

4541/2 (PP)
Kimia
Kertas 2
Oktober
2024



MAKTAB RENDAH SAINS MARA

PEPERIKSAAN AKHIR SIJIL PENDIDIKAN MRSM 2024

KIMIA

Kertas 2

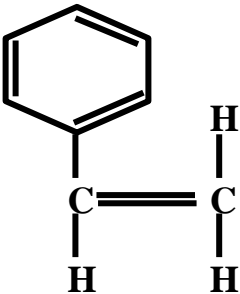
Peraturan Pemarkahan

Untuk Kegunaan Pemeriksa Sahaja

Peraturan Pemarkahan ini mengandungi **29** halaman bercetak

| No. | | | Mark Scheme | Sub mark | Total mark |
|-----|-----|-------|---|----------|------------|
| 1 | (a) | (i) | <p>[Dapat menyatakan maksud formula molekul dengan betul] [Able to state the definition of molecular formula correctly]</p> <p>Jawapan/Answer:</p> <p>Formula kimia yang menunjukkan bilangan atom yang sebenar bagi setiap unsur dalam suatu molekul / sebatian. <i>Chemical formula that shows the actual number of atoms of each element in a molecule / compound.</i></p> | 1 | 1 |
| | | (ii) | <p>[Dapat menamakan semua unsur yang hadir dalam kedua-dua asid dengan betul] [Able to name all elements that present in both acids correctly]</p> <p>Jawapan/Answer :</p> <p>Karbon, hidrogen dan oksigen <i>Carbon, hydrogen and oxygen</i></p> | 1 | 1 |
| | | (iii) | <p>[Dapat menyatakan formula molekul bagi asid metanoik dengan betul] [Able to state the molecular formula of methanoic acid correctly]</p> <p>Jawapan/ Answer :</p> <p>HCOOH // CH₂O₂</p> | 1 | 1 |
| | (b) | | <p>[Dapat memberikan maklumat kualitatif dan kuantitatif dengan betul] [Able to give information qualitatively and quantitatively correctly]</p> <p>P1 Maklumat kualitatif [bahan tindak balas, hasil tindak balas] P2 Maklumat kuantitatif</p> <p>Contoh jawapan/Sample answer:</p> <p><u>Maklumat kualitatif</u></p> <p>P1 Magnesium bertindak balas dengan asid etanoik menghasilkan magnesium etanoat dan gas hidrogen // Bahan tindak balas adalah magnesium dan asid etanoik manakala hasil tindak balas adalah magnesium etanoat dan gas hidrogen //</p> | 1 | 2 |

| | | | | |
|--|--|---|--------------|----------|
| | | <p><u>Maklumat kuantitatif</u></p> <p>P2 1 mol magnesium bertindak balas dengan 2 mol asid etanoik menghasilkan 1 mol magnesium etanoat dan 1 mol gas hidrogen</p> <p><u>Qualitative information</u></p> <p>P1 <i>Magnesium reacts with ethanoic acid to produce magnesium ethanoate and hydrogen gas // Reactants are magnesium and ethanoic acid while products are magnesium ethanoate and hydrogen gas</i></p> <p><u>Quantitative information</u></p> <p>P2 1 mol <i>magnesium reacts with 2 mol ethanoic acid producing 1 mol magnesium ethanoate and 1 mol hydrogen gas</i></p> <p>Note : can consider P1 and P2 in P2</p> | 1 | |
| | | | Total | 5 |

