2023

KIMIA

PRAKTIS TOPIKAL

KERTAS 1 & KERTAS 2

TINGKATAN 4

SKEMA JAWAPAN

Unit Kimia
Bahagian Pendidikan Menengah MARA

BAB 2: JIRIM DAN STRUKTUR ATOM

NO	JAWAPAN	SOALAN
1	C	Q1, SPM 2021
2	B	Q2, SPM 2021
3	D	Q3, SPM 2021
4	C	Q1, SPM 2022
5	A	Q2, SPM 2022
6	D	Q3, SPM 2022
7	D	Q1, SPMRSM 2021
8	C	Q16, SPMRSM 2021
9	B	Q17, SPMRSM 2021
10	A	Q18, SPMRSM 2021
11	A	Q1, SPMRSM 2022
12	B	Q15, SPMRSM 2022
13	C	Q16, SPMRSM 2022
14	B	Q3, SBP 2021
15	B	Q17, SBP 2021
16	B	Q31, SBP 2021
17	B	Q1, SBP 2022
18	B	Q2, SBP 2022
19	B	Q16, SBP 2022
20	B	Q31, SBP 2022

BAB 3: KONSEP MOL, FORMULA DAN PERSAMAAN KIMIA

NO	JAWAPAN	SOALAN
1	C	Q4, SPM 2021
2	C	Q5, SPM 2021
3	D	Q26, SPM 2021
4	A	Q36, SPM 2021
5	D	Q38, SPM 2021
6	C	Q4, SPM 2022
7	D	Q30, SPM 2022
8	A	Q31, SPM 2022
9	C	Q32, SPM 2022
10	B	Q34, SPM 2022
11	C	Q2, SPMRSM 2021
12	A	Q18, SPMRSM 2021
13	B	Q31, SPMRSM 2021
14	B	Q2, SPMRSM 2022
15	D	Q17, SPMRSM 2022
16	D	Q30, SPMRSM 2022
17	C	Q18, SBP 2021
18	B	Q20, SBP 2021
19	A	Q32, SBP 2021
20	A	Q33, SBP 2021
21	D	Q34, SBP 2021
22	B	Q3, SBP 2022
23	C	Q4, SBP 2022
24	D	Q17, SBP 2022
25	C	Q32, SBP 2022

BAB 4: JADUAL BERKALA UNSUR

NO	JAWAPAN	SOALAN
1	**C**	Q6, SPM 2021
2	**A**	Q7, SPM 2021
3	**D**	Q8, SPM 2021
4	**D**	Q5, SPM 2022
5	**C**	Q7, SPM 2022
6	**C**	Q3, SPMRSM 2021
7	**A**	Q19, SPMRSM 2021
8	**A**	Q3, SPMRSM 2022
9	**C**	Q18, SPMRSM 2022
10	**C**	Q19, SPMRSM 2022
11	**C**	Q5, SBP 2021
12	**C**	Q16, SBP 2021
13	**A**	Q5, SBP 2022
14	**D**	Q18, SBP 2022

BAB 5: IKATAN KIMIA

NO	JAWAPAN	SOALAN
1	D	Q8, SPM 2021
2	B	Q9, SPM 2021
3	B	Q10, SPM 2021
4	B	Q8, SPM 202
5	A	Q9, SPM 2022
6	A	Q24, SPMRSM 2021
7	C	Q21, SPMRSM 2021
8	C	Q32, SPMRSM 2021
9	A	Q5, SPMRSM 2022
10	B	Q20, SPMRSM 2022
11	C	Q31, SPMRSM 2022
12	D	Q6, SBP 2021
13	C	Q19, SBP 2021
14	C	Q6, SBP 2022
15	A	Q19, SBP 2022
16	C	Q20, SBP 2022

BAB 6: ASID, BES DAN GARAM

NO	JAWAPAN	SOALAN
1	C	Q11, SPM 2021
2	A	Q13, SPM 2021
3	C	Q32, SPM 2021
4	A	Q40, SPM 2021
5	A	Q10, SPM 2022
6	A	Q33, SPM 2022
7	C	Q40, SPM 2022
8	D	Q5, SPMRSM 2021
9	B	Q6, SPMRSM 2021
10	A	Q22, SPMRSM 2021
11	C	Q33, SPMRSM 2021
12	C	Q39, SPMRSM 2021
13	A	Q4, SPMRSM 2022
14	B	Q21, SPMRSM 2022
15	D	Q32, SPMRSM 2022
16	D	Q34, SPMRSM 2022
17	B	Q38, SPMRSM 2022
18	B	Q21, SBP 2021
19	A	Q22, SBP 2021
20	A	Q35, SBP 2021
21	D	Q39, SBP 2021
22	D	Q7, SBP 2022
23	A	Q21, SBP 2022
24	A	Q22, SBP 2022
25	C	Q35, SBP 2022
26	B	Q39, SBP 2022

BAB 7: KADAR TINDAK BALAS

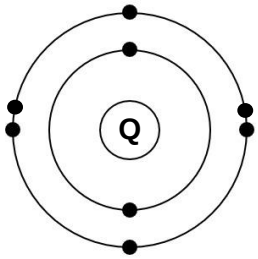
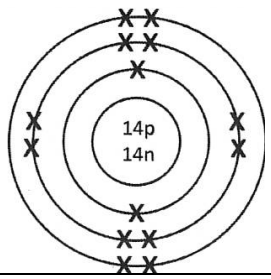
NO	JAWAPAN	SOALAN
1	C	Q11, SPM 2021
2	C	Q14, SPM 2021
3	D	Q15, SPM 2021
4	B	Q33, SPM 2021
5	D	Q11, SPM 2022
6	B	Q36, SPM 2022
7	B	Q39, SPM 2022
8	D	Q7, SPMRSM 2021
9	A	Q23, SPMRSM 2021
10	B	Q6, SPMRSM 2022
11	D	Q22, SPMRSM 2022
12	A	Q23, SPMRSM 2022
13	B	Q33, SPMRSM 2022
14	C	Q8, SBP 2021
15	A	Q24, SBP 2021
16	B	Q40, SBP 2021
17	C	Q8, SBP 2022
18	B	Q23, SBP 2022
19	B	Q40, SBP 2021

BAB 8: BAHAN BUATAN DALAM INDUSTRI

NO	JAWAPAN	SOALAN
1	B	Q16, SPM 2021
2	B	Q17, SPM 2021
3	A	Q12, SPM 2022
4	A	Q8, SPMRSM 2021
5	B	Q25, SPMRSM 2021
6	C	Q7, SPMRSM 2022
7	D	Q10, SBP 2021
8	D	Q12, SBP 2021
9	A	Q9, SBP 2022
10	A	Q10, SBP 2022
11	D	Q24,SBP 2022
12	D	Q37, SBP 2022

SKEMA PEMARKAHAN
KERTAS 2
BAB 2: JIRIM DAN STRUKTUR ATOM

Soalan	Rubrik			Markah
1.	Q1 SPM 2021			
	(a)	Hasil tambah / Jumlah bilangan proton dan nucleon di dalam sesuatu atom *The sum / total number of protons and number of neutrons in an atom*		**1**
	(b)	8		**1**
	(c)	$^{12}_{6}Y$		**1**
	(d)	(i)	Pepejal/*Solid* ⟶ Gas/*Gas*	**1**
		(ii)	Bergerak secara rawak / bebas *Moves randomly / slowly*	**1**
			JUMLAH	**5**
2.	Q4 SPM 2022			
	(a)	Atom-atom bagi unsur yang sama dengan mempunyai bilangan proton yang sama tetapi bilangan neutron yang berbeza. *Atoms of same element with same number of protons but different number of neutrons.*		**1**
	(b)	L dan M *L and M*		**1**
	(c)	$^{13}_{6}M$		**1**
	(d)	$\frac{(79\times24)+(10\times25)+(11\times26)}{100}$ Jisim atom relatif bagi R = 24.32 *Relative atomic mass of R = 24.32*		**1** **1**

