CONFIDENTIAL
4541/2
Chemistry
Paper 2
August
2018

SIJIL PENDIDIKAN
MAKTAB RENDAH SAINS MARA
2018

CHEMISTRY

Paper 2

MARKING SCHEME

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ATTENTION

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The marking scheme consists of 13 printed pages

1		MARKING SCHEME	MARK	TOTAL MARKS
(a)	(i)	Pure metal : J Alloy : K	1	1
	(ii)	P1 : The presence of <u>zinc atoms</u> that are <u>different size</u> <u>disturb/disrupt the orderly arrangement</u> of <u>copper atoms</u> P2 : Reduce/minimize/difficult/ the layer of copper atoms from sliding.// not easily slide *r : prevent*	1 1	2
(b)	(i)	Penicillin	1	1
	(ii)	Psychotherapeutic	1	1
	(iii)	Paracetamol	1	1
	(iv)	**Sample answer:** P1. Barbiturates are useful. P2. It can cure many mental problems. P3. It can be used as prescribed by doctors. **or** P1. Barbiturates are bad. P2. It can cause addiction/ death P3. If overdose	 1 1 1 1 1 1	3
			Total	**9**

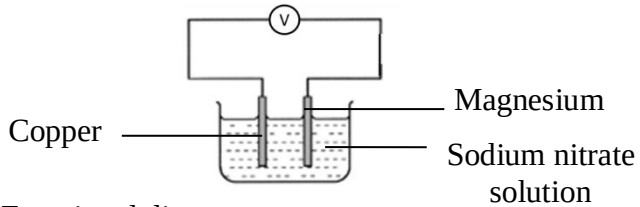
2		MARKING SCHEME	MARK	TOTAL MARKS
(a)	(i)	2.8	1	1
	(ii)	Atom W achieve stable octet electron arrangement// Atom W has 8 valence electron	1	1
(b)		Y // Cl	1	1
(c)		Z // Fe	1	1
(d)	(i)	P1 correct chemical formula of reactants and products P2 balance Sample answer: $2X + 2H_2O \rightarrow 2XOH + H_2$ $//2Na + 2H_2O \rightarrow 2NaOH + H_2$	1 1	2
	(ii)	2 mol X produce 1 mol H_2 Volume of $H_2 = 1 \times 24$ $= 24\ dm^3$ [r: without unit]	1 1	2
(e)		Element R is more reactive than element X	1	1
			Total	**9**

[Lihat halaman sebelah

<table>
<tr><th colspan="2">3</th><th>MARKING SCHEME</th><th>MARK</th><th>TOTAL MARK</th></tr>
<tr><td rowspan="3">(a)</td><td>(i)</td><td>A chemical formula that shows the simplest ratio of atoms of each element in a compound.</td><td>1</td><td rowspan="3">3</td></tr>
<tr><td>(ii)</td><td>CH</td><td>1</td></tr>
<tr><td>(iii)</td><td>CH_3COOH / $C_2H_4O_2$</td><td>1</td></tr>
<tr><td rowspan="3">(b)</td><td>(i)</td><td><table><tr><td>Element</td><td>Cu</td><td>O</td></tr><tr><td>Mass of element (g)</td><td>1.92</td><td>0.48</td></tr><tr><td>Number of moles</td><td>1.92÷64
= 0.03</td><td>0.48÷16
=0.03</td></tr><tr><td>Simplest ratio of moles</td><td>0.03÷0.03
= 1</td><td>0.03÷0.03
= 1</td></tr></table>Empirical formula : CuO</td><td>1