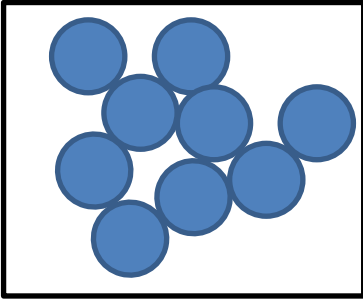
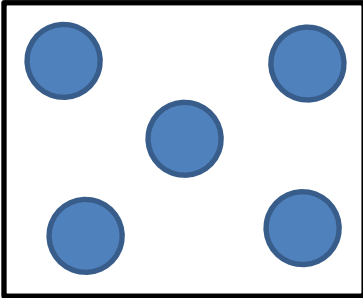
| No. | | | Mark Scheme | Sub mark | Total mark |
|--------------|-----|-------|--|----------|------------|
| 2 | (a) | (i) | <p>[Dapat menyatakan maksud polimer dengan betul] [Able to state definition of polymer correctly]</p> <p>Jawapan/Answer:</p> <p>Molekul berantai panjang yang terhasil daripada pencantuman banyak ulangan unit asas/monomer // <i>A long chain molecule that is made from a combination of many repeating basic units/monomers</i></p> | 1 | 1 |
| | | (ii) | <p>[Dapat melukis formula struktur bagi monomer polimer A dengan betul] [Able to draw the structural formula for monomer of polymer A correctly]</p> <p>Jawapan/Answer :</p> <div style="text-align: center;">  </div> | 1 | 1 |
| | | (iii) | <p>[Dapat menamakan jenis tindak balas pempolimeran polimer A dengan betul] [Able to name the type of polymerisation reaction of polymer A correctly]</p> <p>Jawapan/Answer :</p> <p>Pempolimeran penambahan // <i>Addition polymerisation</i></p> | 1 | 1 |
| | (b) | (i) | <p>[Dapat menyatakan jenis polimer dengan betul] [Able to state type of polymer correctly]</p> <p>Jawapan/Answer:</p> <p>Polimer termoset // <i>Thermosetting polymer</i></p> | 1 | 1 |
| | | (ii) | <p>[Dapat berikan kegunaan polimer dengan betul] [Able to give use of polymer correctly]</p> <p>Contoh jawapan/ sample answer:</p> <p>Untuk menghasilkan pinggan / mangkuk // bampar kereta <i>To produce plate / bowl // car bumper</i></p> <p>Note : <i>any suitable answer</i></p> | 1 | 1 |
| Total | | | | | 5 |

| No. | | Mark Scheme | Sub mark | Total mark |
|-----|-----|--|----------|------------|
| 3 | (a) | <p>[Dapat menulis susunan elektron bagi atom magnesium dengan betul] [Able to write the electron arrangement for magnesium atom correctly]</p> <p>Jawapan/Answer: 2.8.2//2,8,2 r: 2:8:2</p> | 1 | 1 |
| | (b) | <p>[Dapat menyatakan jenis ikatan bagi sebatian P dengan betul] [Able to state the type of bond in compound P correctly]</p> <p>Jawapan/Answer: Ikatan ion // <i>Ionic bond</i> r: ikatan ionik // sebatian ion // <i>ionic compound</i></p> | 1 | 1 |
| | (c) | <p>[Dapat menulis persamaan kimia bagi pembentukan sebatian P dengan betul] [Able to write the chemical equation for the formation of compound P correctly]</p> <p>P1 Formula bahan tindak balas dan hasil tindak balas P2 Persamaan seimbang P1 <i>Correct chemical formula of reactants and product</i> P2 <i>Balanced equation</i></p> <p>Jawapan/Answer: $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$</p> | 1 1 | 2 |
| | (d) | <p>[Dapat mengira isi padu gas oksigen yang diperlukan dengan betul] [Able to calculate volume of oxygen gas required correctly]</p> <p>P1 Nisbah mol P2 Isipadu gas oksigen dengan unit yang betul P1 <i>Mol ratio</i> P2 <i>Volume of oxygen gas with correct unit</i></p> <p>Contoh Jawapan / Sample Answer : P1 2 mol Mg menghasilkan 1 mol O₂ 0.5 mol Mg menghasilkan 0.25 mol O₂ P2 Isipadu O₂ = (0.25 x 24) dm³ // 6 dm³ // 6000 cm³ P1 2 mol of Mg produce 1 mol of O₂ 0.5 mol of Mg produce 0.25 mol of O₂ P2 Volume O₂ = (0.25 x 24) dm³ // 6 dm³ // 6000 cm³</p> | 1 1 | 2 |
| | | Total | | 6 |

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| No. | | | Mark Scheme | Sub mark | Total mark |
|-----|-----|------|--|----------|------------|
| 4 | (a) | (i) | <p>[Dapat menyatakan bahan Z dengan betul] [Able to state substance Z correctly] Jawapan/Answer: Silikon dioksida // silikon(IV) oksida // Silika <i>Silicon dioxide // silicon(IV) oxide // Silica</i> Note : <i>Accept formula</i></p> | 1 | 1 |
| | | (ii) | <p>[Dapat menyatakan jenis kaca R dan S dengan betul] [Able to state type of glass R and S correctly] Jawapan/Answer: R: Kaca soda kapur S: Kaca borosilikat R: <i>soda-lime glass</i> S: <i>borosilicate glass</i></p> | 1 1 | 2 |
| | (b) | | <p>[Dapat memilih dan mewajarkan pemilihan bekas dengan betul] [Able to justify selection of the container correctly] P1 Pemilihan bekas yang betul P2 Penerangan P1 <i>Correct choices of container</i> P2 <i>Explanation</i> Contoh Jawapan/ Sample Answer: P1 Balang kaca P2 Lengai secara kimia // Lut sinar // Kalis air P1 <i>Glass jar</i> P2 <i>Chemically inert // Transparent // waterproof</i> Atau // Or P1 Bekas logam P2 Ringan // Tidak mudah pecah P1 <i>Metal container</i> P2 <i>Light // Does not break easily</i></p> | 1 1 | 2 |
| | (c) | | <p>[Dapat mencadangkan bagaimana gentian kaca dapat diperkukuhkan untuk menghasilkan gentian optik dengan betul] [Able to suggest how glass fibre can be strengthened to produce optical fibre correctly] Jawapan/Answer: Dengan menambahkan plastik // <i>Add plastic</i></p> | 1 | 2 |

