



# 2023 KIMIA PRAKTIS TOPIKAL

**KERTAS 1 & KERTAS 2  
TINGKATAN 5  
SKEMA JAWAPAN**

Unit Kimia  
Bahagian Pendidikan Menengah MARA

**BAB 1 : KESEIMBANGAN REDOKS**

<b>NO</b>	<b>JAWAPAN</b>	<b>SOALAN</b>
1	B	(Q18, SPM 2021)
2	B	(Q19, SPM 2021)
3	B	(Q20, SPM 2021)
4	A	(Q13, SPM 2022)
5	C	(Q14, SPM 2022)
6	B	(Q15, SPM 2022)
7	B	(Q16, SPM 2022)
8	A	(Q9, SPMRSM 2021)
9	D	(Q10, SPMRSM 2021)
10	D	(Q26, SPMRSM 2021)
11	D	(Q35, SPMRSM 2021)
12	A	(Q36, SPMRSM 20216)
13	D	(Q40, SPMRSM 2021)
14	D	(Q8, SPMRSM 2022)
15	B	(Q10, SPMRSM 2022)
16	D	(Q35, SPMRSM 2022)
17	A	(SPMRSM 2022, Q39)
18	D	(SPMRSM 2022, Q40)
19	C	(SBP 2021, Q9)
20	D	(SBP 2021, Q29)
21	A	(SBP 2021, Q36)
22	D	(SBP 2022, Q25)
23	B	(SBP 2022, Q34)

**BAB 2: SEBATIAN KARBON**

<b>NO</b>	<b>JAWAPAN</b>	<b>SOALAN</b>
1	<b>C</b>	Q21, SPM 2021
2	<b>C</b>	Q22, SPM 2021
3	<b>C</b>	Q23, SPM 2021
4	<b>B</b>	Q24, SPM 2021
5	<b>A</b>	Q36, SPM 2021
6	<b>C</b>	Q17, SPM 2022
7	<b>D</b>	Q18, SPM 2022
8	<b>C</b>	Q19, SPM 2022
9	<b>C</b>	Q20, SPM 2022
10	<b>B</b>	Q21, SPM 2022
11	<b>B</b>	Q11, SPMRSM 2021
12	<b>A</b>	Q12, SPMRSM 2021
13	<b>C</b>	Q27, SPMRSM 2021
14	<b>B</b>	Q38, SPMRSM 2022
15	<b>A</b>	Q9, SPMRSM 2022
16	<b>C</b>	Q11, SPMRSM 2021
17	<b>B</b>	Q37, SPMRSM 2022
18	<b>A</b>	Q13, SBP 2021
19	<b>C</b>	Q27, SBP 2021
20	<b>A</b>	Q12, SBP 2022
21	<b>A</b>	Q26, SBP 2022
22	<b>C</b>	Q32, SBP 2022

**BAB 3: TERMOKIMIA**

<b>NO</b>	<b>JAWAPAN</b>	<b>SOALAN</b>
1	B	Q25, SPM 2021
2	C	SQ26, PM 2021
3	C	Q37, SPM 2021
4	D	Q39, SPM 2021
5	B	Q22, SPM 2022
6	C	Q24, SPM 2022
7	D	Q36, SPM 2022
8	D	Q37, SPM 2022
9	D	Q38, SPM 2022
10	D	Q13, SPMRSM 2021
11	D	Q24, SPMRSM 2021
12	C	Q28, SPMRSM 2021
13	C	Q37, SPMRSM 2021
14	B	Q25, SPMRSM 2022
15	C	Q27, SPMRSM 2022
16	A	Q36, SPMRSM 2022
17	D	Q14, SBP 2021
18	B	Q26, SBP 2021
19	C	Q37, SBP 2021
20	C	Q13, SBP 2022
21	A	Q27, SBP 2022
22	B	Q31, SBP 2022
23	D	Q38, SBP 2022

**BAB 4: POLIMER**

<b>NO</b>	<b>JAWAPAN</b>	<b>SOALAN</b>
1	C	Q27, SPM 2021
2	D	Q28, SPM 2021
3	B	Q25, SPM 2022
4	D	Q29, SPMRSM 2021
5	D	Q28, SPMRSM 2022
6	D	Q29, SPMRSM 2022
7	D	Q15, SBP 2021
8	A	Q28, SBP 2021
9	C	Q38, SBP 2021
10	A	Q14, SBP 2022
11	D	Q28, SBP 2022

**BAB 5: KIMIA KONSUMER DAN INDUSTRI**

<b>NO</b>	<b>JAWAPAN</b>	<b>SOALAN</b>
1	A	(Q29, SPM 2021)
2	B	(Q30, SPM 2021)
3	A	(Q26, SPM 2022)
4	C	(Q27, SPM 2022)
5	A	(Q28, SPM 2022)
6	B	(Q15, SPMRSM 2021)
7	B	(Q30, SPMRSM 2021)
8	A	(Q14, SPMRSM 2022)
9	D	(Q24, SPMRSM 2022)
10	A	(Q11, SBP 2021)
11	D	(Q25, SBP 2021)
12	B	(Q30, SBP 2021)
13	A	(Q15, SBP 2022)
14	D	(Q29, SBP 2022)
15	C	(Q30, SBP 2022)

**SKEMA PEMARKAHAN  
KERTAS 2  
BAB 1: KESEIMBANGAN REDOKS**

No.	Mark Scheme		Sub Mark	Total Mark
<b>1</b>	(Q11, SPM 2021)			
(a)	(i)	<p><b>[Boleh menyatakan maksud tindak balas redoks dengan betul]</b></p> <p>Answer:</p> <p>Tindak balas yang melibatkan pengoksidaan dan penurunan yang berlaku secara serentak // Reaction which involves oxidation and reduction occur simultaneously.</p>	1	1
	(ii)	<p>P1: Kuprum/ copper // Cu P2: Argentum nitrat/ <i>Silver nitrate</i> // AgNO<sub>3</sub> P3: X + 2YNO<sub>3</sub> → X(NO<sub>3</sub>)<sub>2</sub> + 2Y</p>	1 1 2	4
(b)		<p>P1: X: Klorin / <i>Chlorine</i> // Cl<sub>2</sub> P2: Y: Iodin / <i>Iodine</i> // I<sub>2</sub> P3: Z: Bromin / <i>Bromine</i> // Br<sub>2</sub> P4:</p> <ul style="list-style-type: none"> <li>• Eksperimen I / <i>Experiment I</i> dan/ and Eksperimen III / <i>Experiment III</i></li> </ul> <p><b>Eksperimen I / <i>Experiment I</i></b> P6: Setengah persamaan pengoksidaan / <i>oxidation half equation</i> 2Br<sup>-</sup> → Br<sub>2</sub> + 2e P7: Setengah persamaan penurunan / <i>reduction half equation</i> Cl<sub>2</sub> + 2e → 2Cl<sup>-</sup></p> <p>Atau / <i>or</i></p> <p><b>Eksperimen III / <i>Experiment III</i></b> P6: Setengah persamaan pengoksidaan / <i>oxidation half equation</i> 2I<sup>-</sup> → I<sub>2</sub> + 2e P7: Setengah persamaan penurunan / <i>reduction half equation</i> Br<sub>2</sub> + 2e → 2Br<sup>-</sup></p>	1 1 1 1+1  1 1	7
(c)		<p>P1: Kaedah I / <i>Method I</i>: Badan kapal dicat / <i>Paint ship's hull</i> P2: Lapisan pelindung / <i>protected layer</i></p>	1  1	2

**PRAKTIS TOPIKAL: KERTAS 2  
BPM 2023**

		<p>Menghalang udara dan air bersentuhan dengan besi / <i>Prevent oxygen and water from contact with iron</i></p> <p>Atau / <i>or</i></p> <p>P1: Kaedah 2 / <i>Method 2:</i> Blok zink / <i>Zinc block</i></p> <p>P2: Zink dioksidakan / <i>Zinc is oxidised</i> Zink merupakan logam korban / <i>Zinc is a sacrificial metal</i></p>										
(6)		<p>Sampel jawapan:</p> <table border="1" style="width: 100%;"> <thead> <tr> <th style="text-align: center;"><b>Cadangan / Suggestion</b></th> <th style="text-align: center;"><b>Penerangan / Explanation</b></th> </tr> </thead> <tbody> <tr> <td>P1. Bersihkan rantai berkarat dengan kertas pasir // <i>Clean the rusty chain with sand paper</i></td> <td>P2. Untuk membuang lapisan oksida // <i>To remove the oxide layer</i></td> </tr> <tr> <td>P3. Semburkan gris / minyak pada rantai // <i>Spray grease / oil the chain</i></td> <td>P4. Basikal bergerak dengan lancar // <i>The bicycle moves smoothly</i></td> </tr> <tr> <td>P5. Sapukan cat pada rangka // <i>Coated paint on the frame</i></td> <td>P6. Untuk menghalang rangka besi bersentuhan dengan oksigen dan air // <i>To prevent iron from being in contact with oxygen and water</i></td> </tr> </tbody> </table>	<b>Cadangan / Suggestion</b>	<b>Penerangan / Explanation</b>	P1. Bersihkan rantai berkarat dengan kertas pasir // <i>Clean the rusty chain with sand paper</i>	P2. Untuk membuang lapisan oksida // <i>To remove the oxide layer</i>	P3. Semburkan gris / minyak pada rantai // <i>Spray grease / oil the chain</i>	P4. Basikal bergerak dengan lancar // <i>The bicycle moves smoothly</i>	P5. Sapukan cat pada rangka // <i>Coated paint on the frame</i>	P6. Untuk menghalang rangka besi bersentuhan dengan oksigen dan air // <i>To prevent iron from being in contact with oxygen and water</i>	<p>1+1</p> <p>1+1</p> <p>1+1</p>	<p>6</p>
<b>Cadangan / Suggestion</b>	<b>Penerangan / Explanation</b>											
P1. Bersihkan rantai berkarat dengan kertas pasir // <i>Clean the rusty chain with sand paper</i>	P2. Untuk membuang lapisan oksida // <i>To remove the oxide layer</i>											
P3. Semburkan gris / minyak pada rantai // <i>Spray grease / oil the chain</i>	P4. Basikal bergerak dengan lancar // <i>The bicycle moves smoothly</i>											
P5. Sapukan cat pada rangka // <i>Coated paint on the frame</i>	P6. Untuk menghalang rangka besi bersentuhan dengan oksigen dan air // <i>To prevent iron from being in contact with oxygen and water</i>											
<b>Total</b>			<b>20</b>									



**PRAKTIS TOPIKAL: KERTAS 2**  
**BPM 2023**

No.	Mark Scheme		Sub Mark	Total Mark	
<b>2</b>	(Q6, SPM 2022)				
	(a)	<p><b>[Able to give definition of redox reaction]</b></p> <p>Sample answer:</p> <p>Chemical reaction in which oxidation and reduction occur simultaneously/at the same time</p>	1	1	
	(b)	(i)	<p><b>[Able to state substance that undergo oxidation solution correctly]</b></p> <p>Iron(II) sulphate solution</p>	1	1
		(ii)	<p><b>[Able to write the half equation for oxidation correctly]</b></p> <p><math>\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}^{-}</math></p>	1	1
		(iii)	<p><b>[Able to calculate the oxidation number of sulphur in iron(I) sulphate correctly]</b></p> <p><math>(+2) + \text{S} + 4(-2) = 0</math></p> <p>The oxidation number of S = +2</p>	1 1	2
	(c)	(i)	<p><b>[Able to suggest substance X and determine the role of green solution in Set I and the role of brown solution in Set II.]</b></p> <p>Substance X: Mg / Al / Zn</p> <p>Green solution shows the presence of <math>\text{Fe}^{2+}</math></p> <p>Brown solution shows the presence of <math>\text{Fe}^{3+}</math></p>	1 1 1	3
		(ii)	<p><b>[Able to write the equation for substance X correctly]</b></p> <p><math>\text{Mg}^{2+} \rightarrow \text{Mg}^{2+} + 2\text{e}^{-}</math></p>	1	1
			<b>Total</b>	<b>9</b>	