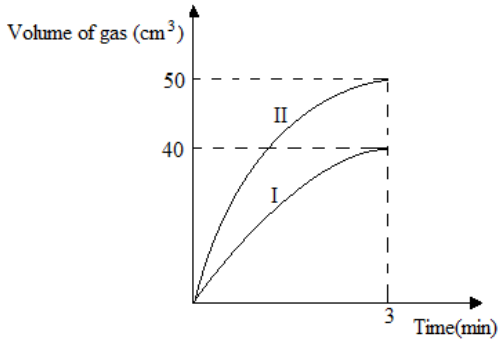
1

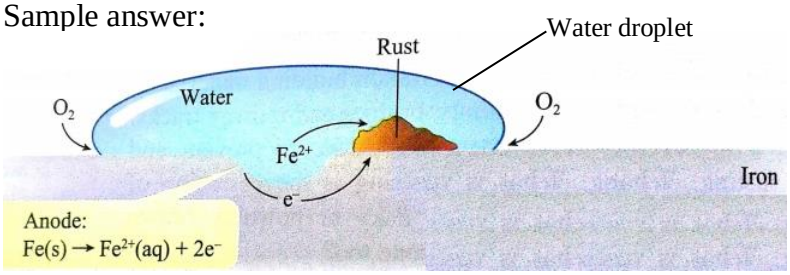
1
1</td><td>4</td></tr>
<tr><td>(ii)</td><td>By heating, cooling and weighing until a constant mass is obtained.</td><td>1</td><td>1</td></tr>
<tr><td>(iii)</td><td>P1 Cannot.
P2 Because magnesium is above hydrogen in the Reactivity Series// Magnesium is more reactive than hydrogen.
r: electropositive</td><td>1
1</td><td>2</td></tr>
<tr><td colspan="3"></td><td>Total</td><td>10</td></tr>
</table>

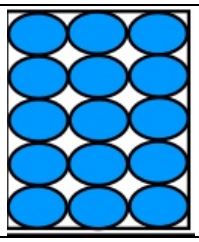
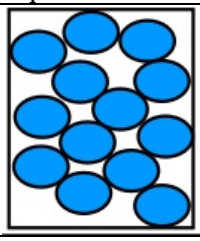
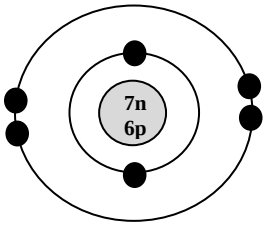
<table>
<tr><th colspan="2">4</th><th>MARKING SCHEME</th><th>MARK</th><th>TOTAL MARKS</th></tr>
<tr><td rowspan="6">(a)</td><td>(i)</td><td>Chemical / Substance that can conduct electricity in aqueous or molten state and undergoes chemical changes.</td><td>1</td><td>1</td></tr>
<tr><td>(ii)</td><td>Cl^- and OH^- // chloride ion and hydroxide ion</td><td>1</td><td>1</td></tr>
<tr><td>(iii)</td><td>P1 Chlorine gas
P2 Because concentration of Cl^- ion is higher than concentration of OH^- ion</td><td>1
1</td><td>2</td></tr>
<tr><td>(iv)</td><td>$2Cl^- \rightarrow Cl_2 + 2e$</td><td>1</td><td>1</td></tr>
<tr><td>(v)</td><td>Hydrogen gas</td><td>1</td><td>1</td></tr>
<tr><td>(vi)</td><td>P1 Put/place a lighted wooden splinter near the mouth of the test tube.
P2 ‘Pop’ sound is heard/produced.</td><td>1
1</td><td>2</td></tr>
<tr><td colspan="2">(b)</td><td> 

P1 Functional diagram
P2 Label</td><td>

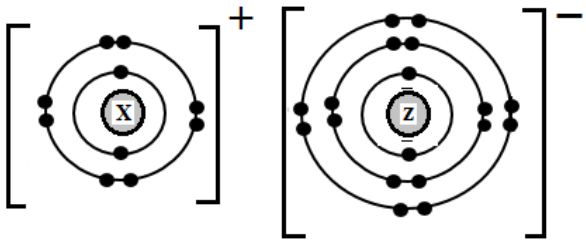
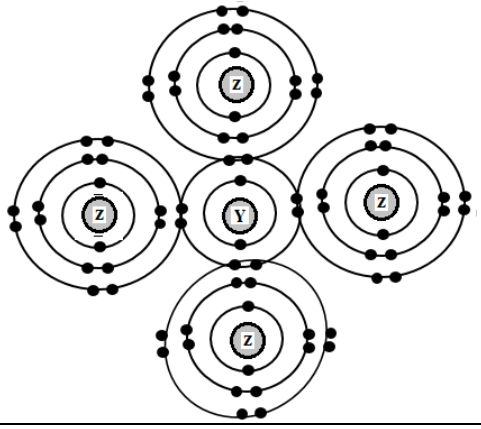
1
1</td><td>2</td></tr>
<tr><td colspan="3"></td><td>Total</td><td>10</td></tr>
</table>

