemerhatian</i></td> <td><i>Inference/Inferen</i></td> </tr> <tr> <td>Blue solution is formed</td> <td><b>Solution formed contains copper(II) ions</b> <b><i>Larutan mengandungi ion kuprum(II)</i></b></td> </tr> </table>	<i>Observation/Pemerhatian</i>	<i>Inference/Inferen</i>	Blue solution is formed	<b>Solution formed contains copper(II) ions</b> <b><i>Larutan mengandungi ion kuprum(II)</i></b>		
<i>Observation/Pemerhatian</i>	<i>Inference/Inferen</i>					
Blue solution is formed	<b>Solution formed contains copper(II) ions</b> <b><i>Larutan mengandungi ion kuprum(II)</i></b>					
Able to state an inference less correctly						
Sample answer: The solution contains ion	2					
<i>Larutan mengandungi ion</i>						
Able to state an idea of inference	1					
Sample answer: Reaction occurs // Copper(II) sulphate is a salt						
<i>Tindak balas berlaku // Kuprum(II) sulfat adalah garam.</i>						
No response given or wrong response	0					

Question	Rubric	Score
2(c)	Able to state <b>all</b> variables correctly	3
	Sample answer :	
	Manipulated variable : Copper(II) sulphate, zinc carbonate and lead(II) nitrate // Type of salts	
	Responding variable : Solubility of salt // Formation of solution	
	Constant variable : Water // Temperature of water // Type of solvent	
<i>Pemboleh ubah manipulasi : Kuprum(II) sulfat, zink karbonat dan plumbum(II) nitrat // Jenis garam</i>		
<i>Pemboleh ubah bergerak balas : Keterlarutan garam // Pembentukan larutan</i>		
<i>Pemboleh ubah dimalarkan: Air // Suhu air // Jenis pelarut</i>		
Able to state any <b>two</b> variables correctly	2	
Able to state any <b>one</b> variable correctly	1	
No response or wrong response	0	

Question	Rubric	Score
	<p>Able to give the hypothesis correctly</p> <p><u>Sample answer :</u> Copper(II) sulphate and lead(II) nitrate soluble in water while zinc carbonate does not soluble in water // Some salts are soluble in water while some salts are insoluble in water</p> <p><i>Kuprum(II) sulfat dan plumbum(II) nitrat larut di dalam air manakala zink karbonat tidak larut di dalam air // Sesetengah garam larut di dalam air manakala sesetengah garam tidak larut dalam air</i></p>	3
2 (d)	<p>Able to give the hypothesis almost correct</p> <p><u>Sample answer :</u> Copper(II) sulphate and lead(II) nitrate soluble in water // Zinc carbonate does not soluble in water Some salts are soluble in water // Some salts are insoluble in water</p> <p><i>Kuprum(II) sulfat dan plumbum(II) nitrat larut di dalam air // Zink karbonat tidak larut di dalam air // Sesetengah garam larut di dalam air // Sesetengah garam tidak larut dalam air</i></p>	2
	<p>Able to state an idea of the hypothesis</p> <p><u>Sample answer :</u> Solubility of salt depends on type of salts // Type of salts affect the solubility of salt</p> <p><i>Keterlarutan garam bergantung kepada jenis garam // Jenis garam mempengaruhi keterlarutan garam</i></p>	1
	No response or wrong response	0

Question	Rubric	Score
2 (e)	Able to state the correct operational definition 1. <i>what should be done and</i> 2. <i>what should be observed</i>  <u>Sample answer :</u> When a salt is added/put into water, it dissolves When a salt is added/put into water, a solution formed  <i>Apabila garam dimasukkan ke dalam air, garam larut</i> <i>Apabila garam dimasukkan ke dalam air, larutan terhasil</i>	3
	Able to state the operational definition almost correctly  <u>Sample answer:</u> Salt dissolves // Solution formed  <i>Garam larut // Larutan terhasil</i>	2
	Able to state any idea of soluble salt  <u>Sample answer:</u> Reaction occur  <i>Tindak balas</i>	1
	No response given or wrong response	0