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|--|--|--|---|----------|
| | | <p>[Dapat menyatakan sifat gentian optik dengan betul] [Able to state the properties of optical fibre correctly]</p> <p>Jawapan/Answer:</p> <p>Kekuatan mampatan tinggi // Fleksibel <i>High compression strength // Flexible</i></p> | 1 | |
| | | Total | | 7 |

| No. | | | Mark Scheme | Sub mark | Total mark |
|-----|-----|-------|--|------------|------------|
| 5 | (a) | (i) | <p>[Dapat menamakan proses perubahan keadaan jirim air dengan betul] [Able to name the process involved in changing the state of matter of water correctly]</p> <p>Jawapan/ Answer: Penyejatan // <i>Evaporation</i></p> | 1 | 1 |
| | | (ii) | <p>[Dapat melukis zarah-zarah air sebelum dan selepas proses di 5 (a) (i) dengan betul] [Able to draw the arrangement of water particles before and after the process in 5 (a)(i) correctly]</p> <p>Jawapan/ Answer: Sebelum/<i>before</i></p> <div style="text-align: center;">  </div> <p>Selepas/<i>After</i></p> <div style="text-align: center;">  </div> | 1 1 | 2 |
| | | (iii) | <p>[Dapat menyatakan perubahan daya tarikan antara zarah dengan betul] [Able to state the change in the attraction force between particles correctly]</p> <p>Jawapan/ Answer: Daya tarikan antara zarah/ molekul semakin lemah// <i>Attraction force between particles/ molecules become weaker</i></p> <p><i>Reject</i> : daya antara zarah // <i>force between particles</i></p> | 1 | 1 |

| | | | | |
|--------------|-----|---|--------|----------|
| | (b) | <p>[Dapat memilih dua atom sebagai isotop dan menerangkan pilihan isotop dengan betul] [Able to choose two atoms as isotope and explain the choice of isotope correctly]</p> <p>P1 Pilihan dua atom sebagai isotop P2 Penerangan</p> <p>P1 <i>Choice of two atoms as isotope</i> P2 <i>Explanation</i></p> <p>Jawapan/ Answer:</p> <p>P1 W dan X P2 Kedua-dua atom mempunyai bilangan proton yang sama tetapi bilangan neutron yang berbeza//</p> <p>P1 <i>W and X</i> P2 <i>Both atoms have same number of protons but different number of neutrons</i></p> <p><i>Reject: kedua-dua atom mempunyai nombor proton yang sama tetapi nombor nukleon yang berbeza //</i> <i>both atoms have same proton number but different nucleon number</i></p> | 1 1 | 2 |
| | (c) | <p>[Dapat menghitung jisim atom relatif bagi Q dengan betul] [Able to calculate the relative atomic mass of Q correctly]</p> <p>P1 Calculation P2 Correct answer</p> <p>Jawapan/ Answer:</p> <p>P1 $\frac{(2 \times 204) + (24 \times 206) + (22 \times 207) + (52 \times 208)}{100}$ P2 207.22</p> | 1 1 | 2 |
| Total | | | | 8 |

| No. | | | Mark Scheme | Sub mark | Total mark |
|-----|-----|------|---|----------|------------|
| 6 | (a) | (i) | <p>[Dapat menamakan Tindak balas I dengan betul] [Able to name Reaction I correctly]</p> <p>Jawapan/ Answer: Penapaian // <i>Fermentation</i></p> | 1 | 1 |
| | | (ii) | <p>[Dapat menulis formula kimia bagi sebatian X dengan betul] [Able to write the chemical formula for compound X correctly]</p> <p>Jawapan/ Answer: C_2H_5OH // C_2H_6O</p> | 1 | 1 |
| | (b) | (i) | <p>[Dapat mencadangkan reagen bagi menjalankan Tindak balas II dengan betul] [Able to suggest a reagent to carry out Reaction II correctly]</p> <p>Jawapan/ Answer: <u>Larutan</u> kalium manganat(VII) berasid// <u>Larutan</u> kalium dikromat(VI) berasid</p> <p><i>Acidified potassium manganate(VII) solution //</i> <i>Acidified potassium dichromate(VI) solution</i></p> <p>Note : terima formula // accept formula</p> | 1 | 1 |
| | | (ii) | <p>[Dapat menyatakan satu pemerhatian berdasarkan cadangan di 6(b)(i) dengan betul] [Able to state one observation based on suggestion in 6(b)(i) correctly]</p> <p>Jawapan/ Answer: Larutan ungu berubah kepada tanpa warna / dinyahwarnakan // Larutan jingga berubah kepada hijau</p> <p><i>Purple solution turns colorless / decolourised //</i> <i>Orange solution turns green</i></p> | 1 | 1 |
| | (c) | (i) | <p>[Dapat mengenalpasti bilangan isomer bagi propanol dengan betul] [Able to identify the number of isomers for propanol correctly]</p> <p>Jawapan/ Answer: 2</p> | 1 | 1 |