No.	Mark Scheme		Sub Mark	Total Mark
<b>3</b>	(Q7, SPMRSM 2021)			
	(a)	<p><b>[Able to state the meaning of redox reaction correctly]</b></p> <p>Answer:</p> <p>Chemical reaction where oxidation and reduction occur simultaneously/ at the same time</p>	1	1
	(b)	<p style="text-align: center;">(i)</p> <p><b>[Able to state the strongest reducing agent correctly]</b></p> <p>Answer:</p> <p>Mg // Magnesium</p>	1	1
		<p style="text-align: center;">(ii)</p> <p><b>[Able to calculate the oxidation number for chromium in <math>\text{Cr}_2\text{O}_7^{2-}</math> correctly]</b></p> <p>Answer:</p> <p><math>2x + 7(-2) = -2</math></p> <p><math>x = +6</math></p>	1	1
	(c)	<p style="text-align: center;">(i)</p> <p><b>[Able to state the observation in Beaker A after 30 minutes correctly]</b></p> <p>Answer:</p> <p>Intensity of blue colour decreases // Electrode becomes thicker.</p>	1	1
		<p style="text-align: center;">(ii)</p> <p><b>[Able to state and explain which electrode will undergo oxidation in terms of standard electrode potential correctly]</b></p> <p>Answer:</p> <p>P1. Sn/Tin P2. Standard electrode potential value for Sn/tin is more negative/less positive than Cu/copper // Standard electrode potential value for Cu/copper is more positive/less negative than Sn/tin</p>	1 1	2

		<p>(iii) <b>[Able to write the cell notation for the voltaic cell in Diagram 7 and calculate the cell voltage correctly]</b></p> <p>Answer:</p> <p>P1. <math>\text{Sn(s)}   \text{Sn}^{2+}(\text{aq})    \text{Cu}^{2+}(\text{aq})   \text{Cu(s)}</math></p> <p>P2. <math>E^0_{\text{cell}} = E_{\text{cathode}} - E_{\text{anode}}</math>  <math>= (+0.34) - (-0.14) = +0.48\text{V}</math></p>	<p style="text-align: center;">1</p> <p style="text-align: center;">1</p>	<p style="text-align: center;">2</p>
		<p>(iv) <b>[Able to describe how to increase the cell voltage of the two half-cells based on answer in 7(c)(iii) correctly]</b></p> <p>Sample answer:</p> <p>P1. Replace Sn with Mg  P2. Replace tin(II) nitrate solution with magnesium nitrate solution.</p> <p style="text-align: center;">OR</p> <p>P1. Replace Cu with Ag  P2. Replace copper(II) nitrate solution with silver nitrate solution.</p>	<p style="text-align: center;">1</p> <p style="text-align: center;">1</p>	<p style="text-align: center;">2</p>
<b>Total</b>			<b>10</b>	

No.	Mark Scheme		Sub Mark	Total Mark
<b>4</b>	(Q8, SPMRSM 2021)			
(a)	(i)	<p><b>[Able to suggest metal Q correctly]</b></p> <p>Answer: Zn/Zinc</p>	1	1
	(ii)	<p><b>[Able to calculate the change in temperature correctly]</b></p> <p>P1. Number of mole of Pb<sup>2+</sup>/Pb displaced            P2. Ratio of the heat release            P3. Temperature with correct unit</p> <p>Sample answer:</p> <p>P1. Number of moles of Pb<sup>2+</sup>/Pb displaced            = MV/1000            = 0.5 x 100/1000            = 0.05 mol</p> <p>P2. 1 mol of Pb displaced releases 112000J of heat            0.05 mol of Pb displaced releases 5600J of heat            //  <math>Q = n \times \Delta H</math>            = 0.05 mol x 112000 J mol<sup>-1</sup>            = 5600 J</p> <p>P3. Heat given out = mc<math>\theta</math>            5600 J = (100)(4.2)(<math>\theta</math>)  <math>\theta = 13.3 \text{ }^\circ\text{C}</math></p>	1 1 1	3
(b)	(i)	<p><b>[Able to identify acid R and acid S correctly]</b></p> <p>Answer:</p> <p>R : Ethanoic acid // any weak acids            S : Hydrochloric acid // any strong acids</p> <p>Accept formula of acids</p>	1 1	2
	(ii)	<p><b>[Able to write the thermochemical equation for the reaction between acid R and potassium hydroxide solution correctly]</b></p> <p>P1. Correct formulae of reactants and products            P2. <math>\Delta H</math> with correct value and unit</p> <p>Answer:  <math>\text{CH}_3\text{COOH} + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O}</math>  <math>\Delta H = -55 \text{ kJ mol}^{-1}</math></p> <p>Penalty P2 if no equation/P1 given</p>	1 1	2

	(iii)	<p><b>[Able to explain the difference in heat of neutralisation for both reactions correctly]</b></p> <p>Sample answer:</p> <p>P1. Ethanoic acid/ acid R ionizes partially in water and some remain as molecules (to produce low concentration of H<sup>+</sup> ions) while hydrochloric acid/ acid S ionized completely in water (to produce high concentration of H<sup>+</sup> ions)</p> <p>// Ethanoic acid/ acid R is a weak acid while hydrochloric acid/ acid S is a strong acid</p> <p>P2. Some of the heat released during neutralisation is absorbed by ethanoic acid/ acid R molecules and used to completely ionise the weak acid</p> <p>Note: mention <u>molecules</u> at least once</p>	1	
			1	2
<b>Total</b>				<b>10</b>

**TOPIC 1: REDOX EQUILIBRIUM**

BAHAGIAN A / SECTION A

(SPM 2022)

No.		Mark Scheme	Sub Mark	Total Mark
6	(a)	<p><b>[Able to give definition of redox reaction]</b></p> <p>Sample answer:</p> <p>Chemical reaction in which oxidation and reduction occur simultaneously/at the same time</p>	1	1
	(b) (i)	<p><b>[Able to state substance that undergo oxidation solution correctly]</b></p> <p>Iron(II) sulphate solution</p>	1	1
	(ii)	<p><b>[Able to write the half equation for oxidation correctly]</b></p> <p><math>Fe^{2+} \rightarrow Fe^{3+} + e^{-}</math></p>	1	1
	(iii)	<p><b>[Able to calculate the oxidation number of sulphur in iron(I) sulphate correctly]</b></p> <p><math>(+2) + S + 4(-2) = 0</math></p>	1	

**PRAKTIS TOPIKAL: KERTAS 2**  
**BPM 2023**

No.		Mark Scheme	Sub Mark	Total Mark
		The oxidation number of S = +2	1	2
(c)	(i)	<p><b>[Able to suggest substance X and determine the role of green solution in Set I and the role of brown solution in Set II.]</b></p> <p>Substance X: Mg / Al / Zn</p> <p>Green solution shows the presence of Fe<sup>2+</sup></p> <p>Brown solution shows the presence of Fe<sup>3+</sup></p>	1 1 1	3
	(ii)	<p><b>[Able to write the equation for substance X correctly]</b></p> <p><math>Mg^{2+} \rightarrow Mg^{2+} + 2e^{-}</math></p>	1	1
			<b>Total</b>	<b>9</b>

No.	Mark Scheme	Sub Mark	Total Mark
<b>5</b>	(Q8, SPMRSM 2022)		
(a)	(i) <b>[Able to state all anions present in NaCl solution correctly]</b> Sample answer: Chloride and hydroxide ions // Cl <sup>-</sup> & OH <sup>-</sup>	1	1
	(ii) <b>[Able to name the product formed at electrode P correctly]</b> Answer: Chlorine r: formula	1	1
	(iii) <b>[Able to explain the selection of ions to be discharged at electrode P correctly]</b> Answer: Concentration of chloride ions/Cl <sup>-</sup> is higher than hydroxide ions/OH <sup>-</sup>	1	1
	(iv) <b>[Able to describe a chemical test to verify the product formed at electrode P]</b> P1. Method and reagent P2. Observation Sample answer: P1. Place a damp blue litmus paper into a test tube containing the product formed P2. Blue litmus paper turns to red and then <u>bleached</u>	1 1	2
(b)	<b>[Able to write the half equation correctly]</b> Answer: $4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$	1	1
(c)	(i) <b>[Able to compare and explain the difference in the observations correctly]</b> Sample answer: P1. Inference based on observation in Test tube I and II P2. Reason for observation in Test tube I P3. Reason for observation in Test tube II P1. Test tube I : Lead metal formed Test tube II: No reaction occurs P2. Test tube I : Lead(II) ion receives/gains electron to form lead atom //	1 1 1	3

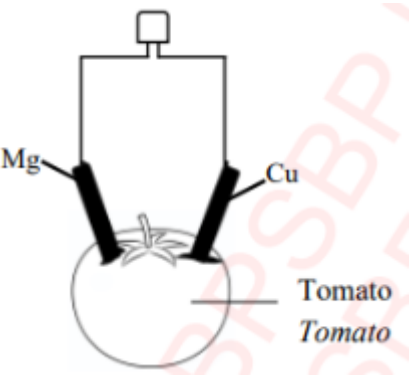
**PRAKTIS TOPIKAL: KERTAS 2  
BPM 2023**

No.	Mark Scheme	Sub Mark	Total Mark
	<p>Lead is displaced from lead(II) nitrate solution by iron //</p> <p>Iron is more electropositive than lead //</p> <p><math>E^0</math> value of iron is more negative than <math>E^0</math> value of lead</p> <p>P3. Test tube II : Copper cannot displace lead from lead(II) nitrate solution//</p> <p>Copper less electropositive than lead //</p> <p><math>E^0</math> value of copper is more positive than <math>E^0</math> value of lead</p>		
	<p>(ii) <b>[Able to suggest an action to be taken to ensure reaction occurs in test tube II correctly]</b></p> <p>Sample answer:</p> <p>Change copper wire with a more electropositive metal //</p> <p>Change copper wire with a metal with more negative <math>E^0</math> value. //</p> <p>Change lead(II) nitrate solution with silver nitrate solution</p>	1	1
<b>Total</b>			<b>10</b>

No.	Mark Scheme	Sub Mark	Total Mark
<b>6</b>	(Q11, SBP 2021)		
(a)	<p><b>[Boleh menyatakan maksud tindak balas redoks dengan betul]</b></p> <p>Answer:</p> <p>Tindak balas kimia yang melibatkan pengoksidaan dan penurunan berlaku secara serentak //</p> <p>Chemical reaction where oxidation and reduction occur simultaneously.</p>	1	1
(b)	<p>(i) <b>[Boleh mengenal pasti terminal positif dan terminal negatif sel dengan betul]</b></p> <p>Answer:</p> <p>1. Terminal negatif / <i>Negative terminal</i>: Magnesium // Mg</p> <p>2. Terminal positif / <i>Postive terminal</i>: Argentum // Ag</p>	1 1	2



