

**SULIT**

Nama: ..... Tingkatan: .....

**PROGRAM PENINGKATAN PRESTASI AKADEMIK  
SPM  
TAHUN 2012**

**CHEMISTRY**

**Paper 3**

One hour and thirty minutes

**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU**

1. Kertas soalan ini adalah dalam dwibahasa.
2. Soalan dalam Bahasa Inggeris mendahului soalan yang sepadan dalam Bahasa Melayu.
3. Calon dibenarkan menjawab keseluruhan atau sebahagian soalan sama ada dalam Bahasa Inggeris atau Bahasa Melayu.
4. Calon dikehendaki membaca maklumat di halaman belakang kertas soalan ini.

Untuk Kegunaan Pemeriksa		
Soalan	Markah penuh	Markah diperoleh
1	24	
2	9	
3	17	
JUMLAH		

Kertas soalan ini mengandungi **9 halaman bercetak**

**INFORMATION FOR CANDIDITES**

1. This question paper consists of three questions. Answer all questions.
2. Write your answers for **Question 1 and Question 2** in the spaces provided in the question paper.
3. Write your answers for **Question 3** on the "helaian tambahan". You may use equation, diagrams, tables, graphs and other suitable methods to explain your answer.
4. Show your working, it may help you to get marks.
5. If you wish to change your answer, neatly cross out the answer that you have done. Then write down the new answer.
6. The diagrams in the questions are not drawn to scale unless stated.
7. Mark allocated for each question or part question are shown in brackets.
8. The time suggested to answers **Question 1 and Question 2** is 45 minutes and **Question 3** is 45 minutes.
9. You may use a non-programmable scientific calculator.
10. Hand your answer sheets at the end of the examination.

Marks awarded:

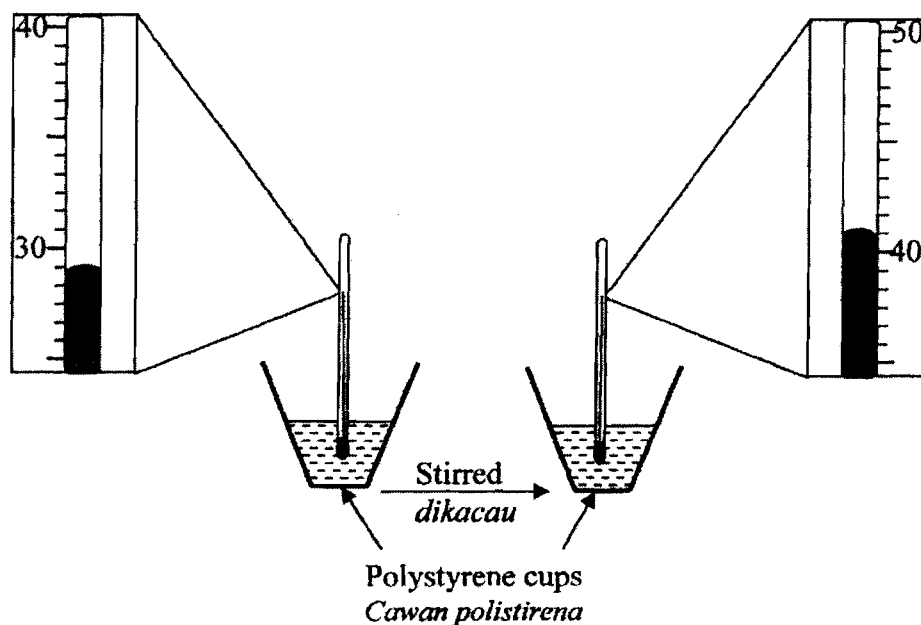
Mark	Description
3	Excellent : The best response
2	Satisfactory : An average response
1	Weak : An inaccurate response
0	No response or wrong response

- 1 Diagram 1.1 shows two experiments to determine the heat of neutralization.  
*Rajah 1.1 menunjukkan dua eksperimen untuk menentukan haba peneutralan*