	(e)		Nukleus & Simbol – 1 markah *Nucleus & Symbol – 1 marks* Susunan electron – 1 markah *Electron arrangment– 1 markah*	**1** **1**
			JUMLAH	**7**
3.	Q1 SPMRSM 2021			
	(a)	(i)	[Able to state the name of positively charged subatomic particle in the atom correctly] Answer: Proton [r: symbol]	**1**
		(ii)	[Able to state the number of neutrons found in the nucleus of carbon-12 atom correctly] Answer: 6	**1**
		(iii)	[Able to state the difference between carbon-14 and carbon-12 correctly] Answer: Number of neutrons	**1**
	(b)	(i)	[Able to write the standard representation of atom Z correctly] Answer: $^{9}_{4}\boldsymbol{Z}$	**1**
		(ii)	[Able to write the electron arrangement of Z ion correctly] Answer: 2	**1**
			JUMLAH	**5**
4.	Q3 SPMRSM 2022			
	(a)	[Able to state the meaning of isotopes correctly] Sample answer: Atoms of the same element with the <u>same proton number</u> but <u>different nucleon number</u> // Atoms of the same element with the <u>same number of protons</u> but <u>different number of neutrons</u>		**1**
	(b)	[Able to draw the atomic structure of Si-28 correctly] P1. Nucleus is shown and correct number of shell P2. Correct number of electron and label proton and neutron in the nucleus Sample answer: 		**1** **1**

	(c)	[Able to calculate the relative atomic mass of Si correctly] P1. Calculation P2. Correct answer Sample answer: $\frac{(92 \times 28) + (5 \times 29) + (3 \times 30)}{100}$ Jisim atom relatif bagi Si = 28 *Relative atomic mass of Si = 28*	**1** **1**
	(d)	[Able to state one example of isotopes used in medicine field correctly] Sample answer: Cobalt-60 // Iodine-131 *Accept any suitable isotopes	**1**
		JUMLAH	**6**

5	Q1 SBP 2021		Markah
	(a)	**[Boleh menyatakan maksud isotop dengan betul]** Jawapan: Isotop ialah atom-atom bagi unsur yang sama yang mempunyai bilangan proton/nombor proton yang sama tetapi bilangan neutron/nombor nucleon yang berbeza// *Isotopes are atoms of the same element with the same number of protons/proton number but different number of neutrons/nucleon number.*	1
	(b)	**[Boleh menyatakan semua nama zarah subatom yang terdapat di dalam nukleus dengan betul]** Jawapan: Neutron dan proton// *Neutron and proton*	1
	(c)	**[Boleh menyatakan nama zarah subatom yang bercas negative dengan betul]** Jawapan : Elektron // *Electron*	1
	(d)	**[Boleh memberi jawapan dan menerangkan sebab atom-atom isotop mempunyai sifat kimia yang sama dengan betul]** Sampel jawapan: 1. Ya/ Yes 2. Atom mempunyai bilangan electron valens yang sama// Atom have same number of valence electrons	 1 1
		JUMLAH	5

6	(a)	Q2 SBP 2021 **[Boleh menyatakan jenis zarah yang terdapat dalam gas A dengan betul]** Jawapan: Molekul/*Molecule*	1
		JUMLAH	1
7	(a)	Q3 SBP 2021 **[Boleh menyatakan apakah yang diwakili oleh nombor 17 dengan betul]** Jawapan: Nombor proton// *Proton number*	1
		JUMLAH	1
8.	Q5, SBP 2022		
	(a)	The total number of protons and neutrons in the nucleus of an atom	1
	(b)	8	1
		JUMLAH	**2**
9.	Q6, SBP 2022		
	(a)	Ion	
		JUMLAH	1

SKEMA PEMARKAHAN
KERTAS 2
BAB 3: KONSEP MOL, FORMULA DAN PERSAMAAN KIMIA

<table>
<tr><td colspan="4">SPM 2021</td><td>Marks</td></tr>
<tr><td>3</td><td>(c)</td><td></td><td>P1: Find Ratio
P2: Find mass

Ratio
1 mol of Y: 2 mol of YO_2
∴
No. of mol of YO_2 = 1.0mol

mass of Y oxide = 1.0mol x 62g mol^{-1}
= 62g</td><td>1

1</td></tr>
<tr><td>4</td><td>(b)</td><td>(iii)</td><td>Na + Cl_2 -> 2NaCl</td><td>1+1</td></tr>
<tr><td></td><td></td><td>(iv)</td><td>P1: Find Ratio
P2: Find mass

no of mol of Na = 2.3g/23 g mol^{-1}
= 0.1mol

Ratio
1 mol of Na: 2 mol of NaCl
∴0.1 mol of Na: 0.2 mol of NaCl

mass of NaCl = 0.2mol x 58.5g mol^{-1}
= 11.7g</td><td>1

1</td></tr>
<tr><td>6</td><td>(a)</td><td></td><td>Chemical formula that shows the simplest ratio of the number of atoms of each element in a compound</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Logam X: Magnesium
Penerangan: Magnesium is reactive towards oxygen.
Logam Y: Copper
Penerangan: Copper is less reactive towards hydrogen</td><td>1
1
1
1</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td><table><tr><td>Element</td><td>X</td><td>Oxygen</td></tr><tr><td>Mass (gram)</td><td>1.08</td><td>0.96</td></tr><tr><td>No of mol</td><td>1.08/27= 0.04</td><td>0.96/16= 0.06</td></tr><tr><td>Ratio mol</td><td>0.04/0.04 = 1</td><td>0.06/0.04 = 1.5</td></tr><tr><td>Simplest ratio mol</td><td>2</td><td>3</td></tr></table>Empirical formula: X_2O_3</td><td>1
1

1</td></tr>
<tr><td></td><td></td><td></td><td>(ii) Method II</td><td>1</td></tr>
</table>

SPM 2022				Marks
8	(a)	(i)	Suhu	1
		(ii)	Bil mol = 0.1(50) / 1000 // 0.1(0.05) // 0.005 2 mol HCl menghasilkan 0.0025 mol H_2 // 0.005 mol HCl menghasilkan 0.00025 mol H_2 Isi padu = 0.0025 x 24 dm3 // 0.06 dm3 // 60 cm^3	1 1 1
9	(a)		Jawapan 1.Molekul 2. Formula bahan dan hasil tindak balas 3. Persamaan kimia yang seimbang Jawapan $2NaN_3 \longrightarrow 2\ Na + 3N_2$ [Dapat menghitung jisim natrium azida yang diperlukan dengan betul] 4. Bilangan mol 5. Nisbah mol 6. Jisim relative NaN_3 7. Jisim NaN_3 dengan unit yang betul Jawapan Bilangan mol = 56.4/24 // 2.35 3 mol N_2 memerlukan 2 mol NaN_3 2.35 mole N_2 memerlukan 1.57 mol NaN_3 Jisim molekul NaN_3 = 23 + 3(14) // 65 Jisim = 1.57 (65) g // 102.05 g	 1 1 1 1 1 1 1
	(b)		[Dapat menerangkan mengapa terdapat perbezaan dalam pemerhatian belon A dan belon B dengan betul] Contoh jawapan 1. Kedudukan belon A lebih tinggi daripada belon B 2. Pada isipadu yang sama, jisim belon A gas H_2 lebih kecil /ringan daripada belon B/ gas He 3. Mol H_2 = 0.6/24 // 0.025 4. Jisim H_2 = 0.025 x 2(1) // 0.05 g 5. Jisim He = 0.025 x 4 // 0.1 g	 1 1 1 1 1
10	(a)		[Dapat menulis persamaan kimia bagi tindak balas tersebut dan menghitung jisim sebatian T dengan betul] 1. Formula bahan tindak balas dengan hasil tindak balas 2. Persamaan seimbang 3. Bil mol oksigen 4. Nisbah mol 5. Jisim formula relative sebatian T 6. Jisim sebatian dengan unit yang betul Contoh jawapan $2\ Y + 0_2 \longrightarrow 2\ YO$ // $2\ Mg + 0_2 \longrightarrow 2MgO$ Bil mol oksigen = 120/24000 // 0.005 1 mol O_2 menghasilkan 2 mol YO 0.005 mol O2 menghasilkan 0.01 mol YO Jisim relative formula YO = 24 + 16 // 40 Jisim YO = 0.01 x 40g // 0.4 g	 1 1 1 1 1 1