(b)	(ii)	<p><b>[Boleh menulis persamaan ion keseluruhan dengan betul]</b></p> <p>3. Formula bahan dan hasil tindak balas yang betul 4. Persamaan seimbang</p> <p>Answer: <math>Mg + 2Ag^+ \rightarrow Mg^{2+} + 2Ag</math></p>	1  1	  2				
(b)	(iii)	<p><b>[Boleh menulis notasi sel kimia dengan betul]</b></p> <p>5. Formula bahan tindak balas, hasil tindak balas, keadaan fizik dan kemolaran yang betul 6. Susunan pengoksidaan dan penurunan yang betul</p> <p>Answer: <math>Mg (p/s)   Mg^{2+} (ak/aq, 1.0 \text{ mol dm}^{-3})    Ag^+ (ak/aq, 1.0 \text{ mol dm}^{-3})   Ag (p/s)</math></p>	1  1	  2				
(c)		<p><b>[Boleh membandingkan sel P dan sel Q berdasarkan perubahan warna larutan kuprum(II) sulfat selepas eksperimen dijalankan selama 30 minit dan meneangkan jawapan dengan betul]</b></p> <p>Sampel jawapan:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">Sel P / Cell P</th> <th style="width: 50%; text-align: center;">Sel Q / Cell Q</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;"> <p>1. Warna biru larutan kuprum(II) sulfat / <math>CuSO_4</math> menjadi semakin pudar // Keamatan warna biru kuprum(II) sulfat / <math>CuSO_4</math> berkurang // <i>Blue colour of copper(II) sulphate / <math>CuSO_4</math> solution becomes paler // Intensity of the blue colour of copper(II) sulphate / <math>CuSO_4</math> solution decreases</i></p> </td> <td style="vertical-align: top;"> <p>Warna biru larutan kuprum(II) sulfat / <math>CuSO_4</math> tidak berubah // Keamatan warna biru kuprum(II) sulfat / <math>CuSO_4</math> tidak berubah // <i>Blue colour of copper(II) sulphate / <math>CuSO_4</math> solution unchanged // Intensity of the blue colour of copper(II) sulphate / <math>CuSO_4</math> solution unchanged</i></p> </td> </tr> </tbody> </table>	Sel P / Cell P	Sel Q / Cell Q	<p>1. Warna biru larutan kuprum(II) sulfat / <math>CuSO_4</math> menjadi semakin pudar // Keamatan warna biru kuprum(II) sulfat / <math>CuSO_4</math> berkurang // <i>Blue colour of copper(II) sulphate / <math>CuSO_4</math> solution becomes paler // Intensity of the blue colour of copper(II) sulphate / <math>CuSO_4</math> solution decreases</i></p>	<p>Warna biru larutan kuprum(II) sulfat / <math>CuSO_4</math> tidak berubah // Keamatan warna biru kuprum(II) sulfat / <math>CuSO_4</math> tidak berubah // <i>Blue colour of copper(II) sulphate / <math>CuSO_4</math> solution unchanged // Intensity of the blue colour of copper(II) sulphate / <math>CuSO_4</math> solution unchanged</i></p>	1	1
Sel P / Cell P	Sel Q / Cell Q							
<p>1. Warna biru larutan kuprum(II) sulfat / <math>CuSO_4</math> menjadi semakin pudar // Keamatan warna biru kuprum(II) sulfat / <math>CuSO_4</math> berkurang // <i>Blue colour of copper(II) sulphate / <math>CuSO_4</math> solution becomes paler // Intensity of the blue colour of copper(II) sulphate / <math>CuSO_4</math> solution decreases</i></p>	<p>Warna biru larutan kuprum(II) sulfat / <math>CuSO_4</math> tidak berubah // Keamatan warna biru kuprum(II) sulfat / <math>CuSO_4</math> tidak berubah // <i>Blue colour of copper(II) sulphate / <math>CuSO_4</math> solution unchanged // Intensity of the blue colour of copper(II) sulphate / <math>CuSO_4</math> solution unchanged</i></p>							

		<p>2. Kepekatan ion kuprum(II) / <math>\text{Cu}^{2+}</math> berkurang // Concentration of <math>\text{Cu}^{2+}</math> / copper(II) ion decreases</p>	<p>Kepekatan ion kuprum(II) / <math>\text{Cu}^{2+}</math> tidak berubah // Concentration of <math>\text{Cu}^{2+}</math> / copper(II) ion unchanged</p>		1+1	
		<p>3. Ion kuprum(II) / <math>\text{Cu}^{2+}</math> dinyahcas membentuk atom Cu / kuprum di katod // <math>\text{Cu}^{2+}</math> / copper(II) ion is discharged to form Cu / copper atom at cathode.</p>	<p>4. Kadar nyahcas ion ion kuprum(II) / <math>\text{Cu}^{2+}</math> kepada tom Cu/ kuprum di katod adalah sama dengan// The rate of Cu/ copper atom at cathode is equal to the</p> <p>5. kadar atom Cu/ kuprum mengion kepada ion kuprum(II)/ <math>\text{Cu}^{2+}</math> di anod// rate of Cu/ copper atom ionizes to <math>\text{Cu}^{2+}</math> / copper(II) ion at anode.</p>		1	5
(d)		<p><b>[Boleh melukis radas sel kimia dengan menggunakan dua logam berbeza dengan betul]</b></p> <p>1. Rajah berfungsi 2. Label setiap logam dan tomato</p> <p>Sampel jawapan:</p>  <p><b>[Boleh menghuraikan secara ringkas langkah pembinaan sel kimia dan menerangkan tindak balas redoks yang berlaku dengan betul]</b></p>			1 1	

		<p>Sampel jawapan:</p> <p>3. Gosok kepingan magnesium dan wayar kuprum dengan kertas pasir // <i>Clean magnesium strip and copper wire using sandpaper.</i></p> <p>4. Sambungkan kepingan magnesium dan wayar kuprum kepada mentol LED menggunakan wayar penyambung // <i>Connect the magnesium strip and copper wire to the LED bulb using connecting wire.</i></p> <p>5. Cucuk kepingan magnesium dan wayar kuprum pada tomato// <i>Insert magnesium strip and copper wire into tomato.</i></p> <p>6. Atom magnesium melepaskan elektron membentuk ion <math>Mg^{2+}</math> // Magnesium mengalami pengoksidaan // <i>Magnesium atom loses electron to form <math>Mg^{2+}</math> ion// Magnesium undergoes oxidation.</i></p> <p>7. Ion <math>H^+</math> menerima elektron membentuk gas hydrogen// Ion <math>H^+</math> mengalami penurunan// <i><math>H^+</math> ion gains elektron to form hydrogen gas// <math>H^+</math> ion undergoes reduction.</i></p> <p><b>[Boleh menentukan nilai bacaan voltan yang diperolehi dengan betul]</b></p> <p>Sampel jawapan:</p> <ul style="list-style-type: none"> <li><math>E^{\circ} \text{ sel} = (+0.34) - (-2.38) // +2.72 \text{ V}</math></li> </ul>	1	
			1	
			1	
			1	
			1	8
<b>Total</b>				<b>20</b>

**PRAKTIS TOPIKAL: KERTAS 2**  
**BPM 2023**

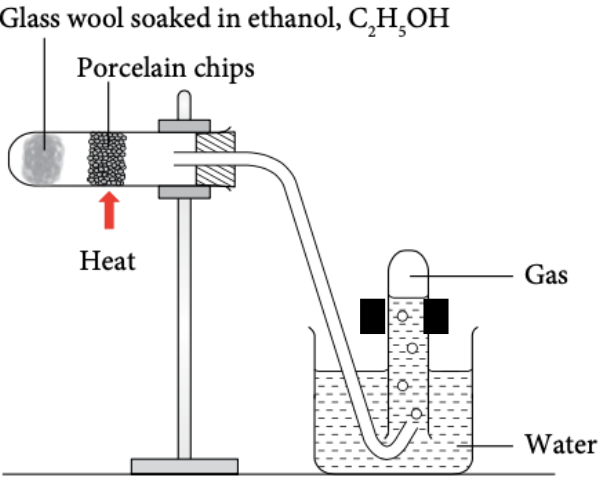
No.	Mark Scheme		Sub Mark	Total Mark
<b>7</b>	(Q7, SBP 2022)			
(a)	(i)	<p><b>[Dapat menyatakan satu keadaan piawai dengan betul]</b></p> <p>Contoh jawapan:</p> <p>Kepekatan ion di dalam larutan akueus 1.0 mol dm<sup>-3</sup> // Tekanan gas 1 atm atau 101 kPa// Suhu 25 °C atau 298K // Platinum digunakan sebagai elektrod // <i>Concentration of ions in aqueous solutions is 1.0 mol dm<sup>-3</sup>// Gas pressure of 1 atm or 101 kPa // Temperature at 25°C or 298K // Platinum is used as an electrode</i></p>	1	1
	(ii)	<p><b>[Dapat mencadangkan elektrolit dengan betul]</b></p> <p>Contoh jawapan:</p> <p>Argentum nitrat// AgNO<sub>3</sub>// <i>Silver nitrate</i></p>	1	1
	(iii)	<p><b>[Dapat menyatakan pengubahsuaian yang telah dilakukan terhadap susunan radas dalam Jadual 7.1 dan menerangkan bagaimana gas itu terhasil dengan betul]</b></p> <p>Contoh jawapan:</p> <p>1. Elektrod argentum ditukarkan kepada elektrod karbon// <i>Silver electrode is changed to carbon electrode</i></p> <p>2. Ion OH<sup>-</sup> terpilih untuk dinyahcaskan // OH<sup>-</sup> value chosen to be discharged</p> <p>3. Kerana nilai E° OH<sup>-</sup> lebih negatif berbanding NO<sub>3</sub><sup>-</sup> // <i>Because the E° value of OH<sup>-</sup> is more negative than NO<sub>3</sub><sup>-</sup></i></p>	1  1  1	3
(b)		<p><b>[Dapat mewajarkan proses pengekstrakan di industri dengan betul]</b></p> <p>Contoh jawapan:</p> <p>1. Sesuai// Suitable 2. Permintaan yang tinggi terhadap aluminium// <i>High demand of aluminium</i></p> <p><b>Atau</b></p> <p>1. Tidak sesuai// <i>Not suitable</i></p>	1 1	2

**PRAKTIS TOPIKAL: KERTAS 2**  
**BPM 2023**

No.	Mark Scheme	Sub Mark	Total Mark								
	2. Memberikan kesan negatif kepada alam sekitar// <i>Gives negative effect to the environment</i>										
(c)	<p><b>[Dapat menerangkan perbezaan dalam pemerhatian bagi Set I dan Set II dengan betul]</b></p> <p>Contoh jawapan:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Set I</th> <th style="text-align: center;">Set II</th> </tr> </thead> <tbody> <tr> <td>1. Paku besi berkarat // <i>Iron nail rust</i></td> <td>Paku besi tidak berkarat // <i>Iron nail does not rust</i></td> </tr> <tr> <td>2. Ion ferum(II) / <math>Fe^{2+}</math> hadir <i>Iron(II) ion / <math>Fe^{2+}</math> present</i></td> <td>Ion ferum(II) / <math>Fe^{2+}</math> tidak hadir // <i>Iron(II) ion / <math>Fe^{2+}</math> absent</i></td> </tr> <tr> <td>3. Kuprum / Cu kurang elektropositif berbanding ferum / Fe // <i>Copper is less electropositive than iron / Fe</i></td> <td>Zink/ Zn lebih elektropositif berbanding ferum / Fe // <i>Zinc/ Zn is more electropositive than iron/ Fe</i></td> </tr> </tbody> </table>	Set I	Set II	1. Paku besi berkarat // <i>Iron nail rust</i>	Paku besi tidak berkarat // <i>Iron nail does not rust</i>	2. Ion ferum(II) / $Fe^{2+}$ hadir <i>Iron(II) ion / <math>Fe^{2+}</math> present</i>	Ion ferum(II) / $Fe^{2+}$ tidak hadir // <i>Iron(II) ion / <math>Fe^{2+}</math> absent</i>	3. Kuprum / Cu kurang elektropositif berbanding ferum / Fe // <i>Copper is less electropositive than iron / Fe</i>	Zink/ Zn lebih elektropositif berbanding ferum / Fe // <i>Zinc/ Zn is more electropositive than iron/ Fe</i>	<p>1</p> <p>1</p> <p>1</p>	3
Set I	Set II										
1. Paku besi berkarat // <i>Iron nail rust</i>	Paku besi tidak berkarat // <i>Iron nail does not rust</i>										
2. Ion ferum(II) / $Fe^{2+}$ hadir <i>Iron(II) ion / <math>Fe^{2+}</math> present</i>	Ion ferum(II) / $Fe^{2+}$ tidak hadir // <i>Iron(II) ion / <math>Fe^{2+}</math> absent</i>										
3. Kuprum / Cu kurang elektropositif berbanding ferum / Fe // <i>Copper is less electropositive than iron / Fe</i>	Zink/ Zn lebih elektropositif berbanding ferum / Fe // <i>Zinc/ Zn is more electropositive than iron/ Fe</i>										
	Jumlah	10									