### Experiment I

Reaction between  $25\text{ cm}^3$  of sodium hydroxide solution,  $\text{NaOH } 1.0\text{ mol dm}^{-3}$  and  $25\text{ cm}^3$  of hydrochloric acid,  $\text{HCl } 1.0\text{ mol dm}^{-3}$

*Tindak balas antara  $25\text{ cm}^3$  larutan natrium hidroksida,  $\text{NaOH } 1.0\text{ mol dm}^{-3}$  dengan  $25\text{ cm}^3$  asid hidroklorik,  $\text{HCl } 1.0\text{ mol dm}^{-3}$*



Initial temperature of the mixture : ..... °C  
*Suhu awal campuran*

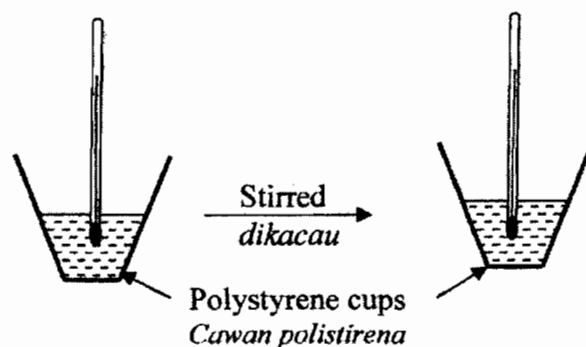
Highest temperature of the mixture: ..... °C  
*Suhu tertinggi campuran*

Change in temperature : ..... °C  
*Perubahan suhu*

**Experiment II**

Reaction between  $25 \text{ cm}^3$  of sodium hydroxide solution,  $\text{NaOH } 2.0 \text{ mol dm}^{-3}$  and  $25 \text{ cm}^3$  of ethanoic acid,  $\text{CH}_3\text{COOH } 2.0 \text{ mol dm}^{-3}$

*Tindak balas antara  $25 \text{ cm}^3$  larutan natrium hidroksida,  $\text{NaOH } 2.0 \text{ mol dm}^{-3}$  dengan  $25 \text{ cm}^3$  asid etanoik  $2.0 \text{ mol dm}^{-3}$*



Initial temperature of the mixture :  $T_1 \text{ } ^\circ\text{C}$

*Suhu awal campuran*

Highest temperature of the mixture:  $T_2 \text{ } ^\circ\text{C}$

*Suhu tertinggi campuran*

Change in temperature :  $T_3 \text{ } ^\circ\text{C}$

*Perubahan suhu*

- (a) Write the initial and the highest temperature of the mixture and change in temperature for Experiment I in Diagram 1.1

*Tulis suhu awal dan suhu tertinggi campuran serta perubahan suhu untuk Eksperimen I dalam Rajah 1.1*

[ 3 marks ]

- (b) Construct a table that can be used to record the data from both experiments.

*Bina satu jadual yang boleh digunakan untuk merekod data bagi kedua-dua eksperimen*

[ 3 marks ]

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- (c) State one hypothesis for both experiments.  
*Nyatakan satu hipotesis bagi kedua-dua eksperimen*

.....

..... [ 3 marks ]

- (d) Based on the temperatures in Experiment I, predict the change in temperature in Experiment II  
*Berdasarkan suhu dalam Eksperimen I, ramalkan perubahan suhu bagi Eksperimen II*

..... [ 3 marks ]

- (e) Why must the initial temperature and the highest temperature be recorded in these experiments?  
*Mengapakah suhu awal dan suhu tertinggi perlu direkodkan dalam eksperimen ini?*

.....

..... [3 marks ]

- (f) How can the value of the change of temperature be obtained?  
*Bagaimanakah nilai perubahan suhu diperolehi?*

.....