SPMRSM 2021				Marks
4	(a)	(iii)	P1.2 mole of Fe produces 2 mol of $FeCl_3$ 0.1 mole of Fe produces 0.1 mol of $FeCl_3$	1
			P2. Mass of FeCl3 = 0.1 x [56+(3 x 35.5)] = 16.25g	
		(ii)	Bil mol = 0.1(50) / 1000 // 0.1(0.05) // 0.005	1
			2 mol HCl menghasilkan 0.0025 mol H_2 // 0.005 mol HCl menghasilkan 0.00025 mol H_2	1
			Isi padu = 0.0025 x 24 dm3 // 0.06 dm3 // 60 cm^3	1

SPMRSM 2022				Marks
2	(b)		P1. Identify <u>reactants and product</u> P2. Mole ratio//quantity ratio of reactant and product Sample answer: 4 mol of aluminium reacts with 3 mol of oxygen to produce 2 mol of aluminium oxide // 4 aluminium <u>atoms</u> react with 3 oxygen <u>molecules</u> to produce 2 <u>units</u> of aluminium oxide.	1 1
11	(b)	(ii)	[**Able to write a balanced chemical equation and calculate the volume of gas Z correctly**] P1. Correct formula of reactant and products P2. Balanced chemical equation P3. No. of mole of salt X P4. Mole ratio P5.Volume of gas Z with correct unit Answer: P1 & P2. $2Cu(NO_3)_2 \rightarrow 2CuO + 4NO_2 + O_2$ P3. No. of mole of X = 9.4/(64+2(14)+6(16)) = 0.05 mol P4. 2 mol $Cu(NO_3)_2$ produce 4 mol NO_2 0.05 mol $Cu(NO_3)_2$ produce 0.1 mol NO_2 Note: Apply ecf P4 from P1 & P2 P5. Volume of gas Z = 0.1 x 24 = 2.4 dm^3	1 + 1 1 1 1

SBP 2021				Marks
3	(c)	(i)	$3X_2 + 2Fe \rightarrow 2FeX_3$ // $3Cl_2 + 2Fe \rightarrow 2FeCl_3$	1 1
		(ii)	3 mol X2 : 2 mol Fex3 // 0.3 mol X2 : 0.2 mol FeX3 // Jisim FeX3 = 0.2 x 162.5g // 32.5 g Mass of FeX3	 1 1
4	(a)		Jawapan: Formula kimia yang menunjukkan nisbah paling ringkas bagi bilangan atom setiap jenis unsur dalam suatu sebatian// *Chemical formula that shows the simplest ratio of the number of atoms of each element in a compound.*	1
	(b)		Jawapan: Untuk menghasilkan gas hidrogen// To produce hydrogen gas.	1
	(c)		Jawapan: Plumbum (II) oksida // argentum oksida// stanum (II) oksida // Lead (II) oxide // silver oxide // tin (II) oxide	1
	(d)	(i)	[Boleh mengira jisim bagi kuprum dan oksigen dengan betul] Sampel jawapan: Kuprum: [9.33 – 9.25] g // 0.08 g Copper Oksigen: [9.35 -9.33] g // 0.02 g Oxygen	1
		(ii)	Sampel jawapan: Bilangan mol kuprum = 0.08/64 // 0.00125 Number of moles of copper Bilangan mol oksigen = 0.02/16 // 0.00125 Number of moles of oxygen Formula empiric = CuO Empirical formula	 1 1 1

SBP 2022				Marks
3	(a)		Nombor proton// Proton number	1
	(b)		Kala 3// Period 3	1
	(c)	(i)	$3X_2 + 2Fe \rightarrow 2FeX_3$ // $3Cl_2 + 2Fe \rightarrow 2FeCl_3$	1 1
		(ii)	3 mol X_2 : 2 mol FeX_3 // ∴ 0.3 mol X_2 : 0.2 mol FeX_3 // Jisim FeX_3 *Mass of* FeX_3 = 0.2 × 162.5 g// 32.5 g	 1 1

SKEMA PEMARKAHAN
KERTAS 2
BAB 3: JADUAL BERKALA UNSUR

P2 SPM 2021

No.			MARK SCHEME	SUB MARK	TOTAL MARK
3	(a)		Answer : 1	1	1
				Total	1

P2 SPM 2022

No.			MARK SCHEME	SUB MARK	TOTAL MARK
1	(a)		Disusun mengikut tertib nombor proton yang menaik. *Arranged in ascending order of proton number.*	1	1
	(b)		Kalsium *Calcium*	1	1
	(c)		Li > N > F	1	1
	(d)		2.8.7	1	1
	(e)		**[Salah satu jawapan diterima]** Unsur peralihan berfungsi sebagai mangkin bagi mempercepat tindak balas tanpa mengubah secara kimia pada akhir tindak balas. *Transition elements function as a catalyst to increase the rate of reaction without undergoing chemical change at the end of reaction.* Unsur peralihan berupaya membentuk ion berwarna. *Transition elements form coloured ions or compounds.*	1 1	1

			Unsur peralihan mempunyai lebih daripada satu nombor pengoksidaan. *Transition elements have more than one oxidation number.* Unsur peralihan berupaya membentuk ion kompleks. *Transition elements can be form complex ions.*		
				Total	**5**

P2 SPMRSM 2021

No.			MARK SCHEME	SUB MARK	TOTAL MARK
4	(a)	(i)	**[Able to state the colour of chlorine gas correctly]** Answer: Greenish yellow	1	1
		(ii)	**[Able to write a chemical equation for the reaction between chlorine gas and iron wool correctly]** P1. Correct formulae of reactants and product P2. Balanced equation Answer: $2Fe + 3Cl_2 \rightarrow 2FeCl_3$	1 1	2
	b)		**[Able to explain why bromine is less reactive than chlorine towards hot iron wool correctly]** Sample answer: P1. **<u>Atomic size</u>** of bromine is bigger than chlorine // the distance between nucleus and the valence shell in bromine atom is further than chlorine atom P2. Forces of attraction between nucleus and valence electron is weaker in bromine **<u>atom</u>** than chlorine **<u>atom</u>**. // Nuclear attraction force is weaker in bromine **<u>atom</u>** than chlorine **<u>atom</u>**. P3. Harder for bromine **<u>atom</u>** to receive/attract electrons.	1 1 1 **Max 2**	2
				Total	**5**