5		MARKING SCHEME	MARK	TOTAL MARKS
(a)		Catalyst is a substance that change/alters the rate of reaction and remain chemically unchanged.	1	1
(b)		 P1. Correct shape of the graph with label I and II P2. Label volume of gas and time at 3 mins	 1 1	 2
(c)	(i)	$40 \div 3 = 13.33\ cm^3\ min^{-1}$ *r: without unit*	1	2
	(ii)	$50 \div 3 = 16.67\ cm^3\ min^{-1}$ *r: without unit*	1	
	(iii)	The rate of reaction of Set I is lower than Set II // The rate of reaction of Set II is higher than Set I	1	1
	(iv)	P1. Catalyst provide alternative path with <u>lower activation energy.</u> P2. More colliding reacting particles can achieve the lower activation energy. P3. Frequency of effective collision between H^+ ion and Zn atom is higher.	1 1 1	3
(d)		**Sample answer:** P1. Cut the meat into smaller pieces P2. It will increase the total surface area of the meat P3. More heat is absorbed by the meat. **OR** P1. Cook the meat by using pressure cooker. P2. When pressure increase, it will increase the boiling point of water / increase the temperature P3. More heat is absorbed by the meat.	 1 1 1 1 1 1	 3 Max 2
			Total	**11**

6		MARKING SCHEME	MARK	TOTAL MARKS
(a)	(i)	P1 correct chemical formula of reactants and products P2 balance Answer: $3C + 2Fe_2O_3 \rightarrow 3CO_2 + 4Fe$	1 1	2
	(ii)	From +3 to 0 // *+3 → 0*	1	1
	(iii)	Iron (III) oxide	1	1
(b)		P1. Set II no reaction because magnesium is more reactive than carbon. P2. Set III, Metal X / copper is formed shows carbon is more reactive than metal X.	1 1	2
(c)		X , Fe , C , Mg	1	1
(d)	(i)	Rusting	1	1
	(ii)	P1. Diagram with label for iron, water (droplet) and oxygen P2. Flow of electron in the iron P3. Half equation at anode Sample answer:  	1 1 1	3
			Total	**11**

<table>
<tr><th colspan="2">7</th><th>MARKING SCHEME</th><th>MARK</th><th>TOTAL MARKS</th></tr>
<tr><td rowspan="2">(a)</td><td>(i)</td><td>P1. Diffusion
P2. The mothballs vapour particles/molecules are tiny and discrete
P3. which move <u>freely/randomly</u> in between the air particles/molecules
P4. From the higher concentration area/region to the lower concentration area/region</td><td>1
1
1
1</td><td>4</td></tr>
<tr><td>(ii)</td><td><table><tr><th></th><th>P to Q</th><th>R to S</th></tr><tr><td>State of matter</td><td>Solid</td><td>Liquid</td></tr><tr><td>Movement of particle</td><td>Vibrate and rotate at their fixed positions</td><td>Vibrate, rotate and move/slide throughout the liquids</td></tr><tr><td>Particles arrangement</td><td>  </td><td>  </td></tr></table></td><td>1 + 1
1 + 1
1+ 1</td><td>6</td></tr>
<tr><td rowspan="3">(b)</td><td>(i)</td><td>P1. <u>Atoms</u> are isotopes
P2. <u>Atoms</u> have the same number of proton but different number of neutron
adp: atoms for P2
a: <u>Atoms</u> have the same proton number but different nucleon number</td><td>1
1</td><td>2</td></tr>
<tr><td>(ii)</td><td><table><tr><th></th><th>C-12</th><th>C-13</th><th>C-14</th></tr><tr><td>Number of proton</td><td>6</td><td>6</td><td>6</td></tr><tr><td>Number of neutron</td><td>6</td><td>7</td><td>8</td></tr><tr><td>Number of electron</td><td>6</td><td>6</td><td>6</td></tr><tr><td>Physical properties</td><td colspan="3">Different</td></tr><tr><td>Chemical properties</td><td colspan="3">Similar</td></tr></table>a: any specific chemical reaction of carbon.
Eg: Carbon reacts with oxygen produces carbon dioxide</td><td>1
1
1
1
1</td><td>5</td></tr>
<tr><td>(iii)</td><td>P1. Nucleus is shown (labeled/shaded)
P2. Number of proton & neutron is shown in the nucleus
P3. Correct number of shells and its electrons
  </td><td>1
1
1</td><td>3</td></tr>
<tr><td colspan="3"></td><td>Total</td><td>20</td></tr>
</table>

