

## Essay {Paper03}

[SBPtrial05-03-p3]

(a)

Penerangan	Skor
[Dapat menyatakan tujuan eksperimen/ pernyataan masalah dengan tepat] <b>Contoh jawapan</b> Mengkaji jenis elektrod dapat menentukan jenis ion yang dinyahcas dalam elektrolisis larutan kuprum(II) sulfat // Adakah jenis elektrod mempengaruhi jenis ion yang dinyahcas dalam elektrolisis larutan kuprum(II) sulfat?	3
[Dapat menyatakan pernyataan masalah dengan kurang tepat] <b>Contoh jawapan</b> Jenis elektrod menentukan hasil elektrolisis larutan akueus	2
[Dapat menyatakan idea pernyataan masalah] <b>Contoh jawapan</b> Jenis elektrod mempengaruhi elektrolisis	1
Tidak memberi respon atau respon salah	0

(b)

Penerangan	Skor
[Dapat menyatakan kesemua pemboleh ubah dengan tepat] <b>Contoh jawapan</b> Pemboleh ubah yang dimanipulasikan : Jenis elektrod Pemboleh ubah yang bergerakbalas : Hasil elektrolisis // ion yang dinyahcas Pemboleh ubah yang dimalarkan : Kepekatan ion/larutan kuprum(II) sulfat	3
Dapat memberikan mana-mana dua pemboleh ubah dengan tepat	2
Dapat memberikan mana-mana satu pemboleh ubah dengan tepat	1
Tidak memberi respon atau respon salah	0

(c)

Penerangan	Skor
[Dapat menyenaraikan semua bahan dan radas dengan betul] <b>Contoh jawapan</b> Senarai bahan Larutan kuprum(II) sulfat, $[0.1 - 2.0] \text{ mol dm}^{-3}$ Elektrod karbon, elektrod kuprum Senarai radas Bikar/sel eklektrolisis, wayar penyambung, ammeter, bateri	3
[Dapat menyenaraikan bahan dan radas asas dengan betul] <b>Contoh jawapan</b> Larutan kuprum(II) sulfat, karbon / kuprum Senarai radas Bateri, bikar/sel eklektrolisis/bekas, wayar penyambung	2
[Dapat memberikan idea radas dan bahan untuk eksperimen dengan betul] Mana-mana satu elektrod dan bateri	1
Tidak memberi respon atau respon salah	0

(d)

<b>Penerangan</b>	<b>Skor</b>
[Dapat menyatakan semua langkah eksperimen dengan betul] <b>Contoh jawapan</b> 1. Larutan kuprum(II) sulfat dimasukkan ke dalam sebuah bikar/bekas sesuai 2. Dua elektrod/rod karbon (kuprum) dicelupkan ke dalam larutan kuprum(II) sulfat tersebut. 3. Lengkapkan litar/suis dihidupkan/alirkan arus elektrik dan dibiarkan mengalir selama beberapa / [10 – 30] minit 4. Perubahan pada elektrod katod dan anod diperhatikan. 5. Ulang langkah 1 hingga 4 dengan menggunakan elektrod kuprum (karbon) menggantikan elektrod karbon (kuprum)	3
[Dapat menyatakan 3 langkah untuk menjalankan eksperimen] Langkah 2,3,4	2
[Dapat menyatakan 2 langkah minimum yang betul] Langkah 2, 4	1
Tidak memberi respon atau respon salah	0

(e)

<b>Penerangan</b>	<b>Skor</b>											
[Dapat membina jadual dengan betul yang mengandungi perkara-perkara berikut] - Mempunyai lajur dan baris - Pemerhatian di katod dan di anod  <b>Contoh jawapan</b>	3											
<table border="1"> <thead> <tr> <th rowspan="2">Elektrod</th> <th colspan="2">Pemerhatian</th> </tr> <tr> <th>Anod</th> <th>Katod</th> </tr> </thead> <tbody> <tr> <td>Karbon</td> <td></td> <td></td> </tr> <tr> <td>Kuprum</td> <td></td> <td></td> </tr> </tbody> </table>	Elektrod	Pemerhatian		Anod	Katod	Karbon			Kuprum			
Elektrod		Pemerhatian										
	Anod	Katod										
Karbon												
Kuprum												
[Dapat menunjukkan penjadualan data yang mengandungi perkara-perkara berikut] - Mempunyai lajur dan baris - Pemerhatian di elektrod  <b>Contoh jawapan</b>	2											
<table border="1"> <thead> <tr> <th>Elektrod</th> <th>Pemerhatian</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> </tbody> </table>	Elektrod	Pemerhatian										
Elektrod	Pemerhatian											
[Idea menunjukkan penjadualan data ] - Minimum 2 lajur/baris	1											
<table border="1"> <tbody> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> </tbody> </table>												
Tidak memberi respon atau respon salah	0											