P2 SPMRSM 2022

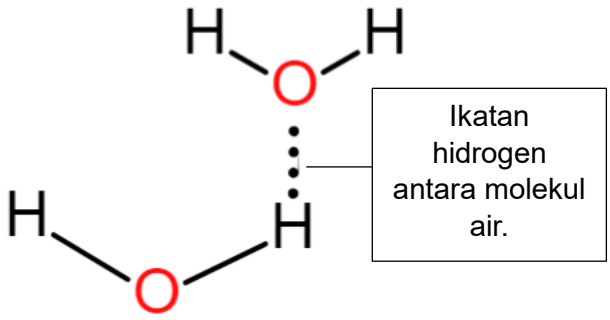
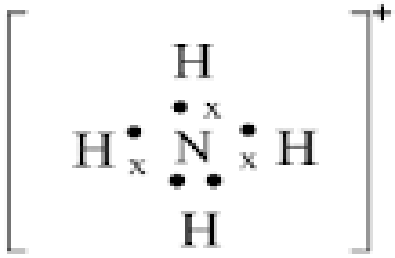
No.			MARK SCHEME	SUB MARK	TOTAL MARK
4	(a)		**[Able to write the electron arrangement of ion T correctly]** Answer: 2.8.8	1	1
	(b)		**[Able to state the position of element S in the Periodic Table of Elements correctly]** Answer: Period 2, Group 16	1	1
	(c)		**[Able to arrange the atomic size of the elements in descending order correctly]** Answer: Q,T,U,P,R,S	1	1
	(d)	(i)	**[Able to state the element that exists as monoatomic gas correctly]** Answer: U	1	1
		(ii)	**[Able to explain answer in d(i) correctly]** Answer: <u>Atom</u> has achieved stable octet electron arrangement	1	1
	(e)		**[Able to explain the difference in reactivity between the two elements correctly]** Answer: P1. Size of Q atom is bigger than P atom// [Atomic size] P2. Attraction forces between nucleus and the valence electron in Q atom is weaker than P atom// Q atom is easier to lose electron than P atom	1 1	2
				Total	**7**

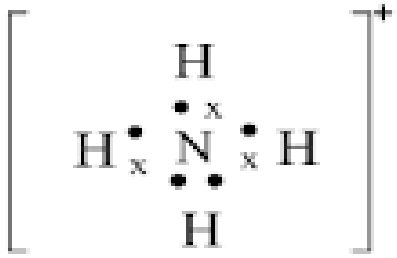
ANSWER SCHEME P2 SBP 2022

No.			MARK SCHEME	SUB MARK	TOTAL MARK
9	(b)	(ii)	**[Able to compare the reactivity of element P and Q correctly]** P1: Q/Potassium/K is more reactive than P/sodium/Na P2: The atomic size of Q /Potassium/K is bigger than P/sodium/ Na atom P3: The distance between the nucleus and the valence electron of Q/ Potassium/K atom is further than P/sodium/Na atom P4: the force of attraction between the nucleus and the valence electron of Q/ potassium/K atom is weaker than P/sodium/Na atom P5: Q/Potassium/K atom is easier to release valence electron than P/sodium/Na atom	1 1 1 1 1	5
				Total	**5**

SKEMA PEMARKAHAN
KERTAS 2
BAB 5: IKATAN KIMIA

No. Soalan *Question No.*	Jawapan *Answer*			Markah *Mark*
4	**(Q4, SPM 2021)**			
	(b)	(i)	Ikatan ion *Ionic bond*	1
		(ii)	Ikatan ion terbentuk melalui pemindahan elektron antara atom logam dengan bukan logam / *Ionic bond formed through electron transfer between metal atom and non-metal atom*	1
		(iii)	$2Na + Cl_2 \rightarrow 2NaCl$ 1 – Bahan tindak balas dan produk yang betul *1 – Correct reactants and product* 1 – Persamaan kimia yang seimbang *1 – Balanced chemical equation*	1 1
10	**(Q10, SPM 2022)**			
			Pilih unsur yang boleh bertindakbalas untuk bentukkan sebatian: A : YZ B : XZ Kenalpasti jenis ikatan dalam sebatian: A: ion B: kovalen Terangkan pembentukan ikatan sebatian: Elektron valens bagi atom X ialah 4 dan atom Z ialah 7 Atom X menyumbang 4 elektron untuk berkongsi, manakala Atom Z menyumbang 1 elektron untuk berkongsi 4 atom Z berkongsi sepasang elektron dengan satu atom X bagi mencapai susunan elektron oktet yang stabil. Ikatan kovalen tunggal terbentuk Molekul kovalen dengan formula XZ_4 terbentuk.	1 1 1 1 1 1 1 1 1 1 1
	(b)	(i)	Maksud ikatan hidrogen: Ikatan hydrogen ialah daya tarikan antara atom hydrogen,H yang mempunyai ikatan dengan atom yang	1

			tinggi keelektronegatifan , iaitu nitrogen,N, oksigen, O, atau fluorin, F di dalam molekul lain. Maksud ikatan datif: Ikatan datif bermaksud sejenis ikatan kovalen yang mana pasangan electron yang dikongsi berasal daripada satu atom sahaja. P1. Correct bonding between hydrogen and oxygen P2. Correct label  Struktur Lewis untuk menunjukkan ikatan datif dalam ion hidroksonium, H_3O^+ . P1. Correct diagram with correct charge P2. Lone pair of electrons shared with H atom Answer: 	1 1 1 1 1
5	**(Q5, SPMRSM 2021)**			
	(a)	(i)	[Able to state the meaning of hydrogen bond correctly] Answer: Attraction forces between hydrogen atom, H that has bonded with an atom of high electronegativity (such as F, O, N) with N, O or F atom in another molecule.	1

		(ii)	[Able to state the name of the element in cellulose that can form hydrogen bond with water molecules correctly] Answer: Oxygen // hydrogen in hydroxyl group/-OH	 1
	(b)		[Able to state to explain why cotton clothes take longer time to dry compared to synthetic clothes correctly] Sample answer: P1. Cotton clothes absorb water more readily than synthetic fibre clothes P2. Hydrogen bond will hold the water to cellulose in cotton OR P1. Synthetic fibre clothes allow water to evaporate easily. P2. No formation of hydrogen bond	 1 1
	(c)		[Able to explain the difference of boiling point between ethanol and ethane correctly] Answer: P1. Ethanol has higher boiling point compared to ethane. P2. Hydrogen bonds formed between ethanol molecules P3. Require more heat to overcome the forces of attraction Vice versa	 1 1 1 Max 2
	(d)		[Able to draw the dative bond in the ammonium ion correctly] P1. Correct diagram with correct charge P2. Lone pair of electrons shared with H atom Answer: 	 1 1
6	**(Q6, SPMRSM 2022)**			
	(a)	ii	*Daya tarikan elektrostatik*	1