SKEMA PEMARKAHAN  
KERTAS 2  
BAB 2: SEBATIAN KARBON

No	Answer Scheme	Sub Mark	Mark												
1	(Q9, SPM 2021)														
	(a) Organic compounds containing only hydrogen and carbon	1	1												
	(b) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Compounds</th> <th style="width: 25%;">Homologous series</th> <th style="width: 50%;">Structural formula</th> </tr> </thead> <tbody> <tr> <td>P Ethene, C<sub>2</sub>H<sub>4</sub></td> <td>Alkene</td> <td> <math display="block">  \begin{array}{c}  \text{H} &amp; &amp; \text{H} \\  &amp; \backslash &amp; / \\  &amp; \text{C} = \text{C} \\  &amp; / &amp; \backslash \\  \text{H} &amp; &amp; \text{H}  \end{array}  </math> </td> </tr> <tr> <td>Q Ethane, C<sub>2</sub>H<sub>6</sub></td> <td>Alkane</td> <td> <math display="block">  \begin{array}{c}  \text{H} &amp; \text{H} \\    &amp;   \\  \text{H}-\text{C} &amp; -\text{C}-\text{H} \\    &amp;   \\  \text{H} &amp; \text{H}  \end{array}  </math> </td> </tr> <tr> <td>R Ethanoic acid, CH<sub>3</sub>COOH, C<sub>2</sub>H<sub>4</sub>O<sub>2</sub></td> <td>Carboxylic acid</td> <td> <math display="block">  \begin{array}{c}  \text{H} &amp; \text{O} \\    &amp;    \\  \text{H}-\text{C} &amp; -\text{C}-\text{OH} \\    \\  \text{H}  \end{array}  </math> </td> </tr> </tbody> </table>	Compounds	Homologous series	Structural formula	P Ethene, C <sub>2</sub> H <sub>4</sub>	Alkene	$  \begin{array}{c}  \text{H} & & \text{H} \\  & \backslash & / \\  & \text{C} = \text{C} \\  & / & \backslash \\  \text{H} & & \text{H}  \end{array}  $	Q Ethane, C <sub>2</sub> H <sub>6</sub>	Alkane	$  \begin{array}{c}  \text{H} & \text{H} \\    &   \\  \text{H}-\text{C} & -\text{C}-\text{H} \\    &   \\  \text{H} & \text{H}  \end{array}  $	R Ethanoic acid, CH <sub>3</sub> COOH, C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	Carboxylic acid	$  \begin{array}{c}  \text{H} & \text{O} \\    &    \\  \text{H}-\text{C} & -\text{C}-\text{OH} \\    \\  \text{H}  \end{array}  $	1+1+1   1+1+1   1+1+1	9
Compounds	Homologous series	Structural formula													
P Ethene, C <sub>2</sub> H <sub>4</sub>	Alkene	$  \begin{array}{c}  \text{H} & & \text{H} \\  & \backslash & / \\  & \text{C} = \text{C} \\  & / & \backslash \\  \text{H} & & \text{H}  \end{array}  $													
Q Ethane, C <sub>2</sub> H <sub>6</sub>	Alkane	$  \begin{array}{c}  \text{H} & \text{H} \\    &   \\  \text{H}-\text{C} & -\text{C}-\text{H} \\    &   \\  \text{H} & \text{H}  \end{array}  $													
R Ethanoic acid, CH <sub>3</sub> COOH, C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	Carboxylic acid	$  \begin{array}{c}  \text{H} & \text{O} \\    &    \\  \text{H}-\text{C} & -\text{C}-\text{OH} \\    \\  \text{H}  \end{array}  $													
	(c) <p>P1 P2 : C<sub>2</sub>H<sub>4</sub> + H<sub>2</sub> → C<sub>2</sub>H<sub>6</sub></p> <p>P3: no of mol of C<sub>2</sub>H<sub>4</sub> = 0.48/24 = 0.02 mol</p> <p>P4: 1 mol of C<sub>2</sub>H<sub>4</sub> : 1 mol C<sub>2</sub>H<sub>6</sub> 0.02 mol C<sub>2</sub>H<sub>4</sub> : 0.02 mol C<sub>2</sub>H<sub>6</sub></p> <p>P5: volume of C<sub>2</sub>H<sub>6</sub>: 0.02 x 24 = 0.48 dm<sup>3</sup>//480cm<sup>3</sup></p>	1+1 1  1  1	5												

	(d)	<p>Reaction III: oxidation Method: Reflux Colour changes: orange to green</p>  <p>Labelled diagram 1 Functional diagram 1</p>	<p>1 1 1</p> <p>1 1</p>	<p>3</p> <p>5</p>
2	(Q9, SPM 2022)			
	(c)	<p>P1: The <b>molecular formula</b> is the chemical formula that shows the <b>actual number</b> of atoms of each element in a molecule of a compound// molecule</p> <p>P2: hexene and hydrogen are reactants while hexane is the product</p> <p>P2 &amp; P3: 1 mole of hexene reacts with 1 mole of hydrogen to produce 1 mole of hexane</p> <p>P4: both hexane and hexene are made up of carbon and hydrogen <b>elements</b> only</p> <p>P5: both have 6 carbon atoms.</p> <p>P6: number of hydrogen atom in hexane is 14 and number of hydrogen atoms in hexene is 12</p> <p>P7: the empirical formula of hexane is C<sub>3</sub>H<sub>7</sub> while hexene is CH<sub>2</sub></p> <p>P8: the number of atom in 1 mol of hexane is greater than 1 mol of hexene.</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>8</p>

**PRAKTIS TOPIKAL: KERTAS 2**  
**BPM 2023**

3	(Q11, SPM 2022)	Marks
(a)	P1 Alkohol // Alcohol	1
	P2 Q : Pendehidratan // dehydration	1
	P3 R : Kalium manganate (VII) berasid // kalium dikromat (VI) berasid // Acidified potassium manganate (VII) // Acidified potassium dichromate (VI)	1
	P4 Formula bahan dan hasil tindak balas	1
	P5 Persamaan seimbang	1
	$\text{C}_3\text{H}_7\text{OH} + 2[\text{O}] \rightarrow \text{C}_2\text{H}_5\text{COOH} + \text{H}_2\text{O} //$ $\text{C}_3\text{H}_7\text{OH} + 2[\text{O}] \rightarrow \text{C}_3\text{H}_6\text{O}_2$	
(b)	Karbosilat // Carboxylate // -COO	1
	Sebatian organik I : Propanol , asid etanoik	1
	Organic compound I : Propanol , ethanoic acid	1
	Sebatian organik II : Etanol , asid propanoik	1
	Organic compound II : Ethanol . propanoic acid	1
(c) (i)	P1 Etena // Ethene // $\text{C}_2\text{H}_4$	1
	P2	
	$\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{H}-\text{C}-\text{C}-\text{OH} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$	1
	P3 Kaedah I // Method I	
	P4 Bahan semula jadi // bahan organik // mudah didapati // Natural substance // organic substance // easy to get	1
	OR	1
	Boleh menghasilkan ethanol dalam kuantiti yang banyak// Etanol boleh dihasilkan dalam masa yang singkat // Can produce ethanol in large quantity // ethanol can be produced in shorter time.	



(c) (ii)	P1 Anggur // Grapes // sukrosa // (any suitable fruit / carbohydrate)	1
	P2 Kisarkan anggur itu // Blend the grapes	1
	P3 Tambah yis // Add yeast	1
	P4 Tutup kelalang kon itu dan biarkan dalam masa [1-7] hari // cover the conical flask and leave it for [1-7] days	1
	P5 Turaskan // filter	1
	P6 Sulingkan hasil turasan // Distill the filtrate	1
TOTAL		20

<b>4</b>	(Q11, SPMRSM 2021)	
(a)	Alkane	1
	$  \begin{array}{cccc}  & \text{H} & \text{H} & \text{H} & \text{H} \\  &   &   &   &   \\  \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{H} \\  &   &   &   &   \\  & \text{H} & \text{H} & \text{H} & \text{H}  \end{array}  $	1
	Butane	1
	$  \begin{array}{c}  & & \text{H} & & \\  & &   & & \\  & \text{H} & - \text{C} & - \text{H} & \\  & &   & & \\  & \text{H} & & & \text{H} \\  &   & & &   \\  \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{H} \\  &   &   &   & \\  & \text{H} & \text{H} & \text{H} &  \end{array}  $	1
	2-methylpropane	1

(ii)	<p>Similarities:</p> <ul style="list-style-type: none"> <li>• Non-hydrocarbon organic compound</li> <li>• Miscible in water</li> <li>• Low boiling point than their corresponding alkene</li> </ul> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Differences</th> </tr> <tr> <th style="width: 50%;">Compound B</th> <th style="width: 50%;">Compound C</th> </tr> </thead> <tbody> <tr> <td>Cannot react with base // no reaction</td> <td>Can react with base to produce salt and water</td> </tr> <tr> <td>Cannot react with metal/metal carbonate // no reaction</td> <td>Can react with metal/ metal carbonate</td> </tr> <tr> <td>Lower boiling point (compared to C)</td> <td>Higher boiling point (compared to B)</td> </tr> <tr> <td>pH neutral // pH = 7</td> <td>pH below 7</td> </tr> <tr> <td>Purple colour of acidified potassium manganate(VII) solution turns colourless</td> <td>No changes on purple colour of acidified potassium manganate(VII) solution</td> </tr> <tr> <td>Functional group: -OH/hydroxyl group</td> <td>Functional group: -COOH/carboxyl group</td> </tr> </tbody> </table>	Differences		Compound B	Compound C	Cannot react with base // no reaction	Can react with base to produce salt and water	Cannot react with metal/metal carbonate // no reaction	Can react with metal/ metal carbonate	Lower boiling point (compared to C)	Higher boiling point (compared to B)	pH neutral // pH = 7	pH below 7	Purple colour of acidified potassium manganate(VII) solution turns colourless	No changes on purple colour of acidified potassium manganate(VII) solution	Functional group: -OH/hydroxyl group	Functional group: -COOH/carboxyl group	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
Differences																		
Compound B	Compound C																	
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Lower boiling point (compared to C)	Higher boiling point (compared to B)																	
pH neutral // pH = 7	pH below 7																	
Purple colour of acidified potassium manganate(VII) solution turns colourless	No changes on purple colour of acidified potassium manganate(VII) solution																	
Functional group: -OH/hydroxyl group	Functional group: -COOH/carboxyl group																	
(b)	<p>P1. Pentan-1-ol P2. Ethanoic acid</p> <p><i>r: pentanol</i></p> <p>P3. Pour [2-4] cm<sup>3</sup> of glacial/pure ethanoic acid and [2-4] cm<sup>3</sup> of pure pentan-1-ol into boiling tube and mix well.</p> <p>P4. Add slowly/a few drops of concentrated sulphuric acid into the mixture.</p> <p>P5. Heat gently/warm the mixture.</p> <p>P6. Pour the mixture into a beaker containing water.</p> <p>OR</p> <p>P3. Pour [25-50] cm<sup>3</sup> of glacial/pure ethanoic acid and [25-50] cm<sup>3</sup> of pure pentan-1-ol into the round bottom flask P4. Add [3-5] cm<sup>3</sup> of concentrated sulphuric acid into the mixture. P5. Heat under reflux. P6. Collect the product formed by using distillation method</p> <p>P7. <math>\text{CH}_3\text{COOH} + \text{C}_5\text{H}_{11}\text{OH} \rightarrow \text{CH}_3\text{COOC}_5\text{H}_{11} + \text{H}_2\text{O}</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>																
(c)	P1. Sanitiser M	1																

	<p>P2. Percentage of alcohol is higher P3. Can kill germs/bacteria better</p> <p>OR</p> <p>P1. Sanitiser N P2. Percentage of alcohol is lower P3. Less irritate the skin // less harm to skin</p> <p>OR</p> <p>P1. Sanitiser M P2. Percentage of alcohol in N is lower P3. Sanitiser N has less irritation on skin// less harm to skin</p> <p>OR</p> <p>P1. Sanitiser N P2. Percentage of alcohol in M is higher P3. Sanitiser M can kill germs/bacteria better</p>	<p>1 1</p>
TOTAL		20

<b>5</b>	(Q10, SPMRSM 2022)			
(a)	(i)	<p><b>[Able to state the method and physical properties involved in the separation process of crude oil correctly]</b></p> <p>Answer</p> <p>P1. <u>Fractional</u> distillation P2. Boiling point</p>	<p>1 1</p>	2
	(ii)	<p><b>[Able to draw the structural formulae for both distillates correctly]</b></p> <p>P1. Structural formula of 2,2,4-trimethylpentane P2. Structural formula of butane</p> <p>Answer</p> $  \begin{array}{ccccccc}  & & \text{CH}_3 & & \text{CH}_3 & & \\  & &   & &   & & \\  \text{CH}_3 & - & \text{C} & - \text{CH}_2 & - \text{CH} & - \text{CH}_3 \\  & &   & & & & \\  & & \text{CH}_3 & & & &   \end{array}  $	<p>1 1</p>	2
		$  \begin{array}{ccccccc}  & & \text{H} & & \text{H} & & \text{H} & & \text{H} \\  & &   & &   & &   & &   \\  \text{H} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{H} \\  & &   & &   & &   & &   \\  & & \text{H} & & \text{H} & & \text{H} & & \text{H}  \end{array}  $		