..... [ 3 marks ]

- (g) For this experiment, state  
*Bagi eksperimen ini, nyatakan*

- (i) Manipulated Variable  
*Pembolehubah dimanipulasi*

.....

- (ii) Responding Variable  
*Pembolehubah bergerakbalas*

.....

- (iii) Constant Variable  
*Pembolehubah dimalarkan*

.....

[ 3 marks ]

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(h)

Diagram 1.2 shows the calculation to determine the heat of neutralisation for the reactions in Experiments I and II

*Rajah 1.2 menunjukkan perhitungan untuk menentukan haba peneutralan bagi tindak balas dalam Eksperimen I dan Eksperimen II*

Experiment I	Experiment II
Heat released <i>Haba yang dibebaskan</i> = $mc\theta$ = $50 \text{ g} \times 4.2 \text{ J g}^{-1} \times \text{_____}^\circ\text{C}$ = $x \text{ J}$	Heat released <i>Haba yang dibebaskan</i> = $mc\theta$ = $50 \text{ g} \times 4.2 \text{ J g}^{-1} \times T_3^\circ\text{C}$ = $y \text{ J}$
Heat of neutralisation <i>Haba peneutralan</i> = $\frac{x \text{ kJ}}{\text{number of mole of water produced}}$ <i>bilangan mol air yang dihasilkan</i>	Heat of neutralisation <i>Haba peneutralan</i> = $\frac{y \text{ kJ}}{\text{number of mole of water produced}}$ <i>bilangan mol air yang dihasilkan</i>

It was found that the value of  $x$  is greater than value of  $y$ .

Explain why.

*Didapati nilai  $x$  lebih besar daripada nilai  $y$ .*

*Terangkan mengapa.*

.....  
 .....  
 .....

[ 3 marks ]

- 2 Table 1 shows Experiment I, Experiment II and Experiment III which are conducted to study the solubility of salts in water.

*Jadual 1 menunjukkan Eksperimen I, Eksperimen II dan Eksperimen III yang dijalankan untuk mengkaji keterlarutan garam dalam air.*

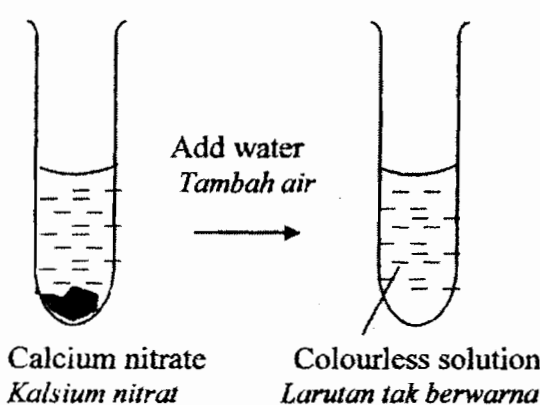
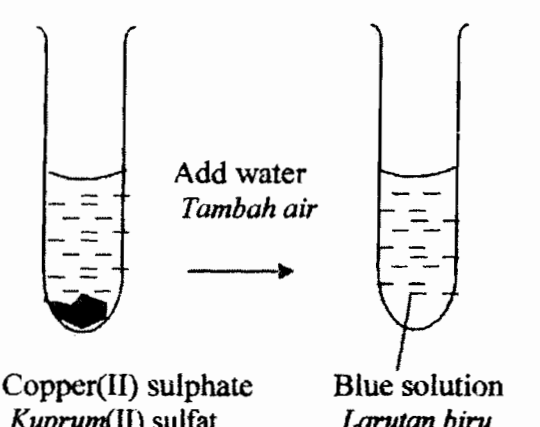
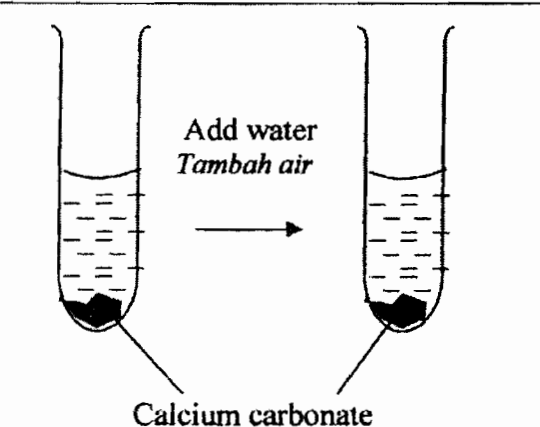
Experiment	Reaction <i>Tindak balas</i>	Observations <i>Pemerhatian</i>
I	 <p>Calcium nitrate <i>Kalsium nitrat</i></p> <p>Colourless solution <i>Larutan tak berwarna</i></p>	
II	 <p>Copper(II) sulphate <i>Kuprum(II) sulfat</i></p> <p>Blue solution <i>Larutan biru</i></p>	
III	 <p>Calcium carbonate <i>Kalsium karbonat</i></p>	