			Electrostatic attraction forces // Electrostatic forces of attraction	
	(b)		P1. Sebatian kovalen// Kovalen r : ikatan kovalen P2. Terdiri daripada molekul neutral // tiada ion bergerak bebas hadir P3. Daya tarikan lemah antara molekul // Daya tarikan antara molekul yang lemah// Daya Van der Waals yang lemah antara molekul *P1. Covalent compound// Covalent* *r : covalent bond* *P2. Consists of neutral molecule //* *no free moving ion present* *P3. Weak attraction forces between molecules//* *Weak intermolecular forces of attraction//* *Weak Van der Waals force between molecules*	1 1 1
2	**(Q2, SBP 2021)**			
	(b)		**[Boleh menyatakan tujuan pembentukan ikatan kimia dengan betul]** Jawapan: Untuk mecapai susunan electron duplet atau octet yang stabil / *To achieve stable duplet or octet electron arrangement.*	**1**
	(c)	(i)	**Boleh menyatakan jenis ikatan yang terlibat dengan betul]** Jawapan: Kovalen / *Covalent*	1
		(ii)	**[Boleh menerangkan bagaimana ikatan kimia itu terbentuk dengan betul]** Sampel jawapan: 1. Tiga atom hidrogen berkongsi sepasang electron dengan satu atom nitrogen // *Three atoms of hydrogen share a pair of electrons with one nitrogen atom.* 2. Satu atom nitrogen menyumbang tiga elektron dan tiga atom hidrogen menyumbang satu elektron // *One atom of nitrogen contributes three electrons and three atoms of hydrogen contribute one electron.*	2
5	**(Q5, SBP 2022)**			
	(c)	(i)	[Dapat menulis persamaan kimia bagi tindak balas yang terlibat dengan betul]	

			1. Formula kimia bahan dan hasil tindak balas yang betul 2. Persamaan seimbang Contoh jawapan: 2W + X2→2WX // 2Na + Cl2 → 2NaCl	1 1
	(d)		[Dapat menerangkan perbezaan takat lebur bagi sebatian VX_4 dengan pepejal putih yang terbentuk dalam 5(c) dengan betul] Contoh jawapan: VX_4 adalah sebatian kovalen manakala pepejal putih/WX / NaCl adalah sebatian ion // Daya tarikan Van der Waals yang lemah antara molekul *VX_4* manakala daya tarikan elektrostatik yang kuat antara ion di dalam pepejal putih/ WX/ NaCl// *VX_4 is a covalent compound while white solid/ WX/ NaCl is an ionic compound// Weak Van der Waals attraction forces between VX_4 molecules while strong electrostatic attraction forces between ions in white solid/ WX/ NaCl* Sedikit tenaga haba yang diperlukan untuk mengatasi daya tarikan dalam VX_4 dan lebih banyak tenaga haba diperlukan untuk mengatasi daya tarikan dalam pepejal putih/ WX/ NaCl *Less heat energy is required to overcome the forces in VX_4 and more heat energy is required to overcome the forces in white solid/ WX/ NaCl*	 1 1

SKEMA PEMARKAHAN
BAB 6: ASID, BES DAN GARAM

[Q5, SPM 2021]				
5	(a)	(i)	Bahan kimia yang mengion dalam air untuk menghasilkan ion hydrogen *Chemical substance that ionize in water to produce hydrogen ion*	1m
		(ii)	$HCl + KOH \rightarrow KCl + H_2O$	2m
		(iii)	Bil mol KOH = 0.025 dm^3 x 0.5 mol dm^{-3} = 0.0125 mol Isipadu HCl = 0.0125 mol x 0.5 mol dm^{-3} = 0.025 dm^3	1m 1m
		(iv)	Asid sulfurik Sulphuric acid	1m
	(b)		- Asid oksalik mengion dalam air dalam Eksperimen I - Asid oksalik tidak mengion dalam propanon dalam Eksperimen II	2m

[SPM 2022, Q2]			
2	(a)	Penguraian ganda dua *Double decomposition reaction*	1m
	(b)	Pb^{2+} , NO_3^-	1m
	(c)	Pepejal X: Plumbum(II) sulfat *Solid X: Lead(II) sulphate* Larutan Y: Larutan zink nitrat *Solution Y: Zinc nitrate solution* **accept formula ion*	1m 1m

[SPMRSM 2021, Q9]

9 (a)

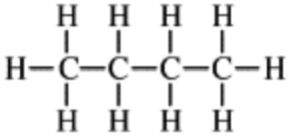
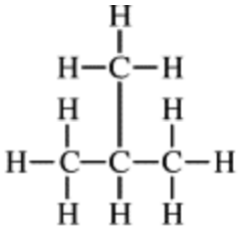
[Able to state the homologous series of hydrocarbon A correctly]

Answer:

P1. Alkane — 1

[Able to draw and name two isomers of butane correctly]

Answer:

P2.	 — 1
P3.	Butane — 1
P4.	 — 1
P5.	2-methylpropane — 1

5

(ii) [Able to compare and contrast compound B and compound C correctly]

Sample answer:

<u>Similarities:</u>

- Non-hydrocarbon organic compound — 1
- Miscible in water — 1
- Low boiling point than their corresponding alkene

Accept any two answers for P1 &P2

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	Can react with metal/ metal carbonate

			// no reaction		
			Lower boiling point (compared to C)	Higher boiling point (compared to B)	1
			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	1 1
			Functional group: -OH/hydroxyl group	Functional group: -COOH/carboxyl group	1
			Accept any three relevant answers for P3, P4 & P5		5
	(b)		[Able to describe the preparation of pentyl ethanoate by using named materials correctly] Answer: P1. Pentan-1-ol P2. Ethanoic acid Note: P1 & P2 can be deduce from procedure *r: pentanol* Sample answer: <u>Procedure:</u> P3. Pour [2-4] cm^3 of glacial/pure ethanoic acid and [2-4] cm^3 of pure pentan-1-ol into boiling tube and mix well. P4. Add slowly/a few drops of concentrated sulphuric acid into the mixture. P5. Heat gently/warm the mixture. P6. Pour the mixture into a beaker containing water. OR [reflux method] P3. Pour [25-50] cm^3 of glacial/pure ethanoic acid and [25-50] cm^3 of pure pentan-1-ol into the round bottom flask P4. Add [3-5] cm^3 of concentrated sulphuric acid into the mixture. P5. Heat under reflux. P6. Collect the product formed by using distillation method P7. $CH_3COOH + C_5H_{11}OH \rightarrow CH_3COOC_5H_{11} + H_2O$	1 1 1 1 1 1 OR 1 1 1 1	

					7
	(c)		[Able to choose the hand sanitiser and able to justify correctly] Sample answer: P1. Sanitiser M P2. Percentage of alcohol is higher P3. Can kill germs/bacteria better OR P1. Sanitiser N P2. Percentage of alcohol is lower P3. Less irritate the skin // less harm to skin OR P1. Sanitiser M P2. Percentage of alcohol in N is lower P3. Sanitiser N has less irritation on skin// less harm to skin OR P1. Sanitiser N P2. Percentage of alcohol in M is higher P3. Sanitiser M can kill germs/bacteria better	1 1 1	3

[Q11, SPMRSM 2022]					
No.			**Mark Scheme**	**Sub Mark**	**Total Mark**
11	(a)	(i)	[**Able to state the basicity of ethanoic acid and explain correctly**] Sample answer: P1. Monoprotic P2. 1 mol of ethanoic acid ionise in water to produce 1 mol of H^+ ion. // 1 molecule of ethanoic acid ionise in water to produce 1 H^+ ion.	1 1	2
		(ii)	[**Able to state and explain the differences in the observation between experiment I and II correctly**] P1. Observation of experiment I and II P2. Inference of experiment I and II P3. Explanation of experiment I and II Sample answer:	1 1 1	3

[Q11, SPMRSM 2022]