**PRAKTIS TOPIKAL: KERTAS 2**  
**BPM 2023**

	(b)	<p><b>[Able to write the chemical equation for the combustion of hexane and calculate volume of carbon dioxide gas correctly]</b></p> <p>P1. Correct formulae of reactants and products            P2. Balanced equation            P3. No. of mole of hexane            P4. Mole ratio            P5. Volume of carbon dioxide gas with correct unit</p> <p>Sample answer:</p> <p>P1&amp;P2. <math>C_6H_{14} + 19/2 O_2 \rightarrow 6CO_2 + 7H_2O</math></p> <p>P3. No of mole <math>C_6H_{14} = 258 / (12(6)+14(1)) = 3 \text{ mol}</math></p> <p>P4. 1 mol <math>C_6H_{14}</math> produce 6 mol <math>CO_2</math> //            3 mol <math>C_6H_{14}</math> produce 18 mol <math>CO_2</math></p> <p>Note: Apply ecf P4 from P1 &amp; P2 or P3</p> <p>P5. Volume of <math>CO_2</math> gas = <math>18 \times 24 = 432 \text{ dm}^3</math></p>	<p>1+1 1 1 1</p>	<p>5</p>
	(c) (i)	<p><b>[Able to suggest the name of alcohol P, write the molecular formula of compound Q, state the homologous series of compound R and name of Reaction III correctly]</b></p> <p>Answer:</p> <p>P1. Ethanol // propanol // Propan-1-ol            P2. <math>C_2H_4</math> // <math>C_3H_6</math>            P3. Alkane            P4. Oxidation</p>	<p>1 1 1 1</p>	<p>4</p>
	(ii)	<p><b>[Able to compare the sootiness of the flame correctly]</b></p> <p>P1. Calculate % of C by mass in compound Q            P2. Calculate % of C by mass in compound R            P3. Compare the % of C by mass between both compounds // per molecules            P4. Compare the sootiness of the flame</p> <p>Sample answer:</p> <p>P1. % of C by mass in compound Q / <math>C_2H_4</math>  <math>= \frac{(12 \times 2)}{(2(12) + 4(1))} \times 100 = 85.71\%</math></p> <p>P2. % of C by mass in compound R / <math>C_2H_6</math>  <math>= \frac{(12 \times 2)}{(2(12) + 6(1))} \times 100 = 80\%</math></p> <p>P3. % of C by mass in compound Q / <math>C_2H_4</math> is higher than compound R / <math>C_2H_6</math></p> <p>P4. compound Q / <math>C_2H_4</math> produces more soot / higher sootiness than compound R / <math>C_2H_6</math></p> <p>OR</p>	<p>1 1 1 1</p>	<p>4</p>

**PRAKTIS TOPIKAL: KERTAS 2**  
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			<p>P1. % of C by mass in compound Q / C<sub>3</sub>H<sub>6</sub>  <math display="block">= \frac{(12 \times 3)}{(3(12) + 6(1))} \times 100 = 85.71\%</math></p> <p>P2. % of C by mass in compound R / C<sub>3</sub>H<sub>8</sub>  <math display="block">= \frac{(12 \times 3)}{(3(12) + 8(1))} \times 100 = 81.82\%</math></p> <p>P3. % of C by mass in compound Q / C<sub>3</sub>H<sub>6</sub> is higher than compound R / C<sub>3</sub>H<sub>8</sub></p> <p>P4. compound Q / C<sub>3</sub>H<sub>6</sub> produces more soot / higher sootiness than compound R / C<sub>3</sub>H<sub>8</sub></p>		
			<b>TOTAL</b>	<b>20</b>	

<b>6</b>	(Q11, SPMRSM 2022)											
	(a)	P1. Monoprotic		1								
	(i)	P2. 1 mol of ethanoic acid ionise in water to produce 1 mol of H <sup>+</sup> ion. // 1 molecule of ethanoic acid ionise in water to produce 1 H <sup>+</sup> ion.		1								
	(a)	P1. Observation of experiment I and II		1								
	(ii)	P2. Inference of experiment I and II		1								
		P3. Explanation of experiment I and II		1								
		<table border="1" style="width: 100%; border-collapse: collapse; margin-left: 20px;"> <thead> <tr> <th style="width: 50%;">Experiment I</th> <th style="width: 50%;">Experiment II</th> </tr> </thead> <tbody> <tr> <td>P1. Balloon does not inflate// No change</td> <td>P1. Balloon inflate</td> </tr> <tr> <td>P2. No carbon dioxide gas release//No reaction occur</td> <td>P2. Carbon dioxide gas released//Reaction occurs</td> </tr> <tr> <td>P3. Exist as molecule // no H<sup>+</sup> present</td> <td>P3. Presence of H<sup>+</sup></td> </tr> </tbody> </table>	Experiment I	Experiment II	P1. Balloon does not inflate// No change	P1. Balloon inflate	P2. No carbon dioxide gas release//No reaction occur	P2. Carbon dioxide gas released//Reaction occurs	P3. Exist as molecule // no H <sup>+</sup> present	P3. Presence of H <sup>+</sup>		
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P3. Exist as molecule // no H <sup>+</sup> present	P3. Presence of H <sup>+</sup>											
		<b>TOTAL</b>		<b>5</b>								

**PRAKTIS TOPIKAL: KERTAS 2**  
**BPM 2023**

7		(Q6, SBP 2021)			
Skema Pemarkahan				Mark	Total
(a)	(i)	<p><b>[Boleh menyatakan nama tindak balas I dengan betul]</b></p> <p>Jawapan:</p> <p>Penapaian// <i>Fermentation</i></p>	1	1	
(a)	(ii)	<p><b>[Boleh menyatakan nama tindak balas I dengan betul]</b></p> <p>Jawapan:</p> <p>Etanol// <i>Ethanol</i></p>	1	1	
(b)	(i)	<p><b>[Boleh menulis persamaan kimia bagi pembakaran lengkap sebatian P dengan betul]</b></p> <p>Jawapan:</p> <p>1. Formula bahan dan hasil tindak balas yang betul 2. Persamaan seimbang</p> <p><math>C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O</math></p>	1 1	2	
(c)	(i)	<p><b>[Boleh memilih dua bahan yang boleh bertindak balas untuk menghasilkan satu sebatian yang berbau wangi dengan betul]</b></p> <p>Sampel jawapan:</p> <p>Etanol dan asid etanoik// P dan S// <math>C_2H_5OH</math> dan <math>CH_3COOH</math>// <i>Ethanol and ethanoic acid</i>// P and S// <math>C_2H_5OH</math> and <math>CH_3COOH</math></p>	1	1	
(c)	(ii)	<p><b>[Boleh melukis formula struktur bagi sebatian yang terbentuk dengan betul]</b></p> <p>Jawapan:</p> $  \begin{array}{ccccccc}  & H & H & H & H & H & \\  &   &    &   &   &   & \\  H & - C & - C & - O & - C & - C & - H \\  &   & &   &   &   & \\  & H & & H & H & H &   \end{array}  $	1	1	

**PRAKTIS TOPIKAL: KERTAS 2**  
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	(d)	<p><b>[Boleh menerangkan perbezaan pemerhatian dengan betul]</b></p> <p>1. Gas R bertindak balas dengan air bromin manakala gas etana tidak bertindak balas dengan air bromin// <i>Gas R reacts with bromine water while ethane gas does not react with bromine water.</i></p> <p>2. Sebatian R mempunyai ikatan ganda dua antara atom karbon// Sebatian R merupakan hidrokarbon tak tepu// <i>Compound R has double bond between carbon atoms// Compound R is unsaturated hydrocarbon</i></p> <p>3. Etana mempunyai ikatan tunggal antara atom karbon// Etana merupakan hidrokarbon tepu// <i>Ethane has single bond between carbon atoms// Ethane is saturated hydrocarbon</i></p>	1	1
			1	1
			1	1
			Total	9

PRAKTIS TOPIKAL: KERTAS 2  
BPM 2023

8	(Q11, SBP 2022)		
	(a) (i)	Fenomena di mana suatu sebatian yang mempunyai formula molekul yang sama tetapi dua atau lebih formula struktur yang berbeza// <i>Phenomenon where a compound has the same molecular formula but with two or more different structural formula.</i>	1
	(a) (ii)	<p>P1</p> $  \begin{array}{ccccccc}  & & \text{H} & & \text{CH}_3 & & \text{H} \\  & &   & &   & &   \\  \text{H} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{H} \\  & & & & & &   \\  & & & & & & \text{H}  \end{array}  $ <p>P2 2-metilpropena// 2-methylpropene</p>	<p>1</p> <p>1</p>
	(a) (iii)	<p>P1: Formula kimia yang betul</p> <p>P2: Persamaan kimia yang seimbang</p> $\text{C}_4\text{H}_8 + \text{H}_2\text{O} \rightarrow \text{C}_4\text{H}_9\text{OH}$ <p>P3: Nisbah mol</p> <p>P4: Jisim butanol yang terhasil dengan unit</p> <p>1 mol C<sub>4</sub>H<sub>8</sub> menghasilkan 1 mol C<sub>4</sub>H<sub>9</sub>OH//</p> <p>0.125 mol C<sub>4</sub>H<sub>8</sub> menghasilkan 0.125 mol C<sub>4</sub>H<sub>9</sub>OH//</p> <p>1 mol C<sub>4</sub>H<sub>8</sub> produce 1 mol of C<sub>4</sub>H<sub>9</sub>OH//</p> <p>0.125 mol of Calls produce 0.125 mol of C<sub>4</sub>H<sub>9</sub>OH</p> <p><i>Jisim ll Mass = 0.125 x [ 4(12) + 10(1) + 16] g // 9.25</i></p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
	(b) (i)	<p>P1: R = etanol// C<sub>2</sub>H<sub>5</sub>OH// ethanol</p> <p>P2: S = propana// C<sub>3</sub>H<sub>8</sub>// propane</p> <p>P3: T= propena// C<sub>3</sub>H<sub>6</sub>// propene</p>	<p>1</p> <p>1</p> <p>1</p>

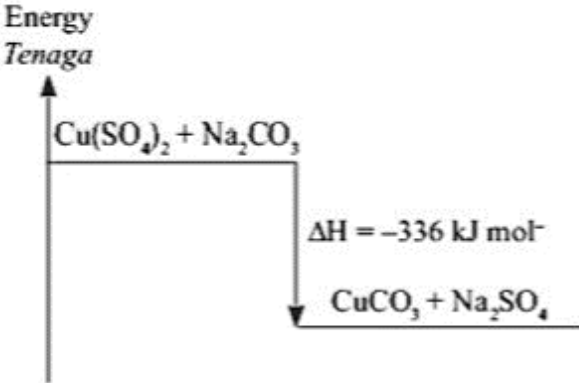
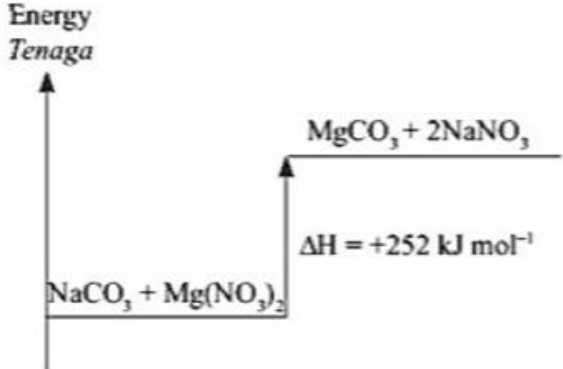