| | | | | |
|--|-------|--|----------------------------|----------|
| | (ii) | <p>[Dapat melukis formula struktur dan menamakan sebatian Z dengan betul] [Able to draw the structural formula and name compound Z correctly]</p> <p>P1 Formula struktur yang betul P2 Nama sebatian Z yang betul</p> <p>P1 <i>Correct structural formula</i> P2 <i>Correct name of compound Z</i></p> <p>Jawapan/ Answer:</p> <p>P1</p> $ \begin{array}{ccccccc} & \text{H} & \text{O} & & \text{H} & \text{H} & \text{H} \\ & & & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{O} & - \text{C} & - \text{C} & - \text{C} - \text{H} \\ & & & & & & \\ & \text{H} & & & \text{H} & \text{H} & \text{H} \end{array} $ <p>P2 Propil etanoat // <i>Propyl ethanoate</i></p> | <p>2</p> <p>1</p> <p>1</p> | <p>2</p> |
| | (iii) | <p>[Dapat mewajarkan penggunaan Kaedah I dengan betul] [Able to justify the use of Method I the action correctly]</p> <p>Contoh Jawapan/ Sample Answer:</p> <p>P1 Propanol mudah terbakar P2 Pemanasan propanol mesti menggunakan kaedah kukusan air</p> <p>P1 <i>Propanol is (highly) flammable</i> P2 <i>Heating of propanol must use water bath method</i></p> <p>Atau / Or</p> <p>P1 Takat didih propanol rendah / kurang dari 100⁰C // Propanol mudah meruap P2 Wap propanol dikondensasikan kepada cecair propanol untuk mengalir semula ke dalam kelalang dasar bulat untuk bertindak balas lengkap dengan asid karboksilik</p> <p>P1 <i>Low boiling point of water / less than 100⁰C / Propanol is volatile</i> P2 <i>Propanol vapor is condensed to propanol liquid to flow back into the round bottom flask to react completely with carboxylic acids</i></p> | <p>1</p> <p>1</p> | <p>2</p> |
| | | Total | | 9 |

| No. | | | Mark Scheme | Sub mark | Total mark |
|-----|-----|------|--|----------|------------|
| 7 | (a) | (i) | <p>[Dapat menyatakan maksud elektron valens dengan betul] [Able to state the meaning of valence electron correctly]</p> <p>Jawapan/ Answer:</p> <p>Elektron pada petala valens dalam suatu atom // Elektron pada petala paling luar suatu atom</p> <p><i>Electrons in the valence shell in an atom // Electrons in the outermost shell of an atom</i></p> | 1 | 1 |
| | | (ii) | <p>[Dapat menerangkan perbezaan saiz atom D dan atom E dengan betul] [Able to explain the difference in atomic size between D atom and E atom correctly]</p> <p>Jawapan/ Answer:</p> <p>P1 Saiz atom E lebih kecil dari atom D P2 Daya tarikan nukleus terhadap elektron di dalam atom E adalah lebih kuat berbanding atom D</p> <p><i>P1 Atomic size E is smaller than D P2 The nuclear attraction force towards electrons in atom E is stronger // Forces of attraction between nucleus and electron in atom E is stronger</i></p> <p>Note : terima sebaliknya // <i>accept vice versa</i></p> | 1 1 | 2 |
| | (b) | | <p>[Boleh meramalkan pemerhatian ke atas kertas litmus biru dengan betul] [Able to predict the observation on the blue litmus paper correctly]</p> <p>Jawapan/ Answer:</p> <p>Kertas litmus biru bertukar menjadi merah dan dilunturkan// <i>Blue litmus paper turns to red and then bleached</i></p> | 1 | 1 |