Table 1

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- (a) Write the observation for Experiment I, II and III in Table 1.  
*Tulis pemerhatian bagi Eksperimen I, II dan III dalam Jadual 1.*

[3 marks]

- (b) Based on Experiment I and II, state the operational definition of soluble salt.  
*Berdasarkan Eksperimen I dan II, nyatakan definisi secara operasi bagi garam terlarut.*

.....  
.....

[3 marks]

- (c) Classify the following salts into soluble salts and insoluble salts.  
*Kelaskan garam-garam di bawah kepada garam terlarut dan garam tak terlarut.*

Sodium sulphate, Lead(II) sulphate, Barium sulphate, Magnesium sulphate  
*Natrium sulfat, Plumbum(II) sulfat, Barium sulfat, Magnesium sulfat*

[3 marks]



3

**The distance between pairs of different metals in the electrochemical series affect the voltage produced.**

*Jarak di antara pasangan logam yang berlainan di dalam siri elektrokimia mempengaruhi voltan yang terhasil.*

Diagram 3 shows a voltaic cell which consist of two different metals dipped in an electrolyte.  
*Rajah 3 menunjukkan satu sel voltan yang terdiri daripada dua logam yang berlainan di celup dalam satu elektrolit.*

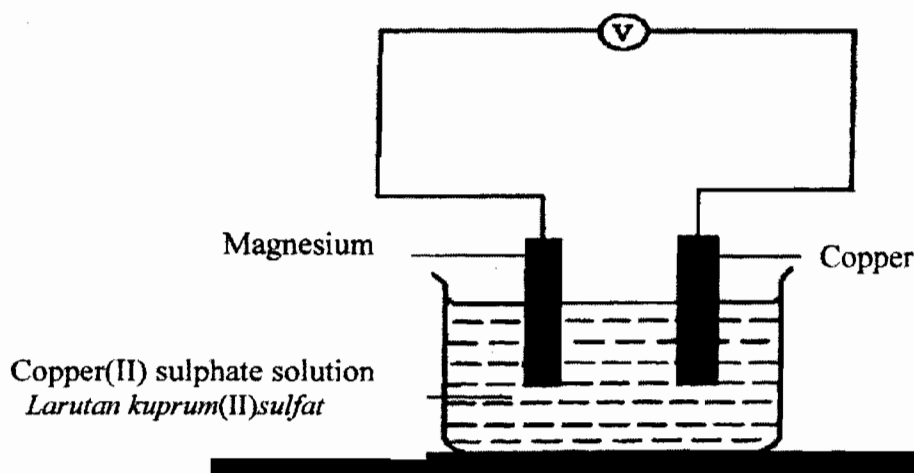


Diagram 3

Based on Diagram 3, plan **one** laboratory experiment to investigate the effect of the distance between two metals in the electrochemical series on the voltage produced.