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## [SBPdiag05-03-P3]

(a)

<b>Penerangan</b>	<b>Skor</b>
Dapat menyatakan tujuan eksperimen dengan tepat . Cadangan jawapan: Membina siri elektrokimia melalui perbezaan voltan pasangan logam	3
Dapat menyatakan tujuan eksperimen dengan kurang tepat  Cadangan jawapan Membina siri elektrokimia melalui perbezaan voltan	2
Dapat menyatakan idea tujuan eksperimen  Cadangan jawapan Membina siri elektrokimia	1
Tidak memberikan respons atau respons salah.	0

(b)

<b>Penerangan</b>	<b>Skor</b>
Dapat menyatakan semua pemboleh ubah dengan tepat. Cadangan jawapan: Pemboleh ubah yang dimanipulasikan : Pasangan logam // logam yang berpasangan dengan kuprum Pemboleh ubah yang bergerakbalas : voltan sel Pemboleh ubah yang dimalarkan : kuprum, larutan kuprum(II)sulfat 1 mol dm <sup>-3</sup>	3
Dapat menyatakan mana-mana dua pemboleh ubah dengan betul	2
Dapat menyatakan mana-mana satu pemboleh ubah dengan betul	1
Tidak memberikan respons atau respons salah.	0

(c)

<b>Penerangan</b>	<b>Skor</b>
Dapat menyatakan bahan dan alat radas dengan betul. Cadangan jawapan:  <i>Bahan</i> : larutan kuprum(II) sulfat 1 mol dm <sup>-3</sup> , kuprum, zink, magnesium dan plumbum  <i>Radas</i> : Voltmeter, wayar penyambung, bikar [100 – 250] cm <sup>3</sup> , kertas pasir	3
Dapat menyatakan sebahagian alat radas dan bahan dengan betul Cadangan jawapan	2

<i>Bahan</i> : larutan kuprum(II) sulfat , kuprum, dan zink/magnesium/plumbum <i>Radas</i> : Voltmeter, wayar penyambung/bikar	
Dapat menyatakan idea tentang bahan dan alat radas Cadangan jawapan  <i>Bahan</i> : Elektrolit, pasangan logam  <i>Radas</i> : Voltmeter	1
Tidak memberikan respons atau respons salah.	0

(d)

<b>Penerangan</b>	<b>Skor</b>
Dapat menyatakan prosedur eksperimen dengan tepat Cadangan jawapan:  1 [50 – 100] cm <sup>3</sup> larutan kuprum(II) sulfat dimasukkan ke dalam sebuah bikar 2 Logam kuprum dan zink dibersihkan dengan kertas pasir 3 Celupkan kedua-dua kepingan logam ke dalam larutan kuprum(II) sulfat 4 Sambungkan logam kuprum dan logam zink kepada voltmeter dengan menggunakan wayar penyambung 5 Bacaan voltmeter direkodkan 6 Langkah 1 hingga 5 diulangi dengan menggunakan pasangan logam kuprum-magnesium dan kuprum-plumbum	3
Dapat menyatakan prosedur eksperimen dengan kurang tepat  Cadangan jawapan Menyatakan langkah 3, 4 dan 5	2
Dapat menyatakan idea eksperimen  Cadangan jawapan Menyatakan langkah 3 dan 5	1
Tidak memberikan respons atau respons salah.	0

(e)

<b>Penerangan</b>	<b>Skor</b>												
[Dapat membina jadual dengan betul yang mengandungi perkara-perkara berikut]	3												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 40%;"><b>Pasangan logam</b></th> <th style="width: 20%;"><b>Voltan sel / V</b></th> <th style="width: 40%;"><b>Logam yang menjadi terminal positif</b></th> </tr> </thead> <tbody> <tr> <td>Kuprum – zink // Cu-Zn</td> <td></td> <td></td> </tr> <tr> <td>Kuprum – magnesium // Cu-Mg</td> <td></td> <td></td> </tr> <tr> <td>Kuprum – plumbum // Cu-Pb</td> <td></td> <td></td> </tr> </tbody> </table>	<b>Pasangan logam</b>	<b>Voltan sel / V</b>	<b>Logam yang menjadi terminal positif</b>	Kuprum – zink // Cu-Zn			Kuprum – magnesium // Cu-Mg			Kuprum – plumbum // Cu-Pb			
<b>Pasangan logam</b>	<b>Voltan sel / V</b>	<b>Logam yang menjadi terminal positif</b>											
Kuprum – zink // Cu-Zn													
Kuprum – magnesium // Cu-Mg													
Kuprum – plumbum // Cu-Pb													