8		MARKING SCHEME	MARK	TOTAL MARKS
(a)	(i)	Method I: Copper(II) nitrate / magnesium chloride Method II– Barium sulphate *a: formula*	1 1	2
	(ii)	*Reactants for insoluble salt: any suitable answer* P1. Soluble barium salt – Barium nitrate / Barium chloride P2. Soluble sulphate salt – Sodium sulphate // potassium sulphate // ammonium sulphate etc. *a: formula*	 1 1	 2
(b)	(i)	Lead(II) nitrate *r: formula*	1	1
	(ii)	P1. No. of moles of $Pb^{2+} = \frac{0.1 \times 5}{1000}$ $= 0.0005$ mole P2. No. of moles of $I^- = \frac{0.2 \times 5}{1000}$ $= 0.001$ mole P3. 0.0005 moles of Pb^{2+} reacts completely with 0.001 moles of I^- 1 moles of Pb^{2+} reacts with 2 moles of I^- P4. Simplest ratio $Pb^{2+} : I^-$ is 1:2 P5. $Pb^{2+} + 2\ I^- \rightarrow PbI_2$	 1 1 1 1 1	 5
(c)	(i)	Gas V : carbon dioxide Solid W : Zinc carbonate Salt Y : Zinc nitrate Solid Z: Zinc Oxide	1 1 1 1	 4
	(ii)	P1 : Pour solution Y into two different test tubes P2 : Add drop by drop of ammonia solution until in excess and shake. P3 : White precipitate is formed and dissolve in excess ammonia. P4 : Add 2 cm^3 dilute sulphuric acid followed by 2 cm^3 iron(II) sulphate P5: Add concentrated sulphuric slowly// slant the test tube carefully P6: A brown ring is formed	1 1 1 1 1 1	 6
			Total	**20**

9		MARKING SCHEME	MARK	TOTAL MARKS
(a)	(i)	P1. X: 2.8.1 P2. Y: 2.4 P3. Z: 2.8.7	1 1 1	3
	(ii)	**OPTION 1** P1. X and Z formed ionic bond P2. To achieve [stable] octet electron arrangement P3. X atom release/donate one [valence] electron to form X^+ ion. P4. Z atom gain/receive one electron to form Z^- ion P5. X^+ and Z^- are attracted by strong electrostatic force P6 & P7. Diagram • Correct number of shells and electron • Labeled nucleus and charge of ions  **OPTION 2** P1. Y and Z form covalent bond P2. To achieve [stable] octet electron arrangement P3. One atom Y contribute 4 electrons while P4. each atom Z contribute 1 electron P5. One atom Y share 4 pairs of/8 electrons with four atom Z P6 & P7. Diagram • Correct number of shells and electron • Labeled nucleus and correct number of atom 	1 1 1 1 1 1 1 1 1 1 1 1 1 1	7

<table>
<tr>
<td>(b)</td>
<td>
Compound T: Sodium chloride/magnesium chloride, etc.
Compound V: Hexane
a: any ionic and covalent compound

<u>Experiment 1: Melting point or boiling point</u>
Procedure:
1) Place half spatula of compound T and pour compound V in evaporating dish separately
2) Leave aside / heat for [5-10] minutes
3) Observe and record the change

<table>
<tr><th colspan="2">Observation</th></tr>
<tr><td>Compound T remains as solid</td><td>Liquid V disappears// Volume of liquid V decreases</td></tr>
</table>

<u>Experiment 2: Solubility in water</u>
Procedure:
1) Pour 5 cm^3 of water into two different test tubes
2) Place half spatula of compound T and 2 cm^3 of compound V into each test tube separately and shake
3) Observe and record the change

<table>
<tr><th colspan="2">Observation</th></tr>
<tr><td>The solid T dissolve in water</td><td>Liquid V does not dissolve in water</td></tr>
</table>

Conclusion:
Compound T is ionic compound and compound V is covalent compound
</td>
<td>
1

1
1
1

1

1
1
1

1

1
</td>
<td>10</td>
</tr>
<tr>
<td colspan="2"></td>
<td>Total</td>
<td>20</td>
</tr>
</table>

<table>
<tr><th colspan="2">10</th><th>MARKING SCHEME</th><th>MARK</th><th>TOTAL MARKS</th></tr>
<tr><td colspan="2">(a)</td><td>P1. Total energy absorbed, E_x
1740 + 994 = 2734 kJ

P2. Total energy released, E_y
1606 + 1856 = 3462 kJ of energy

P3. Energy change, $\Delta H = E_x - E_y$
$= 2734 - 3462$
$= -728$ kJ mol^{-1}
P4. Exothermic reaction</td><td>1

1

1
1</td><td>4</td></tr>
<tr><td>(b)</td><td>(i)</td><td><table><tr><th></th><th>Set I</th><th>Set II</th></tr><tr><td>Heat change in the reaction</td><td>Heat release</td><td>Heat absorb</td></tr><tr><td>The change in total energy of reactants and products</td><td>Total energy content of reactants is higher than total energy content of products</td><td>Total energy content of reactant is lower than total energy content of product</td></tr></table></td><td>1