*Berdasarkan Rajah 3, rancang satu eksperimen makmal untuk mengkaji kesan jarak di antara dua logam dalam siri elektrokimia ke atas voltan yang terhasil.*

Your planning should include the following aspects:

*Perancangan anda hendaklah mengandungi aspek-aspek berikut:*

Problem statement

*Pernyataan masalah*

All the variables

*Semua pemboleh ubah*

Hypothesis

*Hipotesis*

List of materials and apparatus

*Senarai bahan dan radas*

Procedure

*Prosedur*

Tabulation of data

*Penjadualan data*

[17 marks]

END OF QUESTION PAPER

## PAPER 3: CHEMISTRY

Question	Mark Scheme	Marks											
1(a)	<b>Able to record all the temperature accurately</b>  Answer  Initial temperature = 29.0  Highest temperature = 41.0  Change of temperature = 12.0	3											
	<b>Able to record all the temperature correctly</b>  Sample answers  Initial temperature = 29  Highest temperature = 41  Change of temperature = 12	2											
	Able to record one temperature correctly	1											
	No response or wrong response	0											
1(b)	<b>Able to construct table accurately with correct title and unit</b>  Sample answer  <table border="1"> <thead> <tr> <th rowspan="2">Temperature°C</th><th colspan="2">Experiment</th></tr> <tr> <th>I</th><th>II</th></tr> </thead> <tbody> <tr> <td>Initial temperature of mixture</td><td>29.0</td><td>T<sub>1</sub></td></tr> <tr> <td>Highest temperature of mixture</td><td>41.0</td><td>T<sub>2</sub></td></tr> </tbody> </table>	Temperature°C	Experiment		I	II	Initial temperature of mixture	29.0	T <sub>1</sub>	Highest temperature of mixture	41.0	T <sub>2</sub>	3
Temperature°C	Experiment												
	I	II											
Initial temperature of mixture	29.0	T <sub>1</sub>											
Highest temperature of mixture	41.0	T <sub>2</sub>											
	Able to construct table correctly without unit	2											

	Able to construct table less accurate with at least one experiment	1
	No response or wrong response	0
1(c)	<b>Able to state the hypothesis accurately</b>  Sample answer  The heat of neutralization of a weak acid and strong alkali is smaller than the heat of neutralization of strong acid by a strong alkali	3
	<b>Able to state the hypothesis correctly</b>  Sample answer  The heat of neutralization changes when different acids react with strong alkali	2
	<b>Able to state the idea of hypothesis</b>  Sample answer  The heat of neutralization changes	1
	No response or wrong response	0
1(d)	<b>Able to predict the change of temperature accurately</b>  11°C	3
	<b>Able to predict the change of temperature correctly</b>  9-10°C	2
	<b>Able to predict less correctly</b>  7-8°C	1
	No response or wrong answer	0
1(e)	<b>Able to explain with two correct reasons</b>  Sample answer  *This is to enable the change in temperature to be measured.  *The change of temperature is needed to calculate the heat of neutralization	3

	<b>Able to explain at least one reason from the above</b>	2
	<b>Able to give an idea of explaining</b>	1
	No response or wrong response	0
1(f)	<b>Able to state the formula accurately</b>  Sample answer  Change in temperature= Highest temperature of mixture- initial temperature of mixture	3
	<b>Able to state the formula correctly</b>  Sample answer  Difference of temperature between highest and lowest	2
	<b>Able to give an idea of calculating</b>	1
	No response or wrong response	0
1(g)	<b>Able to state all the variables correctly</b>  Answer  Manipulated Variable: The type of acid used // ethanoic acid, hydrochloric acid  Responding Variable : The heat of neutralisation  Constant Variable : The concentration and the volume of acid and alkali // the type of container that is used to hold the mixture	3
	<b>Able to state two variables correctly</b>	2
	<b>Able to state one variable correctly</b>	1
	No response or wrong response	0