[Dapat menunjukkan penjadualan data yang mengandungi perkara-perkara berikut]			2
<b>Pasangan logam</b>	<b>Voltan sel / V</b>	<b>Logam yang menjadi terminal positif</b>	
[Idea menunjukkan penjadualan data ] - Minimum 2 lajur/baris			1
Tidak memberi respon atau respon salah			0

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### [MRSMtrial04-03-P3]

(a)	Does the distance between two metals in Electrochemical Series influence the potential different produce?																				
(b)	The distance between two metals in the Electrochemical Series, the higher the potential different produce.																				
(c)	Materials: silver, iron, aluminium and magnesium; sulphuric acid solution  Apparatus: voltmeter, beaker, sand paper and connecting wires																				
(d)	Procedure: 1. A beaker is filled with sulphuric acid solution. 2. The copper and silver strips are cleaned with sand paper. 3. The strips are immersed into the solution and connected by wires to a voltmeter. 4. The reading of the voltmeter is recorded. 5. Steps 1 - 4 are repeated with iron, aluminium and magnesium																				
(e)	Tabulation of data: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Metal pair</th> <th>Positive terminal</th> <th>Negative terminal</th> <th>Voltage/ V</th> </tr> </thead> <tbody> <tr> <td>Ag - Cu</td> <td>Ag</td> <td>Cu</td> <td></td> </tr> <tr> <td>Mg - Cu</td> <td>Cu</td> <td>Mg</td> <td></td> </tr> <tr> <td>Fe - Cu</td> <td>Cu</td> <td>Fe</td> <td></td> </tr> <tr> <td>Al - Cu</td> <td>Cu</td> <td>Al</td> <td></td> </tr> </tbody> </table>	Metal pair	Positive terminal	Negative terminal	Voltage/ V	Ag - Cu	Ag	Cu		Mg - Cu	Cu	Mg		Fe - Cu	Cu	Fe		Al - Cu	Cu	Al	
Metal pair	Positive terminal	Negative terminal	Voltage/ V																		
Ag - Cu	Ag	Cu																			
Mg - Cu	Cu	Mg																			
Fe - Cu	Cu	Fe																			
Al - Cu	Cu	Al																			

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**[MRSM11-03]**

(a)	To determine the effect of distance between two metals in the electrochemical series influence the voltage produced.										
(b)	Manipulated variable : Pair of metals Responding variable : Voltage of cell Constant variable : Type of electrolyte										
(c)	Hypothesis: The further apart the distance between two metals in the electrochemical series, the higher the voltage produced.										
(iv)	Materials: copper, iron, magnesium and zinc; copper(II) sulphate solution  Apparatus: voltmeter, beaker, sand paper and connecting wires										
(v)	Procedure: 1. A beaker is filled with copper(II) sulphate solution. 2. The copper and magnesium strips are cleaned with sand paper. 3. The strips are immersed into the solution and connected by wires to a voltmeter. 4. The reading of the voltmeter is recorded. 5. Steps 1 - 4 are repeated with zinc, iron and aluminium.										
(vi)	Tabulation of data: <table border="1" data-bbox="239 1272 627 1462"> <thead> <tr> <th>Metal pair</th> <th>Voltage/ V</th> </tr> </thead> <tbody> <tr> <td>Mg - Cu</td> <td></td> </tr> <tr> <td>Zn - Cu</td> <td></td> </tr> <tr> <td>Fe - Cu</td> <td></td> </tr> <tr> <td>Al - Cu</td> <td></td> </tr> </tbody> </table>	Metal pair	Voltage/ V	Mg - Cu		Zn - Cu		Fe - Cu		Al - Cu	
Metal pair	Voltage/ V										
Mg - Cu											
Zn - Cu											
Fe - Cu											
Al - Cu											

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**[SPM07-02-P3]**

(i)	Statement of the problem: How does the distance between two metals in the electrochemical series affect the voltage produced in a cell?
(ii)	Manipulated variable: Pair of metals Responding variable: Voltage of cell Constant variable: Type of electrolyte
(iii)	Hypothesis: The further apart the distance between two metals in the electrochemical series, the higher the voltage produced.