**PRAKTIS TOPIKAL: KERTAS 2  
BPM 2023**

		<p>P4: Sebatian S ialah hidrokarbon tepu manakala sebatian T ialah hidrokarbon tidak tepu// Compound S is a saturated hydrocarbon while compound T is an unsaturated hydrocarbon</p>	1
		<p>P5: Sebatian S tidak bertindak balas dengan larutan kalium manganat(VII) berasid manakala sebatian T mengalami tindak balas penambahan dengan larutan kalium manganat(VII) berasid// Compound S does not react with acidified potassium manganate(VII) solution while compound T undergoes an addition reaction with acidified potassium manganate(VII) solution.</p>	1
	(b)	<p>P1 Anggur// Epa1// Grape/Apple</p>	1
	(ii)	<p>a: Buah-buahan / karbohidrat yang sesuai // Suitable fruits/carbohydrates</p> <p>r: Glukosa// Glucose</p>	
		<p>P2 Kisar/ potong (10 - 201 g lepal) bersama 1100 -300] cm<sup>3</sup> air soling dan masukkan ke dalam kelalang kon // Blend/ cot [10- 301 g of (apple] together with 1100 - 300] cm<sup>3</sup> of distilled water and pour it into a conical flask.</p>	1
		<p>P3 Tambah (5 - 15) g yis ke dalam kelalang kon dan kacau campuran // Add [5 - 15] g of yeast into the conical flask and stir she mixture.</p>	1
		<p>P4 Tutup kelalang kon dengan penyumbat getah yang dipasangkan salur penghantar// Close the conical flask with a stopper connected to the delivery tube.</p>	1
		<p>P5 Masukkan hujung salur penghantar ke dalam tabung uji berisi air kapur // Insert the end of the delivery tube into the test tube containing limewater.</p>	1
		<p>P6 Biarlan pada suhu bilik selama tiga hari // Left at room temperature for three days.</p>	1
		<p>P7 Turas campuran di dalam kelalang kon dan disuling mcnggunakan kacdah pnyulingan bcrperingkat // Filter the mixture in the conical flask and distilled by using fractional distillation method</p>	1
		<p>P8 Kumpul basil sulingan pada 78 °C/ takat didih etanol // Collect the distillate at 78 °C/ boiling point of ethanol</p>	1
		TOTAL	20

**SKEMA PEMARKAHAN  
KERTAS 2  
BAB 3: TERMOKIMIA**

1	(Q10, SPM 2021)												
(a)	(i)	<b>PI:</b> Haba yang dibebaskan apabila 1 mol pemendapan $\text{CuCO}_3$ , terbentuk dari ion-ionnya dalam larutan akues. <i>Heat released when 1 mol precipitate <math>\text{CuCO}_3</math>, is formed from its ions in aqueous solution</i> <b>P2:</b> Hijau // Green	1 1										
	(ii)	<b>PI:</b> Larutan X karbonat / <i>X carbonate solution</i> : Larutan natrium / kalium / ammonium karbonat <i>Sodium / potassium / ammonium carbonate</i> <b>P2:</b> Bahan Y / <i>Substances Y</i> : Magnesium karbonat / <i>Magnesium carbonate</i>	1 1										
	(iii)	Set I <b>P1:</b> Perubahan haba / <i>Heat change</i> $= (200 \times 4.2 \times 4) \text{J} / 3.36 \text{kJ}$ <b>P2 :</b> Bilangan mol / <i>Number of mol</i> $= \frac{100 \times 0.1}{1000} // 0.01 \text{ mol}$ <b>P3 :</b> Haba pemendakan / <i>Heat of precipitate</i> $= \frac{-(3360)}{0.01} \text{J mol}^{-1}$ $= -336\,000 \text{J mol}^{-1} // -336 \text{kJ mol}^{-1}$ <b>P4:</b> Perubahan haba / <i>Heat change</i> $= (200 \times 4.2 \times 3) \text{J} // 2.52 \text{kJ}$ <b>P5:</b> Bilangan mol / <i>Number of mol</i> $= \frac{100 \times 0.1}{1000}$ $= // 0.01 \text{ mol}$ <b>P6:</b> Haba pemendakan / <i>Heat of precipitate</i> $= \frac{+(2520)}{0.01} \text{J mol}^{-1}$ $= +252\,000 \text{J mol}^{-1} // +252 \text{kJ mol}^{-1}$	1 1 1 1 1 1 1										
	(iv)	<table border="1"> <thead> <tr> <th>Set 1</th> <th>Set 2</th> </tr> </thead> <tbody> <tr> <td>Tindak balas eksotermik <i>Exothermic reaction</i></td> <td>Tindak balas endotermik <i>Endothermic reaction</i></td> </tr> <tr> <td>Suhu tindak balas meningkat <i>Temperature of reaction increases</i></td> <td>Suhu tindak balas menurun <i>Temperature of reaction decreases</i></td> </tr> <tr> <td>Kandungan tenaga bahan tindak balas lebih tinggi daripada hasil tindak balas <i>Energy content of reactants is higher than energy content of products</i></td> <td>Kandungan tenaga bahan tindak balas lebih rendah daripada hasil tindak balas <i>Energy content of reactants is lower than energy content of products</i></td> </tr> <tr> <td>Tenaga haba dibebaskan sewaktu pembentukan ikatan lebih tinggi dari tenaga haba</td> <td>Tenaga haba diserap sewaktu pemecahan ikatan lebih tinggi dari tenaga haba yang</td> </tr> </tbody> </table>	Set 1	Set 2	Tindak balas eksotermik <i>Exothermic reaction</i>	Tindak balas endotermik <i>Endothermic reaction</i>	Suhu tindak balas meningkat <i>Temperature of reaction increases</i>	Suhu tindak balas menurun <i>Temperature of reaction decreases</i>	Kandungan tenaga bahan tindak balas lebih tinggi daripada hasil tindak balas <i>Energy content of reactants is higher than energy content of products</i>	Kandungan tenaga bahan tindak balas lebih rendah daripada hasil tindak balas <i>Energy content of reactants is lower than energy content of products</i>	Tenaga haba dibebaskan sewaktu pembentukan ikatan lebih tinggi dari tenaga haba	Tenaga haba diserap sewaktu pemecahan ikatan lebih tinggi dari tenaga haba yang	
Set 1	Set 2												
Tindak balas eksotermik <i>Exothermic reaction</i>	Tindak balas endotermik <i>Endothermic reaction</i>												
Suhu tindak balas meningkat <i>Temperature of reaction increases</i>	Suhu tindak balas menurun <i>Temperature of reaction decreases</i>												
Kandungan tenaga bahan tindak balas lebih tinggi daripada hasil tindak balas <i>Energy content of reactants is higher than energy content of products</i>	Kandungan tenaga bahan tindak balas lebih rendah daripada hasil tindak balas <i>Energy content of reactants is lower than energy content of products</i>												
Tenaga haba dibebaskan sewaktu pembentukan ikatan lebih tinggi dari tenaga haba	Tenaga haba diserap sewaktu pemecahan ikatan lebih tinggi dari tenaga haba yang												

		<p>yang diserap sewaktu pemecahan ikatan. <i>Heat energy released during formation of bond is higher than heat energy absorbed during breaking of bond.</i></p>	<p>dibebaskan sewaktu pembentukan ikatan. <i>Heat energy released during breaking of bond is higher than heat energy absorbed during formation of bond</i></p>	
		<p>PI: Label tenaga /energy P2: Bahan tindak balas/ hasil tindak balas betul <i>Reactant /product correct</i> P3: Haba pemendakan / <i>Heat of precipitate</i></p> <p>Set 1</p>  <p>Set 2</p> 		<p>1 1 1</p>
	(b)	<p>PI: Set I menggunakan asid kuat manakala set I menggunakan asid lemah// <i>Set I uses strong acid while set I uses weak acid</i> P2: Asid P mengion lengkap di dalam air untuk menghasilkan kepekatan ion H<sup>+</sup> yang tinggi manakala asid Q mengion separa dalam air untuk menghasilkan kepekatan ion H<sup>+</sup> yang rendah. <i>Acid P ionises completely in water t oproduce high concentration of H<sup>+</sup> ions, whereas Acid O ionises partially in water to produce low concentration of H<sup>+</sup> ions.</i> P3: Dalam Set I, asid Q, sebahagian haba diserap untuk mengion lengkap asid Q. <i>In Set II, asid Q some of the heat is absorbed to completely ionise acid Q.</i></p>		<p>Total 20</p>

<b>2</b>	(Q5, SPM 2022)		
	(a)	Exothermic equation	1
	(b)	(i)	1
		P1 correct energy level for product and reactant P2 correct level for product and reactant	1
		(ii)	1
		The energy level level of product is lower than energy level of reactant	
	(c)	P1 Hydrogen P2 It has higher fuel value / eat produce higher amount of energy per gram	1 1
		Total	6
<b>3</b>	(Q8, SPMRSM 2021)		
	(a)	(i)	1
		Zn/Zinc	
		(ii)	1
		P1. Number of mole of Pb <sup>2+</sup> /Pb displaced P2. Ratio of the heat release P3. Temperature with correct unit	1 1 1
		Sample answer:  P1. Number of moles of Pb <sup>2+</sup> /Pb displaced = MV/1000 = 0.5 x 100/1000 = 0.05 mol  P2. 1 mol of Pb displaced releases 112000 J of heat 0.05 mol of Pb displaced releases 5600 J of heat // Q = n x ΔH = 0.05 mol x 112000 J mol <sup>-1</sup> = 5600 J  P3. Heat given out = mcθ 5600 J = (100)(4.2)(θ) θ = 13.3 °C	
	(b)	(i)	1
		R : Ethanoic acid // any weak acids S : Hydrochloric acid // any strong acids <b>Accept formula of acids</b>	1
		(ii)	1
		P1. Correct formulae of reactants and products P2. ΔH with correct value and unit Answer:  CH <sub>3</sub> COOH+NaOH→CH <sub>3</sub> COONa+H <sub>2</sub> O    ΔH = -55 kJ mol <sup>-1</sup>  <b>Penalty P2 if no equation/P1 given</b>	1 1

	(iii)	<p>P1. Ethanoic acid/ acid R ionizes partially in water and some remain as <b>molecules</b> (to produce low concentration of H<sup>+</sup> ions) while hydrochloric acid/ acid S ionized completely in water (to produce high concentration of H<sup>+</sup> ions) // Ethanoic acid/ acid R is a weak acid while hydrochloric acid/ acid S is a strong acid</p> <p>P2. Some of the heat released during neutralisation is absorbed by ethanoic acid/ acid R <b>molecules</b> and used to completely ionises the weak acid</p> <p><b>Note: mention molecules at least once</b></p>	1  1	
		Total	10	
<b>4</b>	<b>(Q7, SPMRSM 2022)</b>			
	(a)	(i)	Heat change when 1 mole of precipitate is formed from their ions in aqueous solutions. a: specific definition	1
		(ii)	Precipitation of barium sulphate is an exothermic reaction // 1473.2 kJ heat is released when 1 mol of barium sulphate is formed // Total energy content of reactants is higher than total energy content of products	1
		(iii)	Barium chloride // Barium nitrate r: Formula	1
		(iv)	$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$	1
	(b)	(i)	<p>P1. Number of mole of Pb(NO<sub>3</sub>)<sub>2</sub>/ Na<sub>2</sub>SO<sub>4</sub> P2. Heat released, Q P3. Temperature change, θ with unit Answer: P1. Number of mole of Pb(NO<sub>3</sub>)<sub>2</sub> = <math>MV / 1000</math> <math>= 1 \times 25 / 1000</math> <math>= 0.025 \text{ mol} //</math> Number of mole of Na<sub>2</sub>SO<sub>4</sub> = <math>1 \times 25 / 1000</math> <math>= 0.025 \text{ mol}</math> P2. 1 mol of PbSO<sub>4</sub> released 50.4 kJ 0.025 mol of PbSO<sub>4</sub> released 1.26 kJ // Q = ΔH (n) = 50400 (0.025) = 1260 J P3. θ = Q / mc = 1260 <math>= (25+25) (4.2)</math> <math>= 6 \text{ }^\circ\text{C}</math></p>	1 1 1
		(ii)	Use 0.5 mol dm <sup>-3</sup> lead(II) nitrate solution and 0.5 mol dm <sup>-3</sup> sodium sulphate solution	1
	(c)		<p>P1. Fuel chosen P2. Justification Sample answer: P1. Methane P2. Cheaper OR P1. Octane P2. The fuel value is higher // Easier to handle // Safer</p>	1 1
<b>5</b>	<b>(Q7, SBP 2021)</b>			