No.			Mark Scheme	Sub Mark	Total Mark
			<table><tr><th>Experiment I</th><th>Experiment II</th></tr><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^+ present</td><td>P3. Presence of H^+</td></tr></table>	1 1 1	
	(b)	(i)	[**Able to identify solid salt X, black solid Y, brown gas Z and name substance P correctly**] Answer: P1. Salt X: Copper(II) nitrate P2. Solid Y: Copper(II) oxide P3. Gas Z: Nitrogen dioxide P4. Substance P: Nitric acid *a: formula for P1, P2 & P3 r: formula for P4	 1 1 1 1	4
		(ii)	[**Able to write a balanced chemical equation and calculate the volume of gas Z correctly**] P1. Correct formula of reactant and products P2. Balanced chemical equation P3. No. of mole of salt X P4. Mole ratio P5.Volume of gas Z with correct unit Answer: P1 & P2. $2Cu(NO_3)_2 \rightarrow 2CuO + 4NO_2 + O_2$ P3. No. of mole of X = 9.4/(64+2(14)+6(16)) = 0.05 mol P4. 2 mol $Cu(NO_3)_2$ produce 4 mol NO_2 0.05 mol $Cu(NO_3)_2$ produce 0.1 mol NO_2 Note: Apply ecf P4 from P1 & P2 P5. Volume of gas Z = 0.1 x 24 = 2.4 dm^3	 1 1 1 1 1	5
	(c)		[**Able to suggest chemical substance used to treat the waste, name the reaction and describe confirmatory test correctly**] P1. Suggested chemical substance P2. Name of reaction	 1 1	

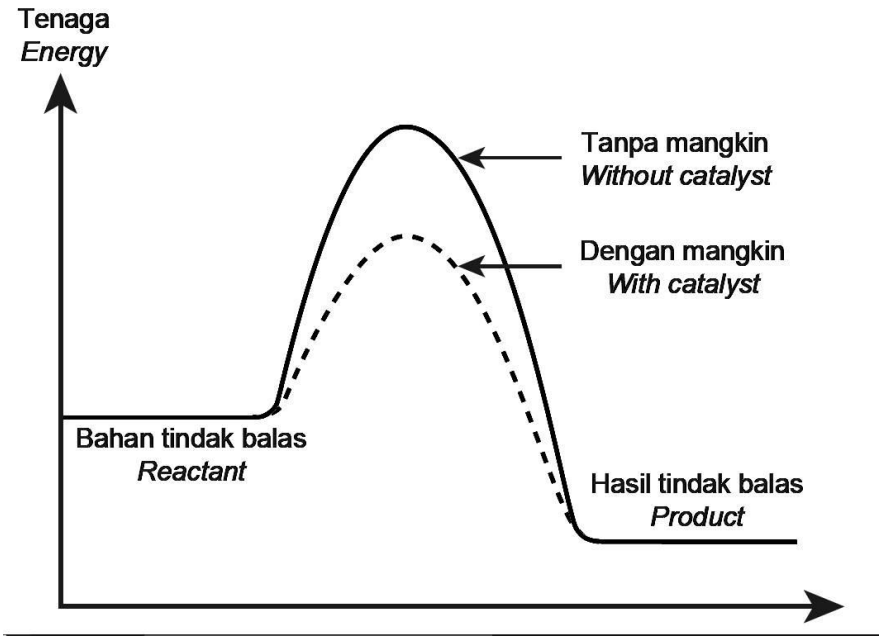
[Q11, SPMRSM 2022]					
No.			**Mark Scheme**	**Sub Mark**	**Total Mark**
			P3. Ionic equation P4,P5&P6. Confirmatory test Sample answer: P1. Any metal oxide // metal hydroxide // metal carbonate *a: formula r : alkali solution / ammonia P2. Neutralisation P3. $H^+ + OH^- \rightarrow H_2O$ * P3 dependent on P1 P4. Pour 2 cm^3 of the waste water into a test tube. P5. Add **(a named metal carbonate / metal)** into the test tube. P6. No effervescence occur // No gas bubbles	1 1+1+1	6
				Total	**20**

[Q5, SBP 2021]			
5		Jawapan (SBP 2021,Q5)	Markah
	(a)	Pengukuran logaritma ke atas kepekatan ion hidrogen yang terkandung dalam suatu larutan akueus *Logarithmic measurement of the concentration of hydrogen ion in an aqueous solution //-log [H^+]*	1
	(b)	pOH=- log [OH^-]//1 pH=14-1=13	1 1
	(c)		
	(i)	Nilai pH larutan R lebih tinggi daripada larutan S *pH value of solution R is higher than S*	1
	(ii)	1. Kepekatan ion hidroksida lebih tinggi dalam larutan R berbanding S *Concentration of hydroxide ion is higher in R solution than S* 2. Semakin tinggi kepekatan ion hidroksida, semakin tinggi nilai pH *The higher the concentration of hydroxide ion, the higher the pH value.*	1 1
	(d)	1. Formula bahan dan hasil tindak balas yang betul. 2. Persamaan seimbang. $ZnCO_3 \rightarrow ZnO + CO_2$	1 1

[Q10, SBP 2021]			
10	(a)	[Dapat menyatakan maksud asid, nama bagi asid A dan asid B dan menerangkan perbenan nilai pH dengan betul] Contoh jawapan: P1: Bahan kimia yang mengion dalam air menghasilkan ion hidrogen/W//Chemica/ substance that ionise in water to produce hydrogen ion P2: Asid etanoik// ethanoic acid///CH_3COOH P3: Asid hidroklorik// asid nitrik// hydrochloric acid//nitric acid//HCl/ HNO_3 P4 : Asid A ialah asid lemah/ mengion separa dalam air manakala asid B ialah asid kuat/ mengion sepenuhnya dalam air // Acid A is a weak acid/ ionises partially in water while acid B is a strong acid/ ionises completely in water P5 : Kepekatan ion hidrogen/ 11. bagi asid A lebih rendah berbanding asid B// Concentration of hydrogen ion/H• in acid A is lower than acid B. P6: Semakin tinggi kepekatan ion hydrogen/H^+, semakin rendah nilai pH// The higher the concentration of hydrogen ion/ H^+ the lower the pH value	1 1 1 1 1
	(b)	(Dapat menulis formula kimia bagi sebattan X dan Y, menyatakan nama bagi gas P, Q dan R yang dibebaskan dalam Tindak balas I dan t1 dengan betul) Jawapan: P I : X — ZnCO, P2: Y- $Zn(NO_3)_2$ P3: Gas P - Karbon dioksida / Carbon dioxide P4: Gas Q – Nitrogen dioksida / Nitrogen dioxide P5: Gas R – Oksigen / Oxygen (Dapat meneadangkan bahan tindak balas untuk menghasilkan sebatian X dengan betul) Contoh jawapan: P6: Zink nitrat// Zink klorida // Zink sulfat// Zinc nitrate// Zinc chloride//Zinc sulphate // $Zn(NO_3)$ill $ZnCl_2$// $ZnSO_4$ P7: Natrium karbonat / Kalium karbonat / Ammonium karbonat// Sodium carbonate// Potassium carbonate// Ammonium carbonate /l Na_2C0_3/ K_2CO_3// $(NH_4)_2CO_3$ [Dapat mcnulis persamaan kimia bagi Tindak balas dengan betul Jawapan: P8: Formula bahan dan hasil tindak balas dengan betul P9: Persamaan seimbang : $2\ Zn(NO_2)_2 \rightarrow 2\ ZnO + 4NO_2 + O_2$	 1 1 1 1 1 1 1 1 1