Question	Rubric	Score				
2 (f)	Able to classify all the salts correctly  <u>Sample answer:</u> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Soluble salts <i>Garam terlarutkan</i></th> <th style="text-align: center;">Insoluble salts <i>Garam tak terlarutkan</i></th> </tr> </thead> <tbody> <tr> <td>Ammonium carbonate/ <math>(\text{NH}_4)_2\text{CO}_3</math> Magnesium nitrate/ <math>\text{Mg}(\text{NO}_3)_2</math>  <i>Ammonium karbonat/ <math>(\text{NH}_4)_2\text{CO}_3</math></i> <i>Magnesium nitrat/ <math>\text{Mg}(\text{NO}_3)_2</math></i></td> <td>Calcium sulphate/ <math>\text{CaSO}_4</math> Silver chloride/ <math>\text{AgCl}</math>  <i>Kalsium sulfat/ <math>\text{CaSO}_4</math></i> <i>Argentum klorida/ <math>\text{AgCl}</math></i></td> </tr> </tbody> </table>	Soluble salts <i>Garam terlarutkan</i>	Insoluble salts <i>Garam tak terlarutkan</i>	Ammonium carbonate/ $(\text{NH}_4)_2\text{CO}_3$ Magnesium nitrate/ $\text{Mg}(\text{NO}_3)_2$  <i>Ammonium karbonat/ <math>(\text{NH}_4)_2\text{CO}_3</math></i> <i>Magnesium nitrat/ <math>\text{Mg}(\text{NO}_3)_2</math></i>	Calcium sulphate/ $\text{CaSO}_4$ Silver chloride/ $\text{AgCl}$  <i>Kalsium sulfat/ <math>\text{CaSO}_4</math></i> <i>Argentum klorida/ <math>\text{AgCl}</math></i>	3
	Soluble salts <i>Garam terlarutkan</i>	Insoluble salts <i>Garam tak terlarutkan</i>				
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	Able to classify any <b>three</b> salts correctly	2				
	Able to classify any <b>two</b> salts correctly or give <b>opposite answers/wrong heading</b>	1				
No response given / wrong response	0					

Question	Rubric	Score
3(a)	<p>Able to state the problem statement correctly</p> <p><u>Sample answer:</u> How does the effectiveness of the cleansing action of soap and detergent in hard water different?</p> <p><i>Adakah keberkesanan tindakan pencucian sabun dan detergen dalam air liat berbeza ?</i></p>	3
	<p>Able to state the problem statement less accurately</p> <p><u>Sample answer:</u> Does the effectiveness of cleansing action of soap and detergent are different?// To investigate/ compare the effectiveness of soap and detergent in hard water</p> <p><i>Adakah keberkesanan tindakan pencucian sabun dan detergen berbeza// Untuk menyiasat/ membanding keberkesanan sabun dan detergen dalam air liat.</i></p>	2
	<p>Able to give an idea of the problem statement.</p> <p><u>Sample answer:</u> Does soap/detergent is more effective? To investigate/ compare the effectiveness of soap and detergent</p> <p><i>Adakah sabun/detergen lebih berkesan ? Untuk menyiasat/membanding keberkesanan sabun dan detergen</i></p>	1
	<p>No response or wrong response</p>	0

Question	Rubric	Score
3(b)	<p>Able to state the three variables correctly</p> <p><u>Sample answer:</u>  <b>Manipulated variable:</b>            Soap and detergent // Type of cleaning agent</p> <p><i>Sabun dan detergen // Jenis agen pencuci</i></p> <p><b>Responding variable:</b>            Effectiveness of cleansing action //            Ability to remove the oily stains on cloth</p> <p><i>Keberkesanan tindakan pencucian //            Keupayaan untuk singkir kotoran berminyak pada pakaian</i></p> <p><b>Constant variable:</b>            Cloth with oily stains // Hard water// Type of water</p> <p><i>Pakaian dengan kotoran berminyak // Air liat // Jenis air</i></p>	3
	Able to state <b>any two</b> variables correctly	2
	Able to state <b>any one</b> variable correctly	1
	No response or wrong response	0



Question	Rubric	Score
	<p>Able to state the relationship correctly between the manipulated variable and the responding variable with direction</p> <p><u>Sample answer:</u> Detergent is more effective than soap in cleansing action in hard water.</p> <p><i>Tindakan pencucian detergen lebih berkesan berbanding sabun dalam air liat.</i></p>	3
3(c)	<p>Able to state the relationship less correctly between the manipulated variable and the responding variable with direction</p> <p><u>Sample answer:</u> Detergent is more effective than soap</p> <p><i>Detergen lebih berkesan berbanding sabun</i></p>	2
	<p>Able to state the idea of hypothesis</p> <p><u>Sample answer:</u> Different cleansing agent have different effectiveness// Detergent/Soap is more effective</p> <p><i>Agen pencuci berbeza mempunyai keberkesanan berbeza// Detergen/ Sabun lebih berkesan</i></p>	1
	No response or wrong response	0