1</td><td>2</td></tr>
<tr><td></td><td>(ii)</td><td>P1. Number of mole $CuSO_4 = \frac{100\ x\ 1.0}{1000} = 0.1$ mol
P2. Heat released = 100 x 4.2 x 12 = 5040 J
P3. [Displacement] of 0.1 mol Cu → 5040 J heat released
[Displacement] of 1 mol Cu → $\frac{5040\ x\ 1}{0.1} = 50400$ J
P4. $\Delta H = -50.4$ kJ mol^{-1}</td><td>1
1
1
1</td><td>4</td></tr>
<tr><td colspan="2">(c)</td><td>P1.Soluble salt 1: suitable carbonate salt solutions to produce precipitate/ insoluble salt
Sample Answer:
Sodium carbonate solution/ ammonium carbonate solution /potassium carbonate solution.

P2. Soluble salt 2: suitable zinc salt solutions to produce precipitate/ insoluble salt
Sample answer:
Zinc nitrate solution/zinc sulphate solution/zinc chloride solution</td><td>1

1
==
2</td><td></td></tr>
</table>

	Procedure: P3. Measure [25-200] cm^3 of [0.1-2.0] $moldm^{-3}$ zinc nitrate solution. P4. Pour into a polystyrene cup. P5. Measure [25-200] cm^3 of [0.1-2.0] $moldm^{-3}$ sodium carbonate solution. P6. Pour into a different polystyrene cup. P7. Measure the initial temperature of both solutions. P8. Pour sodium carbonate solution quickly into zinc nitrate solution.[a: vice versa] P9. Stir the mixture. P10. Record the highest/maximum temperature.[r: final temperature] P11. $Zn(NO_3)_2 + Na_2CO_3 \rightarrow ZnCO_3 + 2NaNO_3$	1 1 1 1 1 1 1 1 == 8 Max 7 1	10
		Total	**20**

TEST SPECIFICATION TABLE
SIJIL PENDIDIKAN MRSM
CHEMISTRY PAPER 2, 2018

Section	Question Number (Topic)	Construct of Elements Evaluated				
		CK 01 Knowledge	**CS 01** Comprehension	**CS 02** Application	**CS 03** Analysis	**CS 04** Synthesis
A	Q1 Manufacture Substance in Industry & Chemical For Consumer	**6**	**3**			
		1a(i)[1m] 1a(ii)[2m] 1b(i)[1m] 1b(ii)[1m] 1b(iii)[1m]	1b(iv)[3m]			
	Q2 Periodic Table of Elements	**3**	**2**	**4**		
		2a(i)[1m] 2a(ii)[1m] 1b(i)[1m]	2c[1m] 2e[1m]	2d(i)[2m] 2d(ii)[2m]		
	Q3 Chemical Formulae & Equation	**3**	**3**	**4**		
		3a(i)[1m] 3a(iii)[1m] 3b(ii)[1m]	3a(ii)[1m] 3b(iii)[2m]	3b(i)[4m]		
	Q4 Electrochemistry	**2**	**3**	**5**		
		4a(i)[1m] 4a(ii)[1m]	4a(iii)[2m] 4a(v)[1m]	4a(iv)[1m] 4a(vi)[2m] 4b[2m]		
	Q5 Rate of Reaction	**1**	**8**	**2**		
		5a[1m]	5b[2m] 5c(iii)[1m] 5c(iv)[3m] 5d[2m]	5c(i)[2m]		
	Q6 Redox	**1**	**4**	**5**	**1**	
		6d(i)[1m]	6a(ii)[1m] 6a(iii)[1m] 6b[2m]	6a(i)[2m] 6d(ii)[3m]	6c[1m]	

Section	Question Number (Topic)	Construct of Elements Evaluated				
		CK 01 Knowledge	**CS 01** Comprehension	**CS 02** Application	**CS 03** Analysis	**CS 04** Synthesis
B	Q7 The Structure Of Atom		**6**	**3**	**11**	
			7a(i)[4m] 7b(i) [2m]	7b(iii)[3m]	7a(ii)[6m] 7b(ii) [5m]	
	Q8 Salts		**4**	**6**	**10**	
			8a(i)[2m] 8a(ii)[2m]	8b(i)[1m] 8b(ii)[5m]	8c(i)[4m] 8c(ii)[6m]	
C	Q9 Chemical Bonds			**3**	**7**	**10**
				9a(i)[3m]	9a(ii)[7m]	9b[10m]
	Q10 Thermochemistry			**2**	**8**	**10**
				10a(i)[2m]	10a(ii)[5m] 10b[3m]	10c[10m]

END OF MARKING SCHEME