1(h)	<b>Able to explain with two reasons correctly</b>  Sample answer  1.Experiment I uses a strong acid whereas Experiment II uses a weak acid. The heat of neutralization of a weak acid by a strong alkali is less than the heat of neutralization of a strong acid by a strong alkali .  2 This is because during neutralization of a weak acid such as ethanoic acid , part of the heat is used to dissociate the acid molecules	3
	<b>Able to explain with one of the reasons</b>	2
	<b>Able to give an idea</b>  Sample answer  Ethanoic acid is a weak acid	1
	No response or wrong response	0

Question	Mark Scheme	Marks								
2 (a)	<b>Able to state all observation correctly</b>  <u><b>Sample answer</b></u> <table><tr><th>EXPERIMENT</th><th>Observation</th></tr><tr><td>EXPT I</td><td>Calcium nitrate dissolves // Colourless solution is formed.</td></tr><tr><td>EXPT II</td><td>Copper(II) sulphate dissolves// Blue solution is formed</td></tr><tr><td>EXPT III</td><td>Calcium carbonate does not dissolve/remains unchanged // No change.</td></tr></table>	EXPERIMENT	Observation	EXPT I	Calcium nitrate dissolves // Colourless solution is formed.	EXPT II	Copper(II) sulphate dissolves// Blue solution is formed	EXPT III	Calcium carbonate does not dissolve/remains unchanged // No change.	3
	EXPERIMENT	Observation								
	EXPT I	Calcium nitrate dissolves // Colourless solution is formed.								
	EXPT II	Copper(II) sulphate dissolves// Blue solution is formed								
	EXPT III	Calcium carbonate does not dissolve/remains unchanged // No change.								
	Able to state any 2 observations correctly.	2								
	Able to state any 1 observation correctly.	1								
No response or wrong response	0									
(b)	<b>Able to state the operational definition of soluble salt correctly</b>  <u><b>Sample answer:</b></u>  When a salt is added into water and dissolves to form a solution, it is a soluble salt.//  When a salt dissolves in water to form a solution, it is a soluble salt.	3								
	<b>Able to state the operational definition of soluble salt less correctly</b>  <u><b>Sample answer</b></u>  When a salt is added into water and forms a solution, it is a soluble salt.  When a salt dissolves to form a solution, it is a soluble salt.  Salt dissolves in water to form a solution.	2								

	<b>Able to state any idea of operational definition of soluble salt</b>  Salt dissolves//Salt dissolves in water.  Solution forms.	1				
	<b>No response or wrong response</b>	0				
(d)	<b>Able to classify all the solutions correctly</b>  <u><b>Sample answer</b></u>  <table><tr><td>Soluble salt</td><td>Insoluble salt</td></tr><tr><td>Potassium sulphate Zinc sulphate</td><td>Lead(II) sulphate Barium sulphate</td></tr></table> <i># Score 1 – if state in the reverse</i>	Soluble salt	Insoluble salt	Potassium sulphate Zinc sulphate	Lead(II) sulphate Barium sulphate	3
Soluble salt	Insoluble salt					
Potassium sulphate Zinc sulphate	Lead(II) sulphate Barium sulphate					
	<b>Able to classify at least 3 salts correctly</b>	2				
	<b>Able to classify any 2 salts correctly</b>	1				
	<b>No response or wrong response</b>	0				

Question	Mark	Score
3(a)	Able to state the problem statement correctly  <u>Sample answer:</u>  How does the distance between two metals in the electrochemical series affect the voltage produced?	2
	Able to state the problem statement less correctly	1
	No response or wrong response	0

Question	Rubric	Score
3(b)	Able to state the three variables correctly  <u>Sample answer:</u> Manipulated: Pairs of metals  Responding: Voltage // Voltmeter reading  Constant: Electrolyte // Copper(II) sulphate solution // Copper electrode//Concentration of electrolyte	3
	Able to state any <b>two</b> variables correctly	2
	Able to state any <b>one</b> variable correctly	1
	No response or wrong response	0