	(a)	Perubahan habai Haba yang dibebaskan apabila 1 mol mendakan terbentuk dari ion-ionnya dalam larutan akueusi. <i>Heat change / release when 1 mol of precipitate is formed from its ions in an aqueous solution.</i>	1
	(b)	Putih <i>White</i>	1
	(c)	P1. Bilangan mol mendakan P2. Haba yang dibebaskan P3. Perubahan suhu  Bilangan mol = $(0.5 (25))/1000$ =0.0125 mol	1 1 1
		Haba yang dibebaskan = $65500 \times 0.0125J$ = 818.75 Perubahan suhu = $818.75 / ((25+25) \times 4.2)$ =3.9 °C	
	(d)	P1. - 65.5 kJ mol <sup>-1</sup> //Sama// <i>Same</i> P2. Bilangan mol mendakan AgCl yang terbentuk adalah sama// <i>Number of moles of AgCl precipitate formed is the same.</i> P3. Ion natrium dan ion kalium tidak mengambil bahagian dalam pemendakan argentum klorida// Ion natrium dan ion kalium bertindak sebagai ion pemerhati// Hanya ion argentum dan ion klorida yang bertindak balas// <i>Sodium ions and potassium ions are not taking part in the precipitation of silver chloride/ Sodium ion and potassium ion are spectator ions/ Only silver ion and chloride ion react.</i>	1 1 1
	(e)	1. Gas hidrogen// <i>Hydrogen gas</i> 2. Nilai bahan api yang paling tinggi// Pembakaran gas hidrogen tidak mencemarkan alam sekitar// <i>Highest fuel value/ Combustion of hydrogen gas does not pollute environment</i>  Atau  1. Gas asli// <i>Natural gas</i> 2. Lebih murah// Nilai bahan api yang lebih tinggi// <i>Cheaper/ Higher fuel value</i>  Atau  1. Etanol// <i>Ethanol</i> 2. Pembakaran etanol tidak mencemarkan alam sekitar// <i>Combustion of ethanol does not pollute environment</i>	1 1
<b>6</b>	<b>(Q8, SBP 2022)</b>		

	(a)	(i)	Kuprum adalah konduktor haba yang baik // <i>Copper is a good heat conductor</i>	1
		(ii)	Pembakaran tidak lengkap alkohol // Jelaga terhasil // Karbon terhasil <i>Incomplete combustion of alcohol // Soot is produced // Carbon is produced</i>	1
		(iii)	P1. Perubahan haba P2. Bilangan mol P3. Nilai haba pembakaran dengan unit dan simbol yang betul  Contoh jawapan: 1. Perubahan haba = $200 \times 4.2 \times 30 \text{ J}$ // <i>Heat change 25200 J // 25.2 kJ</i>  2. Bilangan mol $\text{C}_3\text{H}_7\text{OH} = (3.0/60)$ // 0.05 <i>Number of mole</i>  3. Haba pembakaran = $- 25200 \text{ J mol}^{-1}$ // <i>Heat of combustion = - 25.2 kJ mol<sup>-1</sup> // 0.05</i> <i>= -504 000 J mol<sup>-1</sup> // -504 kJ mol<sup>-1</sup></i>	1 1 1
	(b)		P1. Haba pembakaran etanol lebih tinggi daripada metanol// <i>The heat of combustion of ethanol is higher than methanol.</i> P2. Bilangan atom karbon per molekul etanol lebih banyak daripada metanol// <i>The number of carbon atoms per molecule of ethanol is more than methanol.</i>	1 1
	(c)		P1. Air dan ammonium nitrat// <i>Water and ammonium nitrate</i> P2. Campurkan air dan ammonium nitrat di dalam sebuah besen kecil// <i>Mix water and ammonium nitrate in a small basin</i> P3. Masukkan/ rendamkan minuman dalam tin ke dalam bekas tersebut// <i>Put/ immerse canned beverage into the container</i>	1 1 1
			Total	10

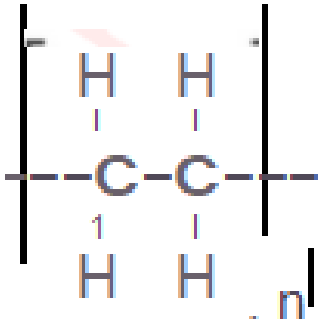
**BAB 4 : POLIMER**

Soalan			Jawapan	Markah
(Q7, SPM 2022)				
1	a	i	<p><b>[Able to state the meaning of the polymer correctly]</b></p> <p>Polimer ialah molekul berantai panjang yang terhasil daripada pencantuman banyak ulangan unit lain.  <i>A polymer is a long chain molecule that is made from a combination of many repeating basic units.</i></p>	1
		ii	<p>Polietyena  <i>Polyethylene</i></p>	1
		iii	$n \begin{array}{c} \text{H} \quad \text{CH}_3 \\   \quad   \\ \text{C} = \text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array} \longrightarrow \left[ \begin{array}{c} \text{H} \quad \text{CH}_3 \\   \quad   \\ \text{---} \text{C} \text{---} \text{C} \text{---} \\   \quad   \\ \text{H} \quad \text{H} \end{array} \right]_n$ <p>propene                      poly(propene)</p>	2
		iv	<p>Poliisoprena  <i>Polyisoprene</i></p>	1
	b		<p><b>P1</b> L: Ethanoic acid, CH<sub>3</sub>COOH solution // [any weak acid]  <b>P2</b> M: Ammonia, NH<sub>3</sub> solution // [any weak alkali solution]  <b>E1</b> Acid contains H<sup>+</sup> neutralise the negatively charged protein membrane, which cause coagulation  <b>E2</b> Alkali contains OH<sup>-</sup> that can neutralise acid produced by bacteria and maintain the protein membrane of rubber particles to remain negatively charged.</p> <p><b>2P + any 1 E</b></p>	3
	c		<p>Accept any reasonable answer for Advantage or Disadvantage of plastic straws <b>and</b> reason.  Sample answers:  <b>P1:</b> Plastic straws are not biodegradable // Difficult to recycle // End up in ocean and waterways // Harmful for ocean wildlife  <b>E1:</b> Cause environmental/ air / water pollution // Cause health problem</p> <p><b>OR</b>  <b>P2:</b> Plastic straws are light//cheap// easily available// less cost to produce  <b>E2:</b> Easy for consumer to use// buy</p> <p><b>Any 1P + 1E</b></p>	2
<b>JUMLAH</b>				<b>10</b>



(Q5, SPMRSM 2022)				
Nombor		Jawapan	Markah	
2	a	i	<p><b>[Able to state the meaning of the polymer correctly]</b></p> <p>Answer: A long chain molecule that is made from a combination of many repeating basic units/monomers..</p>	1
	b	i	<p><b>[Able to draw the structural formula of the monomer correctly]</b></p> <p>Answer:</p> <div style="text-align: center;"> </div>	1
		ii	<p><b>[Able to state the type of polymerisation reaction in the production of the polymer correctly]</b></p> <p>Answer : Addition polymerisation</p>	1
		iii	<p><b>[Able to state one of the uses of the polymer correctly]</b></p> <p>Sample answer: Food container // Plastic bottles // Ropes // Twine *Accept any suitable answer</p>	1
	c	i	<p><b>[Able to choose and justify the use of natural rubber or synthetic rubber in the making of this sport shoe sole correctly]</b></p> <p>P1. Choose the type of rubber P2 &amp; P3. Justification</p> <p>Sample answer: P1. Natural rubber P2. Soft (which makes foot is more comfortable) P3. Low heat resistance (This will make the sole become sticky and less slippery. This makes the sole can grip the flooring better.) OR P1. Synthetic rubber P2. More elastic. (It can retain its shape longer. The shoe can be wear longer) P3. More/High heat resistant. (The shoe sole is not easily worn)</p>	1 1+1
		ii	<p><b>[Able to suggest one way to overcome the issue correctly]</b></p> <p>Sample answer: Recycle // Reuse // Reduce</p>	1
			<b>JUMLAH</b>	<b>8</b>

(Q10, SBP 2021)				
Nombor			Jawapan	Markah
3	a	i	<p><b>[Boleh menyatakan apa yang perlu dilakukan oleh penoreh getah itu bagi mengatasi masalah yang dihadapi dan memberi penerangan dengan betul]</b></p> <p>Sampel jawapan:</p> <ol style="list-style-type: none"> <li>1. Tambah larutan ammonia/ NH<sub>3</sub> ke dalam lateks// <i>add ammonia/ NH<sub>3</sub> into latex</i></li> <li>2. Ion hidroksida/ OH<sup>-</sup> meneutralkan asid yang dihasilkan oleh bakteria// <i>hydroxide ion/ OH<sup>-</sup> neutralises the acid produced by bacteria</i></li> <li>3. Membran protein zarah getah kekal bercas negatif// Penggumpalan lateks dapat dihalang// <i>The protein membrane of rubber particles remains negatively charge// Coagulation of latex can be prevented</i></li> </ol>	<p>1</p> <p>1</p> <p>1</p>
	b	i	<p><b>[Boleh menyatakan jenis getah X dan getah Y dengan betul serta menerangkan perbezaan keputusan eksperimen dengan betul]</b></p> <p>Sampel jawapan:</p> <ol style="list-style-type: none"> <li>1. Getah X: Getah tak tervulkan// <i>Rubber X: Unvulcanised rubber</i></li> <li>2. Getah Y: Getah tervulkan// <i>Rubber Y: Vulcanised rubber</i></li> <li>3. Purata peningkatan panjang getah Y selepas pemberat dialihkan adalah lebih kecil berbanding purata peningkatan panjang getah X// <i>The average increase in length of rubber Y is smaller than the average increase in length of rubber X when weight is removed</i></li> <li>4. Kehadiran rangkai silang sulfur antara polimer getah dalam getah Y// <i>The presence of sulphur cross-link between rubber polymers in rubber Y</i></li> <li>5. Menghalang polimer getah Y daripada menggelongsor antara satu sama lain dengan mudah// <i>Prevent rubber polymer Y from sliding over each other easily</i></li> <li>6. Apabila pemberat dialihkan, getah Y dapat kembali semula ke bentuk asalnya// Getah Y lebih elastik // <i>When weight is removed, rubber Y able to get back to its original position// Rubber Y is more elastic.</i></li> </ol>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>

	ii	<p><b>[Boleh memilih jenis getah tapak kasut yang tahan lebih lama dan memberikan dua sebab dengan betul)</b></p> <p>1. Getah Y// <i>Rubber Y</i></p> <p>2. Lebih elastik// Tidak mudah teroksida// Keras// Kuat// Tahan kepada haba tinggi// <i>More elastic// Not easily oxidised// Hard/ Strong// Resistant to high heat</i> [Mana-mana dua jawapan// <i>any two answers</i>]</p>	<p>1 1+1</p>
c	i	<p><b>[Boleh mendefinisikan polimer dan memberikan satu polimer semula jadi dengan betul)</b></p> <p>1. Polimer adalah molekul berantai panjang yang diperbuat daripada gabungan banyak unit-unit asas/ monomer yang berulang// <i>Polymer is a long chain molecule that is made from combination of many repeating basic units/ monomer</i></p> <p>2. Kanji// Selulosa// Protein// Getah asli// <i>Starch// Cellulose// Protein// Natural rubber</i></p> <p><b>[Boleh melukis formula struktur dan menamakan polimer B mengikut sistem penamaan IUPAC dengan betul)</b></p> <p>3. Formula struktur// <i>Structural formula</i></p> <div style="text-align: center;">  <p>The diagram shows a structural formula for a segment of a polyethylene chain. Two carbon atoms (C) are bonded to each other. Each carbon atom is also bonded to two hydrogen atoms (H). Vertical lines extend from the top and bottom of each carbon atom, indicating the continuation of the polymer chain. The entire structure is enclosed in a box.</p> </div> <p>4. Nama IUPAC/ IUPAC name: Polietena// <i>Polyethene</i></p>	<p>1 1 1 1</p>

**PRAKTIS TOPIKAL: KERTAS 2**  
**BPM 2023**

	c	ii	<b>Boleh membanding bezakan polimer A dan polimer B dari segi jenis tindak balas pempolimeran dan ciri-ciri monomer yang terlibat dengan betul]</b>				
			<b>Perbandingan Comparison</b>	<b>Polimer A Polymer A</b>	<b>Polimer B Polymer B</b>		1+1
			Tindak balas pempolimeran// <i>Polymerisation reaction</i>	Penambahan// <i>Addition</i>	Kondensasi// <i>Condensation</i>		
Ciri-ciri monomer <i>Characteristics of monomer</i>	Monomer mempunyai 1 ikatan ganda dua antara atom karbon// <i>Monomer has double bond between carbon atoms</i>	Monomer mempunyai dua kumpulan berfungsi/ siri homolog// <i>Monomer has two functional groups/ homologous series</i>	1+1				
<b>JUMLAH</b>					<b>20</b>		