	(c)	[Dapat mengatakan nama tindak balas hagi menghasilkan garam tak terlarutkan dengan betul] Contoh jawapan: PI: Pcnguraian ganda dua/ Pemendakana // Double decomposition Precipitation [Dapat menulis persamaan ion dengan betul] P2 : Formula bahan dan hasil tindak balas yang hetul P3 : Persamaan seimbang : $Pb^{2+} + 2\ I^- \rightarrow PbI_2$ [Dapal menghitungjisim plumbum(II) iodida dengan betul] Contoh jawapan: P4 : I mol $Pb(NO_3)_2$ menghasilkan I mol PbI_2 // I mol of $Pb(NO_3)_2$ produce 1 mol of PbI_2 / 0.05 mol $Pb(NO_3)_2$ menghasilkan 0.05 mol PbI_2 // 0.05 mol of $Pb(NO_3)_2$ produce 0.05 mol of PbI_2 P5 : Jisim PbI_2 = 0.05 x 1207 + 127(2)1 = 23.05 g	 1 1 1 1 1
		TOTAL	20

SKEMA PEMARKAHAN
KERTAS 2
BAB 7: KADAR TINDAK BALAS

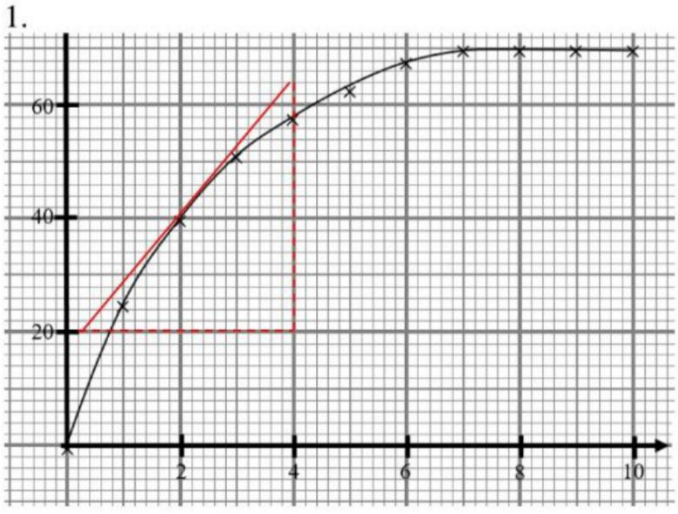
1	(Q2, SPM 2021)			Marks
	(a)	Act as catalyst		1
	(b)	The volume of gas produced remain unchanged		1
	(c)			1
	(d)	1. Sufficient activation energy 2. Correct collision orientation		1 1
			Total marks	5
2	(Q8, SPM 2022)			
	(a)	(i)	**[Dapat mengenal pasti factor yang mempengaruhi kadar tindak balas dengan betul]** Jawapan: Suhu//*Temperature*	**1**
	(b)		**[Dapat menerangkan dengan betul bagaimana lengkung (III) diperoleh tanpa mengubah bahan tindak balas dengan betul]** Contoh jawapan: 1. Guna 25 cm_3 asid hidroklorik 0.1 mol dm_{-3} lebih tinggi daripada 50 °C // tambah mangkin / $CuSO_4$ / kuprum(II) sulfat //	1+1

			Use 25 cm_3, 0.1 mol dm_{-3} hydrochloric acid with temperature higher than 50 °C // Add catalyst / $CuSO_4$ / copper(II) sulphate atau 1. Gunakan 12.5 cm_3 asid hidroklorik dengan kepekatan 0.2 mol dm^{-3} // *Use 12.5 cm^3 hydrochloric acid with concentration of 0.2 mol dm^{-3}* *Nota: Bil mol HCl = 0.0025 mol, supaya mencapai V cm^3 gas	1+1
	(c)		**[Dapat memberi pendapat dan mewajarkan dengan betul]** Contoh jawapan: 1. Tablet antasid perlu dikunyah // *Antacid tablets should be chewed* 2. Meningkatkan jumlah luas permukaan // *Increase total surface area* Mengambil masa yang singkat untuk lega // meningkatkan kadar tindak balas *// Takes shorter time to relieve // increases the rate of reaction*	1 1 1
			Total marks	**6**
3	(Q6, SPMRSM 2021)			
	(b)	(ii)	**[Able to explain which set of experiment used the highest concentration of hydrochloric acid correctly]** Answer: P1. Set I P2. Has the steepest curve/gradient	1 1
			Total marks	**2**

Question			Answer	Marks
4			**(Q9, SPMRSM 2022)**	
	(a)	(ii)	**[Able to calculate the average rate of reaction for Set I and Set II with unit correctly]** Answer: P1. Set I : 48.00/2 = 24 cm^3 min^{-1} // 0.4 cm3 s^{-1} P2. Set II: 72.00/4 = 18 cm^3 min^{-1} // 0.3 cm3 s^{-1}	 1 1
	(b)		**[Able to suggest the change that can be done to Set I and explain the changes based on collision theory correctly]** P1. Changes to obtain Set II P2-P5. Explanation using collision theory P6. Changes to obtain Set III P7-P10. Explanation using collision theory Sample answer: **<u>To obtain Set II</u>** P1. Use zinc granules // Use bigger size of zinc <u>Explanation:</u> P2. Zinc granules have smaller total surface area exposed to collision P3. Frequency of collision between H+ ions and Zn atoms is lower P4. Frequency of effective collision between H+ ions and Zn atoms is lower P5. Rate of reaction will be lower **<u>To obtain Set III</u>** P6. Add copper(II) sulphate (solution) <u>Explanation:</u> P7. The presence of copper(II) sulphate/catalyst provide alternative pathway with lower activation energy P8. More colliding/reactant particles able to achieve the lower activation energy P9. Frequency of effective collision between H+ ions and Zn atoms is higher P10. Rate of reaction will be higher **Note: -reject decreases for P3, P4 and P5* *-reject increases for P9 and P10*	 1 1 1 1 1 1 1 1 1 1
			TOTAL	**10**

5	(Q9, SBP 2021)			
	(a)	(i)	**[Boleh memilih suhu air dan menerangkan mengapa pakaian dapat dibersihkan dengan lebih cepat apabila menggunakan air panas dengan betul]** Sampel jawapan: 1. Air panas// *Hot water* 2. Suhu air dalam air panas lebih tinggi berbanding dalam air sejuk// *Temperature of hot water is higher than cold water.* 3. Tenaga kinetik **molekul air** dalam air panas lebih tinggi berbanding air sejuk // *Kinetic energy of **water molecule** in hot water is higher than cold water.*	1 1 1
		(ii)	**[Boleh menyatakan dua faktor yang dapat menpengaruhi kadar tindak balas selain daripada suhu dengan betul]** Sampel jawapan: 1. Saiz bahan tindak balas//Size *of reactants* 2. Kepekatan bahan tindak balas// *Concentration of reactants*	1 1
	(b)	(i)	**[Boleh menulis persamaan kimia bagi tindak balas itu dan menghitung isi padu maksimum gas yang terbebas dengan betul]** I. Formula kimia bahan dan basil tindak balas yang betul. 2. Persamaan kimia seimbang. 3. Bilangan mol 4. Nisbah mol 5. Isi pade gas dengan unit yang betul Jawapan: $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$ Bilangan *moV/Number of mol = (2)(20) / 1000* // 0.04 I mot H2SO4: I mot H2 // 0.04 mot H2SO4 : 0.04 mot H2 Isi padu// *Volume*= 0.04 x 24 dm^3 // 0.96 dm^3	1 1 1 1 1
		(ii)	**[Boleh membandingkan kadar tindak balas dan menerangkan jawapan berdasarkan Teori Perlanggaran dengan betul]** Sampel jawapan: Set I dan II I. Kadar tindak balas di Set I lebih tinggi berbanding di Set II // *Rate of reaction is Set I is higher compared to Set II* 2. Saiz magnesium/ Mg di Set I lebih kecil berbanding di Set	1 1