Question	Rubric	Score
3(c)	Able to state the hypothesis correctly and with direction  <u>Sample answer:</u> Hypothesis: The further the distance of the pairs of metals in the electrochemical series, the greater the voltage produced	3
	Able to state the relationship between manipulated variable and responding variable but in the opposite direction // no direction	2
	Able to state an idea of the hypothesis	1
	No response or wrong response	0

Question	Rubric	Score
3(d)	Able to give complete list of substances and apparatus  <u>Sample answer:</u>  <u>Substances</u> Copper (II) sulphate solution, magnesium metal, zinc metal, iron metal, copper metal, sandpaper.  <u>Apparatus</u> Beaker, connecting wire, voltmeter	3
	Able to give at least <b>two</b> substances and at least <b>two</b> apparatus	2
	Able to give at least <b>one</b> substance and at least <b>one</b> apparatus	1
	No response or wrong response	0

Question	Rubric	Score
3(e)	<p>Able to list all the steps correctly</p> <p><u>Sample answer:</u></p> <ol style="list-style-type: none"> <li>1. Clean the strips of magnesium and copper with sandpaper.</li> <li>2. Measure 50 – 100 cm<sup>3</sup> of copper(II)sulphate solution and pour into a beaker.</li> <li>3. Dip the magnesium and copper strips into the copper(II) sulphate solution.</li> <li>4. Complete the circuit // Connect the strips to the voltmeter.</li> <li>5. Record the voltmeter reading.</li> <li>6. Repeat steps 1 to 5 by replacing pairs of Mg/Cu with Zn/Cu, Al/Cu and Fe/Cu</li> </ol>	3
	Able to list down steps <b>2, 3, 4 and 5</b>	2
	Able to list down steps <b>3 and 4</b>	1
	No response or wrong response	0

Question	Marks Scheme	Marks										
2(f)	<p>Able to exhibit the tabulation of data that includes the following four information.</p> <p>1. Heading for the manipulated variables</p> <p>2.. Heading for responding variable</p> <p>3. All Manipulated variables</p> <p><u>Sample answer:</u></p> <table><tr><th>Pairs of metals</th><th>Voltmeter reading // Voltage (V)</th></tr><tr><td>Mg / Cu</td><td></td></tr><tr><td>Al / Cu</td><td></td></tr><tr><td>Fe / Cu</td><td></td></tr><tr><td>Zn / Cu</td><td></td></tr></table>	Pairs of metals	Voltmeter reading // Voltage (V)	Mg / Cu		Al / Cu		Fe / Cu		Zn / Cu		3
Pairs of metals	Voltmeter reading // Voltage (V)											
Mg / Cu												
Al / Cu												
Fe / Cu												
Zn / Cu												
	<p>Able to exhibit the tabulation of data that includes the following three information.</p> <p>1. Heading for the manipulated variables</p> <p>2.. Heading for responding variable</p> <p>3. One Manipulated variable</p> <p><u>Sample answer:</u></p> <table><tr><th>Pairs of metals</th><th>Voltmeter reading // Voltage (V)</th></tr><tr><td>Mg / Cu</td><td></td></tr><tr><td></td><td></td></tr></table>	Pairs of metals	Voltmeter reading // Voltage (V)	Mg / Cu				2				
Pairs of metals	Voltmeter reading // Voltage (V)											
Mg / Cu												

	<p>Able to exhibit the tabulation of data that includes the following two information.</p> <ol style="list-style-type: none"><li>1. Heading for the manipulated variables</li><li>2.. Heading for responding variable</li></ol> <p>Sample answer:</p> <table><tr><th>Pairs of metals</th><th>Voltmeter reading // Voltage (V)</th></tr><tr><td></td><td></td></tr></table>	Pairs of metals	Voltmeter reading // Voltage (V)			1
Pairs of metals	Voltmeter reading // Voltage (V)					

**END OF MARKING SCHEME**