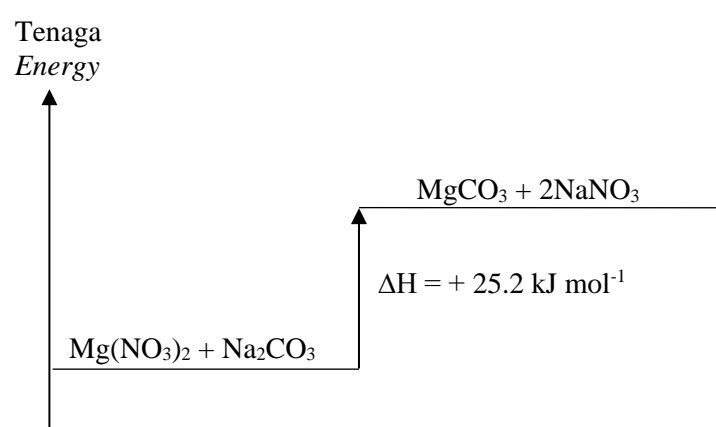
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| (c) | (i) | <p>[Boleh menerangkan perbezaan saiz nyalaan unsur G berbanding unsur D dengan betul] [Able to explain the difference in the flame size of element G compared to element D correctly]</p> <p>Contoh jawapan/ Sample answer:</p> <p>P1 G lebih reaktif terhadap gas oksigen berbanding D P2 Daya tarikan antara nukleus dan elektron valens di dalam <u>atom</u> G lebih lemah</p> <p>P1 G is more reactive towards oxygen gas than D P2 Nuclear attraction force towards valence electron in G <u>atom</u> is weaker</p> <p>Note : terima sebaliknya // <i>accept vice versa</i></p> | 1 1 | 2 |
| | (ii) | <p>[Dapat menulis persamaan kimia dengan betul] [Able to write chemical equation correctly]</p> <p>P1 Formula bahan tindak balas dan hasil tindak balas P2 Persamaan seimbang</p> <p>P1 <i>Chemical formula of reactants and products</i> P2 <i>Balanced equation</i></p> <p>Jawapan/ Answer:</p> <p>$4G + O_2 \rightarrow 2G_2O //$ $4K + O_2 \rightarrow 2K_2O$</p> | 1 1 | 2 |
| | (iii) | <p>[Dapat menghitung jisim sebatian yang terbentuk dengan betul] [Able to calculate mass of the compound formed correctly]</p> <p>P1 Nisbah mol P2 Jisim G₂O dengan unit yang betul</p> <p>P1 <i>Mole ratio</i> P2 <i>Mass of G₂O with correct unit</i></p> <p>Contoh jawapan / Sample answer:</p> <p>P1 4 mol G menghasilkan 2 mol G₂O 0.1 mol G menghasilkan 0.05 mol G₂O</p> <p>P2 $0.05 \times [2(39) + 1(16)] \text{ g} = 4.7 \text{ g}$</p> | 1 1 | 2 |
| | | Total | | 10 |

| No. | | Mark Scheme | Sub mark | Total mark |
|-----|-----|--|----------|------------|
| 8 | (a) | (i) [Dapat menyatakan maksud tindak balas redoks dengan betul] [Able to give the meaning of redox reaction correctly] Jawapan// Answer: <u>Tindak balas kimia</u> yang melibatkan pengoksidaan dan penurunan berlaku secara serentak// <i>Chemical reaction</i> where oxidation and reduction occur simultaneously. | 1 | 1 |
| | | (ii) [Dapat mencadangkan logam X dan Y dengan betul] [Able to suggest metal X and Y correctly] Contoh jawapan // Sample answer: P1 X = Stanum // Plumbum // Kuprum P2 Y = Magnesium // Aluminium // Zink P1 X = Tin //Lead // Copper P2 Y = Magnesium // Aluminium //Zinc Note 1: Accept formula Note 2: Reject calcium, sodium, lithium, potassium | 1 1 | 2 |
| | | (iii) [Dapat menerangkan pemerhatian dalam Set II dengan betul] [Able to explain observation in Set II correctly] Contoh jawapan / Sample answer: Ion Fe ²⁺ tidak hadir //Pengaratan tidak berlaku <i>Fe²⁺ not present // Rusting does not occur</i> | 1 | 1 |
| | | (iv) [Dapat menyusun logam Fe, X dan Y dalam tertib menaik dengan betul] [Able to arrange metal Fe, X and Y in ascending order correctly] Jawapan/ Answer: X, Fe, Y | 1 | 1 |
| | (b) | (i) [Dapat mencadangkan larutan X dengan betul] [Able to suggest solution X correctly] Contoh jawapan // Sample answer: Larutan kalium manganat(VII) berasid // Larutan kalium dikromat(VI) berasid // Air klorin // Air bromin <i>Acidified potassium manganate(VII) solution // Acidified potassium dichromate(VI) solution // Chlorine water // Bromine water [any suitable oxidising agent]</i> Note : terima formula // accept formula | 1 | 1 |