(iv)	Materials: iron, zinc, magnesium, copper and aluminium strips; copper(II) sulphate solution  Apparatus: voltmeter, beaker, sand paper and connecting wires										
(v)	Procedure: 1. A beaker is filled with copper(II) sulphate solution. 2. The copper and magnesium strips are cleaned with sand paper. 3. The strips are immersed into the solution and connected by wires to a voltmeter. 4. The reading of the voltmeter is recorded. 5. Steps 1 - 4 are repeated with zinc, iron and aluminium.										
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Metal pair	Voltage/ V										
Mg - Cu											
Zn - Cu											
Fe - Cu											
Al - Cu											

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### [SBPdiag08-03-P3]

(a)

Rubric	Score
<i>[Able to make a correct statement of problem]</i> Suggested answer: Does the distance between two/ pair of metals in the electrochemical series give different voltage values?	3
<i>[Able to make a statement of the problem or suitable aim]</i> Suggested answer: Does the distance between two /pair of metals give different voltage values?// Distance between two/pair of metals in the electrochemical series gives different voltage values.	2
<i>[Able to state an idea of statement of problem or aim]</i> Metals influence the voltage values	1
<i>No response given / wrong response</i>	0

(b)

Rubric	Score
<i>[Able to state all the three variables correctly]</i> Suggested answer: Manipulated variable : types of pairs of metals Responding variable: voltage values/ /potential difference Constant variable : electrolyte used such as copper(II) sulphate solution.	3

<i>[Able to state any two of the variables correctly]</i>	2
<i>[Able to state one of the variables correctly or state idea regarding variable]</i>	1
<i>No response given / wrong response</i>	0

(c)

<b>Rubric</b>	<b>Score</b>
<i>[Able to state the relationship between manipulated variable and responding variable correctly]</i> Suggested answer: The further the distance/position between two metals in the electrochemical series, the bigger the voltage value. <i>[If the responding variable comes first, the score is 2]</i>	3
<i>[Able to state the relationship between manipulated variable and responding variable]</i> Suggested answer: The further the distance /position between two metals, the bigger the voltage value/ / <i>vice versa</i>	2
<i>[Able to state an idea of the hypothesis]</i> Suggested answer: Metals influence the voltage value	1
<i>No response given / wrong response</i>	0

(d)

<b>Rubric</b>	<b>Score</b>
<i>[Able to state the list of materials and apparatus correctly and completely]</i> Suggested answer: Beaker, connecting wires, crocodile clips, voltmeter, sand paper, [magnesium ribbon, zinc strip, lead strip, copper strip], [copper(II) sulphate solution]	3
<i>[Able to state the list of substances and apparatus correctly but not completely]</i> Suggested answer: Beaker, connecting wires, voltmeter, [magnesium ribbon, zinc, copper],[copper(II) sulphate solution]	2
<i>[Able to state an idea about the list of substances and apparatus]</i> Suggested answer: Beaker, metals, voltmeter, electrolyte, wire.	1
<i>No response given / wrong response</i>	0

(e)

<b>Rubric</b>	<b>Score</b>
<i>[Able to state a complete experimental procedure]</i> Suggested answer: <ol style="list-style-type: none"> <li>[30 -200] cm<sup>3</sup> of copper(II) sulphate solution is poured into a beaker.</li> <li>Magnesium ribbon and copper strip are cleaned with the sand paper.</li> <li>Magnesium and copper are dipped into the copper(II) sulphate solution.</li> <li>Both metals are connected to a voltmeter.</li> <li>The voltmeter reading is recorded.</li> <li>The circuit is completed.</li> <li>Steps 1 to 6 are repeated by using different of metals to pair with copper.</li> </ol>	3



[Able to state the procedure which include the following steps] Answer: Steps 1,3,4,5,6	2
[Able to state an idea of procedure] Answer: Steps 3,5	1
No response given / wrong response	0

(f)