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Question	Rubric	Score
	<p>Able to list all of substances and apparatus completely</p> <p><u>Sample answer:</u></p> <p><b>Substances</b> Soap, detergent, hard water, 2 pieces of cloths with oily stains</p> <p><b>Apparatus</b> Beaker/Basin, glass rod</p> <p><b>Bahan</b> <i>Sabun, detergen, air liat, 2 cebis kain dengan kotoran berminyak</i></p> <p><b>Radas</b> <i>Bikar/besen, rod kaca</i></p>	3
3(d)	<p>Able to list materials and apparatus</p> <p><u>Sample answer:</u></p> <p><b>Substances</b> Soap, detergent, hard water, pieces of cloths with oily stains</p> <p><b>Apparatus</b> Beaker/Basin, glass rod</p> <p><b>Bahan</b> <i>Sabun/ detergen, air liat, cebisan kain dengan kotoran berminyak</i></p> <p><b>Radas</b> <i>Bikar/Besen, rod kaca</i></p>	2
	<p>Able to list the minimum substance and apparatus</p> <p><u>Sample answer:</u></p> <p><b>Substances</b> Soap / detergent, pieces of cloths</p> <p><b>Apparatus</b> [ Any suitable container]</p> <p><b>Bahan</b> <i>Sabun/ detergen, cebisan kain</i></p> <p><b>Radas</b> [ <i>Sebarang bekas yang sesuai</i> ]</p>	1
	No response or wrong response	0

Question	Rubric	Score
3(e)	<p>Able to list <b>all the steps</b> correctly</p> <p><u>Sample answer:</u></p> <ol style="list-style-type: none"> <li>1. <b>Measure</b> and pour [50 - 100] cm<sup>3</sup> of hard water into a beaker. <i>Sukat dan tuang [ 50-100] cm<sup>3</sup> air liat ke dalam bikar.</i></li> <li>2. <b>Add</b> soap into the beaker and stir the mixture. <i>Tambah sabun ke dalam bikar dan kacau campuran.</i></li> <li>3. <b>Immerse</b> a piece of cloth stained with oil in the mixture. <i>Rendam cebisan kain dengan kotoran berminyak ke dalam campuran</i></li> <li>4. <b>Stir</b> the mixture. <i>Kacau campuran</i></li> <li>5. <b>Record</b> the observation. <i>Rekod pemerhatian</i></li> <li>6. <b>Repeat</b> step 1 to 5 by replacing soap with detergent. <i>Ulang langkah 1 hingga 5 dengan menggantikan sabun dengan detergen.</i></li> </ol>	3
	Able to list down steps <b>2, 3, 4 and 6</b>	2
	Able to list down steps <b>2 and 3</b>	1
	No response or wrong response	0

Question	Rubric	Score						
3(f)	<p>Able to tabulate the data with the following aspects</p> <ol style="list-style-type: none"> <li>1. Correct titles</li> <li>2. Complete list of elements</li> </ol> <p><u>Sample answer:</u></p> <table border="1" data-bbox="358 537 1252 743"> <thead> <tr> <th data-bbox="358 537 727 606">Type of cleaning agent <i>Jenis agen pencuci</i></th> <th data-bbox="727 537 1252 606">Observation <i>Pemerhatian</i></th> </tr> </thead> <tbody> <tr> <td data-bbox="358 606 727 676">Soap <i>Sabun</i></td> <td data-bbox="727 606 1252 676"></td> </tr> <tr> <td data-bbox="358 676 727 743">Detergent <i>Detergen</i></td> <td data-bbox="727 676 1252 743"></td> </tr> </tbody> </table>	Type of cleaning agent <i>Jenis agen pencuci</i>	Observation <i>Pemerhatian</i>	Soap <i>Sabun</i>		Detergent <i>Detergen</i>		2
	Type of cleaning agent <i>Jenis agen pencuci</i>	Observation <i>Pemerhatian</i>						
	Soap <i>Sabun</i>							
Detergent <i>Detergen</i>								
<p>Able to construct a table with</p> <ol style="list-style-type: none"> <li>1. At least one title</li> <li>2. Incomplete list of elements</li> </ol> <p><u>Sample answer:</u></p> <table border="1" data-bbox="358 1115 1252 1253"> <thead> <tr> <th data-bbox="358 1115 727 1184">Type of cleaning agent <i>Jenis agen pencuci</i></th> <th data-bbox="727 1115 1252 1184"></th> </tr> </thead> <tbody> <tr> <td data-bbox="358 1184 727 1253">Soap <i>Sabun</i></td> <td data-bbox="727 1184 1252 1253"></td> </tr> </tbody> </table>	Type of cleaning agent <i>Jenis agen pencuci</i>		Soap <i>Sabun</i>		1			
Type of cleaning agent <i>Jenis agen pencuci</i>								
Soap <i>Sabun</i>								
No response or wrong response	0							

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**END OF MARKING SCHEME**