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|--|-------|---|--------|-----------|
| | (ii) | <p>[Dapat menulis setengah persamaan bagi tindak balas pada elektrod P dengan betul] [Able to write half equation for the reaction at electrode P correctly]</p> <p>P1 Formula kimia yang betul bagi bahan dan hasil tindak balas P2 Persamaan seimbang</p> <p>P1 <i>Correct chemical formula of reactant and product</i> P2 <i>Balanced equation.</i></p> <p>Contoh Jawapan/ Sample answer: $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O //$ $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O //$ $Cl_2 + 2e^- \rightarrow 2Cl^- //$ $Br_2 + 2e^- \rightarrow 2Br^-$</p> | 1 1 | 2 |
| | (iii) | <p>[Dapat menerangkan secara ringkas ujian kimia untuk mengenal pasti kehadiran ion Fe^{3+} dengan betul] [Able to explain briefly the chemical test to identify Fe^{3+} ion correctly]</p> <p>P1 Prosedur P2 Pemerhatian</p> <p>Contoh jawapan/ Sample answer:</p> <p>P1 Tambahkan beberapa titis larutan NaOH / NH_3 akueus sehingga berlebihan ke dalam tabung uji yang mengandungi larutan pada elektrod Q P2 Mendakan perang yang terbentuk</p> <p>P1 <i>Add a few drops of NaOH solution / NH_3 aqueous until excess into a test tube containing solution at electrode Q</i> P2 <i>A brown precipitate formed</i></p> <p>Atau / Or</p> <p>P1 Tambahkan larutan kalium heksasianoferrat(II) ke dalam tabung uji yang mengandungi larutan pada elektrod Q P2 Mendakan biru tua terbentuk</p> <p>P1 <i>Add potassium hexacyanoferrate(II) solution into a test tube containing solution at electrode Q</i> P2 <i>Dark blue precipitate formed</i></p> <p>ATAU / OR</p> <p>P1 Tambahkan larutan kalium tiosianat ke dalam tabung uji yang mengandungi larutan pada elektrod Q P2 Larutan merah darah terbentuk</p> <p>P1 <i>Add potassium thiocyanate solution into a test tube containing solution at electrode Q</i> P2 <i>Blood red solution formed</i></p> | 1 1 | 2 |
| | | Total | | 10 |

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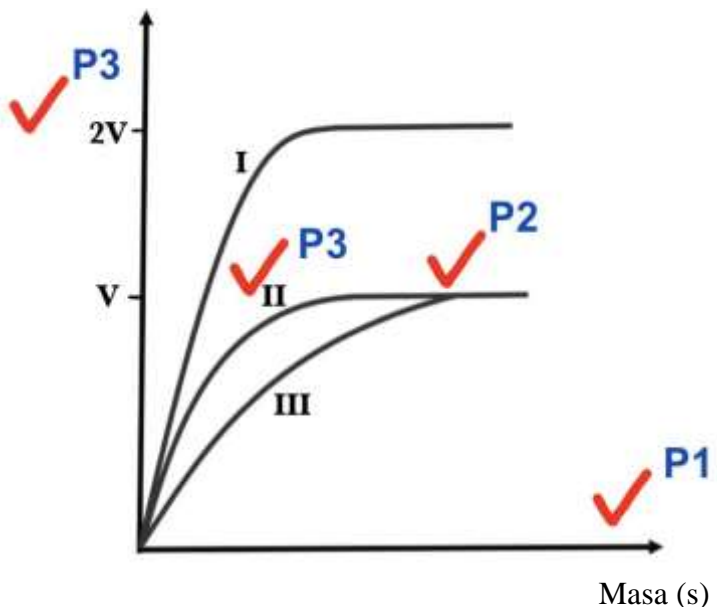
| No. | | Mark Scheme | Sub mark | Total mark | |
|-----|-----|-------------|---|------------|---|
| 9 | (a) | (i) | <p>[Dapat menyatakan perwakilan simbol ΔH dengan betul] [Able to state the representation of ΔH symbol correctly]</p> <p>Jawapan // Answer:</p> <p>Haba tindak balas // <i>Heat of reaction</i></p> | 1 | 4 |
| | | | <p>[Dapat mengenal pasti jenis bagi Tindak balas I dan Tindak balas II dengan betul] [Able to identify type of reaction for Reaction I and Reaction II correctly]</p> <p>Jawapan// Answer:</p> <p>Tindak balas I : Tindak balas endotermik Dan Tindak balas II: Tindak balas eksotermik</p> <p><i>Reaction I : Endothermic reaction</i> <i>And</i> <i>Reaction II : Exothermic reaction</i></p> | 1 | |
| | | | <p>[Dapat membandingkan perubahan tenaga semasa pemecahan ikatan dan pembentukan ikatan semasa tindak balas berlaku bagi Tindak balas I dan II dengan betul] [Able to compare the change of energy during the bond breaking and the bond formation as reactions take place for Reaction I and II correctly]</p> <p>Contoh jawapan/ Sample answer:</p> <p>Tindak balas I</p> <p><u>Jumlah</u> tenaga haba diserap semasa pemecahan ikatan bahan tindak balas lebih tinggi dari <u>jumlah</u> tenaga haba yang dibebaskan semasa pembentukan ikatan hasil tindak balas</p> | 1 | |
| | | | <p>Tindak balas II</p> <p><u>Jumlah</u> tenaga haba dibebaskan sewaktu pembentukan ikatan hasil tindak balas lebih tinggi dari <u>jumlah</u> tenaga haba yang diserap sewaktu pemecahan ikatan bahan tindak balas</p> <p>Reaction I</p> <p><i>Total heat energy absorbed during bond breaking of reactants is higher than total heat energy released during bond formation of products</i></p> | 1 | |