			II// *Size of magnesium/Mg in Set I is smaller compared to in Set II*	1
			3. Jumlah luas permukaan bagi magnesium/ Mg di Set I lebih besar// *Total surface area of magnesium/ Mg in Set I is larger*	1
			4. Frekuensi perlanggaran antara ion hidrogen/ H^+ dan atom magnesium/ Mg lebih tinggi diSet 1// *Frequency of collision between hydrogen ion/ H^+ and magnesium/ Mg atom is higher in Set I*	1
			5. Frekuensi perlanggaran berkesan antara zarah lebih tinggi di Set I// *Frequency of effective collision between particles is higher in Set I*	1
			Set II dan III	1
			6. Kadar tindak balas di Set III lebih tinggi berbanding di Set II// *Rate of reaction in Set III is higher than in Set II*	1
			7. Kepekatan asid sulfurik di Set II lebih tinggi/ dua kali ganda daripada Set I// *Concentration of sulphuric acid in Set III is higher/ double than in Set I*	1
			8. Bilangan ion hidrogen/ H^+ per unit isi padu adalah lebih tinggi/ dua kali ganda di Set III// *Number of hydrogen ion/ W per unit volume is higher/double in Set III*	1
			9. Frekuensi perlanggaran antara ion hidrogen/ H^+ dan atom magnesium/ Mg lebih tinggi di Set III// *Frequency of collision between hydrogen ion/* H^+ *and magnesium/ Mg atom is higher in Set III*	
			10. Frekuensi perlanggaran berkesan antara zarah lebih tinggi di Set III// *Frequency of effective collision between particles is higher in Set III*	
				Total: 20

Question			Answer	Marks
6.	(a)		**(SBP 2022)** **[Dapat menyatakan jenis zarah daiam magnesium karbonat dengan betul]** Jawapan: Ion	 1
	(b)		**[Dapat menulis persarnaan kimia bagi tindak balas dengan betul]** 1. Formula kinnia bahan dan basil tindak balas yang betul 2. Persamaan seimbang Jawapan: $MgCO_3 + H_7SO_4 \rightarrow MgSO_4 + CO_2 + H_2O$	 1 1
	(c)	(I)	**[Dapat menyatakan sebab lengkung pada graf mendatar selepas 7 minit dengan betul]** : Jawapan: Semua acid sulfurik telah bertindak balas dengan lengkap// *Ali sulphuric acid has completely reacted*	 1
		(II)	**[Dapat menghitung kadar tindak balas pada minit kedua dengan betul]** 1.  2. $\frac{(64-20)}{(4-0.2)}$ $cm^3\ min^{-1}$ // $11.58 \pm 0.5\ cm^3\ min^{-1}$ 1. 1.Tangen ditunjukkan pada graf dalam Rajah 6 2. Kadar tindak balas dengan unit yang betul Contoh jawapan:	

	(d)		**[Dapat membandingkan kadar tindak balas antara Set I dan Set II dan menerangkan menggunakan teori perlanggaran dengan betul]** Contoh jawapan: 1. Kadar tindak balas di Set II lebih tinggi daripada Set I// *Rate of reaction in Set II is higher than Set I* 2. Kepekatan acid nitrik lebih tinggi dalam Set II// Bilangan ion H^+ per unit isi padu lebih tinggi dalam Set II// *Concentration of nitric acid is higher in Set II//* *The number of H+ ion per unit volume is higher in Set II* 3. Frekuensi perlanggaran berkesan antara ion H^+ dan $MgCO_3$ lebih tinggi dalam Set II// *The frequency of effective collision between H^+ ion and $MgCO_3$ is higher in Set II* [Atau sebaliknya//*vice versa*]	 1 1 1
			TOTAL	7

PANEL

WAFA BINTI MOHAMAD FAUZI	MRSM ALOR GAJAH
MUHAMMAD HAZRIQ BIN ARIS	MRSM ARAU
NUR SITI FATIMAH BINTI BUKHORI	MRSM ARAU
NIK NURUL FATIHAH BINTI MOHD NOOR	MRSM ATM BERA
NURUL AMIRA BINTI ABU BAKAR	MRSM ATM BERA
NUR SYUHADHA BINTI MOHAMAD ASERI	MRSM ATM BERA
SITI RAUDHAH BINTI ABDUL MANAP	MRSM BAGAN DATUK
AMIERUL HAFREEZ BIN NOOR HASNAN	MRSM BAGAN DATUK
NURAZIELLA BINTI ABDULLAH	MRSM BALING
NURUL 'AFIFAH SYA-IRAH BT ABD NASIR	MRSM BALING
SHAHIRA BINTI MAT YUSOF	MRSM BATU PAHAT
NORHANA HUMAIRAH BINTI ALIAS	MRSM BENTONG
AHMAD TAJUDIN BIN ABDUL RAHMAN	MRSM BESERI
NUR FARHANA BINTI MOHAMAD ALI	MRSM BESERI
RAHAYU BINTI ABDUL RAHMAN	MRSM BESUT
NUR SYAMIMI BINTI AB RASID	MRSM BESUT
NUR QUSYAIRI BIN MOHAMED FAUZI	MRSM BETONG
MUHAMMAD FIRDAUS BIN HAMZAH	MRSM FELDA TROLAK
MUHAMAD HAIZAT BIN GHAZALI	MRSM GEMENCHEH
NIK MUHAMMAD IRFAN HAKIMI BIN MOHD SAUFI	MRSM JOHOR BAHRU
AZHAR BIN ZAWAWI	MRSM JOHOR BAHRU
ABDUL HAFIZ BIN SHEIK MUHAMED	MRSM JELI
NURHAYATUN SOBARIAH BINTI ABDUL RAZAK	MRSM KOTA PUTRA
WAN MUHAMMAD NAJMI BIN WAN ANUAR	MRSM KUALA KLAWANG
NUR ADILA BINTI RAMLON	MRSM KUANTAN
DINAH ADELINA BINTI RAZALI	MRSM KUANTAN
AMIR FARHAN BIN OMAR	MRSM KUCHING
AIDA ROHAYU BINTI ABDUL KARIM	MRSM LANGKAWI
MUHAMMAD NORAZRAA BIN NORDIN	MRSM LANGKAWI
KARTIKA BINTI FIRMAN	MRSM MERSING
NAJIBULLA BIN ROMAINOR	MRSM PENGKALAN CHEPA
ELYSA ANAK CHUNDANG	MRSM KOTA PUTRA
SHAHADAD BIN ZAINOL ABIDIN	MRSM PENGKALAN CHEPA
NORIZAN BINTI RAMLI	MRSM SERTING
DANIAL FIKRI BIN SAMSUDIN	MRSM TUMPAT
SAIDAH NAFISAH BT ZULKUPLI	MRSM TUMPAT
NAJIHAH BINTI HARON	MRSM TUN ABDUL RAZAK
NURFARIZAH BINTI MUHAMMAD FAISAL	MRSM TUN GHAFAR BABA
BASIRAH BINTI ABU BAKAR	MRSM TUN GHAZALI SHAFIE
AMALIN SOFEA BINTI ROZANI	MRSM TUN MOHAMMAD FUAD STEPHENS
NAWAL BINTI NASARUDIN	MRSM TUN MOHAMMAD FUAD STEPHENS
NAJWA BINTI AHMAD SHAHRIR	MRSM TUN MUSTAPHA
NOR AZIEDA BINTI AZAHARI	BPM
GHAZALI BIN MUSA	BPM