<b>(Q2, SBP 2022)</b>			
Nombor		Jawapan	Markah
4	a i	Molekul berantai panjang yang terhasil daripada pencantuman banyak ulangan unit asa/ monomer // <i>Long chain molecule that is made from a combination of many repeating basic units/ monomer.</i>	1
	b	Isoprena // 2-metilbut-1,3-diena // <i>Isoprene // 2-methylbut-1,3-diene</i>	1
	c i	1. Produk B/ Getah tervulkan mengandungi rangkai-silang sulfur // <i>Product B / Vulcanized rubber contains sulphur cross-link</i> 2. Menghalang polimer getah daripada menggelongsor apabila ia diregangkan // <i>Prevent the rubber polymer from sliding when it is stretched.</i>	1
	ii	Keras // Tahan haba yang tinggi // Tahan bahan kimia // Lebih tahan terhadap pengoksidaan // Lebih kenyal// <i>Hard// Resistant to high heat // Resistant to chemicals // More resistant towards oxidation // More elastic</i>	1
<b>JUMLAH</b>			<b>5</b>

**SKEMA PEMARKAHAN**  
**KERTAS 2**  
**BAB 5 : KIMIA KONSUMER DAN INDUSTRI**

<b>1</b>	(Q7, SPM 2021)			
	a	i	Sabun ialah garam natrium atau kalium bagi asid lemak// <i>Soaps are sodium or potassium fatty acid salts</i>	1
		ii.	sodium hydroxide	1
		iii.	Cleaning agent A	1
			Sea water containing calcium ions, Ca <sup>2+</sup> and magnesium ions, Mg <sup>2+</sup>	1
			When cleaning agent A react with with calcium ions, Ca <sup>2+</sup> and magnesium ions, Mg <sup>2+</sup> no scum is produced	1
	b	i	Psychotic Drugs	1
			Haloperidol, Chlorpromazine, Clozapine	1
			Help reduce psychotic symptoms like hallucinations, delusions and extreme emotional changes	1
		ii	Traditional medicine//tamarind juice	1
			Obtained from herbal plants not chemically processed.	
			No side effect	
			Modern medicines // kodeina	1
			More effective	
			Quick recovery	
			<b>TOTAL</b>	<b>10 MARKS</b>
<b>2</b>	(Q3, SPM 2022)			
	a	i	Sabun ialah garam natrium atau kalium bagi asid lemak// <i>Soaps are sodium or potassium fatty acid salts</i>	1
		ii.	$C_3H_5[(CH_2)_{14}COO]_3 + 3NaOH \rightarrow 3CH_3(CH_2)_{14}COONa + C_3H_5(OH)_3$	1
		iii.	Potassium Palmitate	1
	b		Use detergent	1
			Water containing calcium ions, Ca <sup>2+</sup> and magnesium ions, Mg <sup>2+</sup> is called hard water.	
			Soap anions combine with the cations to form insoluble salts	
			The formation of scum causes wastage of soap because more soap will be needed for the cleansing action	1
			Detergent anions also combine with the cations to form soluble salts in water. Therefore, the effectiveness of the detergent's cleansing action is not affected by hard water	1
			<b>TOTAL</b>	<b>6 MARKS</b>

**PRAKTIS TOPIKAL: KERTAS 2**  
**BPM 2023**

<b>3</b>	(Q3, SPMRSM 2021)	
(a)	<p><b>[Able to state the meaning of cosmetics correctly]</b></p> <p>Answer: Cosmetics are materials or products that are used externally to cleanse, protect or enhance one's appearances</p>	1
(b)	<p><b>[Able to state one example of the harmful chemical in cosmetic that can cause redness and peeling skin correctly]</b></p> <p>Answer: Tretinoin</p>	1
(c)(i)	<p><b>[Able to give one example of traditional medicine can be used and describe briefly how it is used correctly]</b></p> <p>Sample answer:</p> <p>P1. Aloe vera P2. (Apply) the gel/juice/liquid and rub onto affected skin // Rub the aloe vera gel/juice/liquid onto the affected skin</p>	2
(c)(ii)	<p><b>[Able to explain the different of efficacy level between modern and traditional medicine correctly]</b></p> <p>Sample answer:</p> <p>P1. Traditional medicine may not undergo clinical trials // may not have data to authenticate the effectiveness</p> <p>P2. Hard to determine the correct dosage / amount</p> <p>OR</p> <p>Any correct statements about modern medicine</p>	2
	Total	6

**PRAKTIS TOPIKAL: KERTAS 2**  
**BPM 2023**

<b>4</b>	(Q1, SPMRSM 2022)			
	(a)	<b>[Able to state the physical state of fats at room temperature correctly]</b> Answer: Solid	1	1M
	(b)	<b>[Able to name the reaction for the conversion of saturated fats into unsaturated fats correctly]</b> Answer: Hydrogenation // Addition of hydrogen	1	1M
	(c)	<b>[Able to state the type of food additives and function of citric acid in the cake correctly]</b> P1. Type of food additives P2. Function of citric acid Answer: P1. Antioxidants P2. Slow down the oxidation of fats in food // Prevent oily or greasy food from becoming rancid.	1+1	2M
	(d)	<b>[Able to state one other example of food additives in the cake correctly]</b> Sample answer: Preservatives // flavourings // stabilisers // emulsifiers// dyes	1	1M

<b>5</b>	(Q8, SBP 2021)		
	<p>(b) Sampel jawapan:</p> <p>1. Perlu // <i>Yes</i>  2. Untuk memastikan keberkesanan pengurusan sampah // <i>To make sure the effectiveness of waste management.</i>  3. Untuk meningkatkan kualiti alam sekitar // <i>to improve quality of the environment</i>  (sebarang jawapan yang sesuai)</p> <p>Atau</p> <p>1. Tidak perlu // <i>No</i>  2. Kos yang tinggi // <i>Costly</i>  3. Tidak berbaloi // Mengambil masa yang lama // <i>Not worthy // Time consuming</i>  (sebarang jawapan yang sesuai)</p>	<p>1 1 1</p>	
	<p>(c) <b>[Boleh mencadangkan dua kaedah yang melibatkan aplikasi Teknologi Hijau bagi mengatasi masalah yang diutarakan dengan betul]</b></p> <p>Sampel jawapan:</p> <p>1. Pengkomposan sisa pepejal organik // <i>Composting organic solid waste</i>  2. Kitar semula // <i>Recycle</i>  3. Penunuan // <i>Incineration</i>  4. Pengumpulan gas metana // <i>Methane gas recovery</i>  (manamana <b>dua</b> jawapan di atas)</p> <p><b>[Boleh memberikan kelebihan bagi salah satu kaedah yang dicadangkan dengan betul]</b></p> <p>Sampel jawapan:</p> <p>1. Menjimatkan kos // <i>Reduce cost</i>  2. Mengurangkan sisa pepejal // <i>Reduce solid waste</i>  3. Menjana tenaga biojisim // <i>Generate biomass energy</i>  4. Mengurangkan pencemaran alam sekitar // <i>Reduce environmental pollution</i>  (manamana <b>satu</b> jawapan yang berkaitan dengan kaedah yang dinyatakan di atas)</p>	<p>1 1  1</p>	<p>3</p>
	<b>Jumlah</b>	<b>10</b>	



6	(Q4, SBP 2022)		
	(a)(i)	<p><b>[Dapat menyatakan bagaimana cara bawang putih atau ginseng digunakan untuk merawat penyakit dengan betul]</b></p> <p>Jawapan:</p> <p>Hancurkan/ rebus bahagian tertentu bawang putih atau ginseng// <i>Crush/ boil certain parts of garlic or ginseng</i></p>	1
	(ii)	<p><b>[Dapat memberikan dua kelebihan menggunakan ubat dalam Rajah 4 dengan betul]</b></p> <p>Contoh jawapan:</p> <p>Diperoleh daripada sumber semula jadi// Tidak diproses secara kimia// Mudah didapati</p> <p><i>Obtained from natural resources// Not chemically processed// Easily available</i></p> <p>[Mana-mana <b>dua</b> jawapan yang sesuai]</p>	1+1
	(b)(i)	<p><b>[Dapat menerangkan sebab mengalami sakit perut dengan betul]</b></p> <p>Jawapan:</p> <p>1. Aspirin adalah berasid// <i>Aspirin is acidic</i> 2. Menyebabkan ulser dalam perut// pendarahan dalam perut <i>//Causes stomach ulcers// stomach bleeding</i></p>	1+1
	(b)(ii)	<p><b>[Dapat mencadangkan nama ubat yang boleh menggantikan aspirin dengan betul]</b></p> <p>Jawapan:</p> <p>Parasetamol// <i>Paracetamol</i></p>	1
	(b)(iii)	<p><b>[Dapat menyatakan kesan sampingan jika ubat yang dicadangkan di 4(b)(ii) diambil secara berlebihan dengan betul]</b></p> <p>Jawapan:</p> <p>Menyebabkan kerosakan hati// <i>Cause liver damage</i></p>	1
		Total	7

Wafa Binti Mohamad Fauzi  
 Muhammad Hazriq Bin Aris  
 Nur Siti Fatimah Binti Bukhori  
 Nik Nurul Fatimah Binti Mohd Noor  
 Nurul Amira Binti Abu Bakar  
 Nur Syuhadha Binti Mohamad Aseri  
 Siti Raudhah Binti Abdul Manap  
 Amierul Hafreez Bin Noor Hasnan  
 Nuraziella Binti Abdullah  
 Nurul 'Afifah Sya-Irah bt Abd Nasir  
 Shahira Binti Mat Yusof  
 Norhana Humairah Binti Alias  
 Ahmad Tajudin Bin Abdul Rahman  
 Nur Farhana Binti Mohamad Ali  
 Rahayu Binti Abdul Rahman  
 Nur Syamimi Binti Ab Rasid  
 Nur Qusyairi Bin Mohamed Fauzi  
 Muhammad Firdaus Bin Hamzah  
 Muhamad Haizat Bin Ghazali  
 Nik Muhammad Irfan Hakimi Bin Mohd Saufi  
 Azhar Bin Zawawi  
 Abdul Hafiz Bin Sheik Muhamed  
 Nurhayatun Sobariah Binti Abdul Razak  
 Wan Muhammad Najmi Bin Wan Anuar  
 Nur Adila Binti Ramlon  
 Dinah Adelina Binti Razali  
 Amir Farhan Bin Omar  
 Aida Rohayu Binti Abdul Karim  
 Muhammad Norazraa Bin Nordin  
 Kartika Binti Firman  
 Najibulla Bin Romainor  
 Elysa Anak Chundang  
 Shahadad Bin Zainol Abidin  
 Norizan Binti Ramli  
 Danial Fikri Bin Samsudin  
 Saidah Nafisah bt Zulkupli  
 Najihah Binti Haron  
 Nurfarizah Binti Muhammad Faisal  
 Basirah Binti Abu Bakar  
 Amalin Sofea Binti Rozani  
 Nawal Binti Nasarudin  
 Najwa Binti Ahmad Shahrir  
 Nor Azieda Binti Azahari  
 Ghazali Bin Musa

MRSM Alor Gajah  
 MRSM Arau  
 MRSM Arau  
 MRSM ATM Bera  
 MRSM ATM Bera  
 MRSM ATM Bera  
 MRSM Bagan Datuk  
 MRSM Bagan Datuk  
 MRSM Baling  
 MRSM Baling  
 MRSM Batu Pahat  
 MRSM Bentong  
 MRSM Beseri  
 MRSM Beseri  
 MRSM Besut  
 MRSM Besut  
 MRSM Betong  
 MRSM Felda Trolak  
 MRSM Gemencéh  
 MRSM Johor Bahru  
 MRSM Johor Bahru  
 MRSM Jeli  
 MRSM Kota Putra  
 MRSM Kuala Klawang  
 MRSM Kuantan  
 MRSM Kuantan  
 MRSM Kuching  
 MRSM Langkawi  
 MRSM Langkawi  
 MRSM Mersing  
 MRSM Pengkalan Chepa  
 MRSM Kota Putra  
 MRSM Pengkalan Chepa  
 MRSM Serting  
 MRSM Tumpat  
 MRSM Tumpat  
 MRSM Tun Abdul Razak  
 MRSM Tun Ghafar Baba  
 MRSM Tun Ghazali Shafie  
 MRSM Tun Mohammad Fuad Stephens  
 MRSM Tun Mohammad Fuad Stephens  
 MRSM Tun Mustapha  
 BPM  
 BPM