| | | | | | |
|--|------|---|---|---|--|
| | | | <p>Reaction II</p> <p><i>Total heat energy releases during bond formation of products is higher than <u>total</u> heat energy absorbed during bond breaking of reactants</i></p> | | |
| | (ii) | <p>[Boleh melukis gambar rajah aras tenaga bagi Tindak balas I dengan betul] [Able to draw the energy level diagram for Reaction I correctly]</p> <p>P1 Paksi-Y berlabel tenaga dengan dua aras tenaga berbeza P2 Formula bahan, hasil tindak balas dan nilai ΔH berserta tandaan dan unit yang betul</p> <p>P1 Y-axis labelled energy with two different energy levels P2 Correct chemical formula of reactant, product and ΔH value with correct sign and unit</p> <p>Jawapan/ Answer:</p>  <p>Note : Accept ionic equation Reject X-axis</p> <p>[Boleh meramalkan haba tindak balas bagi Tindak balas I jika larutan Na₂CO₃ digantikan dengan larutan K₂CO₃ dan menerangkan sebab dengan betul] [Able to predict the heat of reaction for Reaction I if Na₂CO₃ solution is replaced with K₂CO₃ solution and explain the reason correctly]</p> <p>P1 Ramalan perubahan haba yang betul P2 Penerangan</p> <p>P1 Predict the heat of reaction change correctly P2 Explanation</p> | 1 1 | 4 | |

| | | | | | |
|--|-----|-------|--|--------|---|
| | | | <p>Jawapan/ Answer:</p> <p>P1 + 25.2 kJ mol⁻¹//Tiada perubahan P2 Ion natrium dan ion kalium tidak mengambil bahagian dalam pemendakan magnesium karbonat // Ion natrium dan ion kalium merupakan ion pemerhati // Hanya ion magnesium dan ion karbonat yang bertindak balas</p> <p>P1 + 25.2 kJ mol⁻¹//No changes P2 <i>Sodium ions and potassium ions do not take part in the precipitation of magnesium carbonate //</i> <i>Sodium ion and potassium ion are spectator ions //</i> <i>Only magnesium ion and carbonate ion reacts</i></p> | 1 1 | |
| | | (iii) | <p>[Dapat menghitung nilai bahan api metana dengan betul] [Able to calculate the fuel value of methane correctly]</p> <p>P1 : Jisim molar metana, CH₄ P2 : Nilai bahan api dengan unit yang betul</p> <p>P1 : <i>Molar mass of methane, CH₄</i> P2 : <i>Fuel value with correct unit</i></p> <p>Jawapan / Answer :</p> <p>P1 : Jisim molar CH₄ = 1(12) + 4(1) = 16 gmol⁻¹ P2 : Nilai bahan api CH₄ = 885.4 / 16 = 55.3375 kJ g⁻¹ // 55.34 kJ g⁻¹</p> <p>P1 : <i>Molar mass CH₄ = 1(12) + 4(1) = 16 gmol⁻¹</i> P2 : <i>Fuel value CH₄ = 885.4 / 16 = 55.3375 kJ g⁻¹ //</i> 55.34 kJ g⁻¹</p> | 1 1 | 2 |
| | (b) | (i) | <p>[Boleh menghitung haba penyesaran bagi Set I dengan betul] [Able to calculate the heat of displacement for Set I correctly]</p> <p>P1 Bilangan mol P2 Perubahan haba P3 Haba penyesaran dengan tanda dan unit yang betul</p> <p>P1 <i>Number of moles</i> P2 <i>Heat change</i> P3 <i>Heat of displacement with correct sign and unit</i></p> <p>Jawapan/ Answer:</p> <p>P1 Bilangan mol kuprum / <i>No. of mole copper</i> = $\frac{0.1 \times 50}{1000}$ = 0.005 mol</p> | 1 | 4 |