Rubric	Score												
[Able to exhibit the tabulation of data correctly]  <table border="1" style="margin-left: 40px;"> <tr> <td>Pairs of metals</td> <td>Voltage/V</td> <td>Negative terminal</td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </table>	Pairs of metals	Voltage/V	Negative terminal										3
Pairs of metals	Voltage/V	Negative terminal											
[Able to exhibit the tabulation of data less accurately]  <table border="1" style="margin-left: 40px;"> <tr> <td>Pairs of metals</td> <td>Voltage</td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> </table>	Pairs of metals	Voltage					2						
Pairs of metals	Voltage												
[Able state an idea about the tabulation of data]  <table border="1" style="margin-left: 40px;"> <tr> <td>Metals</td> <td>Voltage</td> </tr> <tr> <td> </td> <td> </td> </tr> </table>	Metals	Voltage			1								
Metals	Voltage												
No response given / wrong response	0												

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**[SBPdiag06-03-P3]**

(a)

Rubric	Score
[Able to state the aim of the experiment accurately]  Example: To construct the electrochemical series based on the potential difference between pairs of metal.	3
[Able to state the aim of the experiment with less accuracy]  Example: To construct the electrochemical series based on the potential difference // Can the electrochemical series be constructed based on the potential difference between pairs of metal?	2
[Able to give ideas on the aim of the experiment]  Example: To construct the electrochemical series.	1
No response or wrong response	0

(b)

<b>Rubric</b>	<b>Score</b>
[Able to state all variables correctly] Example: Manipulated variables: Pairs of metal / type of metal Responding variables: Potential difference / voltage readings Fixed variables: Copper electrode / copper(II) sulphate solution	3
[Able to state any two variables correctly]	2
[Able to state any variables correctly]	1
No response or wrong response	0

(c)

<b>Rubric</b>	<b>Score</b>
[Able to relate the manipulated variable to the responding variable correctly] Example: The further apart the metal in the electrochemical series, the greater is their potential difference.	3
[Able to relate the manipulated variable to the responding variable with less accuracy] Example: By using different pairs of metal, the electrochemical series can be constructed // The potential difference between pairs of metal is shown by the distance of the metals in the electrochemical series.	2
[Able to give ideas on the statement of hypothesis] Example: The potential difference can be used to determine the position of metals in the electrochemical series// Different pairs of metal show a different voltage readings.	1
No response or wrong response	0

(d)

<b>Rubric</b>	<b>Score</b>
[Able to list down the materials and apparatus completely] Example: Apparatus: Voltmeter / galvanometer, beaker, connecting wires  Materials: Copper(II) sulphate solution(or any suitable electrolyte), copper strips, lead strip, magnesium strip, zinc strip, sandpaper	3

[Able to list down part of the materials and apparatus] Example: Voltmeter / galvanometer, copper(II) sulphate solution (or any suitable electrolyte), copper strips / lead strip / magnesium strip / zinc strip	2
[Able to give ideas on the materials and apparatus] Example: Voltmeter / galvanometer, electrolyte, electrode	1
No response or wrong response	0

(e)

Rubric	Score
[Able to state the procedures of the experiment accurately] Example: 1. Clean the metals with sandpaper. 2. Pour [50 – 100 cm <sup>3</sup> ] of copper(II) sulphate solution into a beaker. 3. Dip the magnesium and copper strips into copper(II) sulphate solution. 4. Complete the circuit. 5. Record the potential difference / reading of the voltmeter. 6. Determine the metal strips which becomes the negative / positive terminal. 7. Repeat Steps 1 – 6 by replacing magnesium strip with other metals.	3
[Able to state the procedures of the experiment with less accuracy] Example: Write steps 3, 5, 7	2
[Able to give ideas on the procedures of the experiment] Example: Write steps 3, 5	1
No response or wrong response	0

(f)

Rubric	Score												
[Able to tabulate the data correctly which consists of the followings] <table border="1" data-bbox="151 1646 1200 1841"> <thead> <tr> <th>Pair of electrodes</th> <th>Potential difference (V)</th> <th>Negative / Positive terminal</th> </tr> </thead> <tbody> <tr> <td>Mg – Cu</td> <td></td> <td></td> </tr> <tr> <td>Zn – Cu</td> <td></td> <td></td> </tr> <tr> <td>Pb – Cu</td> <td></td> <td></td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>- Name pair of electrodes</li> <li>- Unit for potential difference</li> </ul>	Pair of electrodes	Potential difference (V)	Negative / Positive terminal	Mg – Cu			Zn – Cu			Pb – Cu			3
Pair of electrodes	Potential difference (V)	Negative / Positive terminal											
Mg – Cu													
Zn – Cu													
Pb – Cu													

[Able to tabulate the data which consists of the followings]			2
Pair of electrodes	Potential difference	Negative / Positive terminal	
[Able to give ideas on the tabulation of data]			1
No response or wrong response			0

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