| | | | | |
|--|------|--|--------|---|
| | | <p>P2 $Q = mc\theta$ $= 50 \times 4.2 \times (35-28)$ $= 1470 \text{ J} / 1.47 \text{ kJ}$</p> <p>P3 ΔH // Haba penyerasan // <i>Heat of displacement</i> $= \frac{1.47}{0.005}$ $= -294 \text{ kJ mol}^{-1}$</p> <p>Jawapan akhir : tandaan dan unit <i>Final answer : sign and unit</i></p> <p>[Boleh memberikan sebab cawan polistirena digunakan berbanding bikar dengan betul] [Able to give reason for the use of a polystyrene cup instead of a beaker correctly]</p> <p>Contoh jawapan/ Sample answer:</p> <p>Cawan polisterina adalah penebat haba yang baik // Mengurangkan kehilangan haba ke persekitaran // <i>Polysterine cup is a good heat conductor //</i> <i>To reduce heat loss to the surrounding</i></p> | 1 | |
| | | <p>P3 ΔH // Haba penyerasan // <i>Heat of displacement</i> $= \frac{1.47}{0.005}$ $= -294 \text{ kJ mol}^{-1}$</p> <p>Jawapan akhir : tandaan dan unit <i>Final answer : sign and unit</i></p> <p>[Boleh memberikan sebab cawan polistirena digunakan berbanding bikar dengan betul] [Able to give reason for the use of a polystyrene cup instead of a beaker correctly]</p> <p>Contoh jawapan/ Sample answer:</p> <p>Cawan polisterina adalah penebat haba yang baik // Mengurangkan kehilangan haba ke persekitaran // <i>Polysterine cup is a good heat conductor //</i> <i>To reduce heat loss to the surrounding</i></p> | 1 | |
| | (ii) | <p>[Boleh mencadangkan logam X dan Y dengan betul] [Able to suggest metal X and Y correctly]</p> <p>Contoh jawapan/ Sample answer:</p> <p>X : Magnesium / Mg // Aluminium / Al // Ferum / Fe Y : Kuprum / <i>Copper</i> / Cu // Argentum / <i>Silver</i> / Ag</p> <p>[Boleh menerangkan perbezaan pemerhatian bagi Set I dan Set II , Set I dan Set III dengan betul] [Able to explain the difference in observation for Set I and Set II, Set I and Set III correctly]</p> <p>Contoh jawapan / Sample answer:</p> <p><u>Set I dan Set II / Set 1 and Set II</u></p> <p>P1 Lebih banyak tenaga haba dibebaskan ke persekitaran apabila kuprum disasarkan di Set II. P2 Logam X lebih elektropositif daripada kuprum //</p> <p>P1 : <i>More heat energy is released to the surrounding when copper is displaced in Set II.</i> P2 : <i>Metal X is more electropositive than copper</i></p> | 1 1 | 6 |

| | | | | |
|--|--|---|--------------|-----------|
| | | <p><u>Set I dan Set III / Set I and Set III</u></p> <p>P1 Tenaga haba dibebaskan ke persekitaran di Set I manakala tiada haba dibebaskan di Set III</p> <p>P2 Logam Y kurang elektropositif daripada kuprum //</p> <p>P1 <i>Heat energy is released to surrounding in Set I while no heat released in Set III</i></p> <p>P2 <i>Metal Y is less electropositive than copper</i></p> <p>Note : Accept E^0 value</p> | 1 | |
| | | | Total | 20 |

| | | | | |
|--|------|--|-------------|---|
| | | <p>[Dapat menyusun kadar tindak balas semua set dalam tertib menaik dengan betul] [Able to arrange the rate of reaction of all sets in ascending order correctly]</p> <p>Jawapan / Answer :</p> <p>Set III, Set II, Set I</p> | 1 | |
| | (ii) | <p>[Dapat melakarkan graf isi padu gas hidrogen melawan masa bagi Set I, II dan III apabila semua asid bertindak balas dalam satu paksi yang sama dengan betul] [Able to sketch the graph for the volume of hydrogen gas against time for Set I, II and III on the same axes when all the acids react completely correctly]</p> <p>P1 Paksi berlabel dengan unit yang betul P2 Bentuk graf yang betul P3 Label untuk Set I, II dan III ; isi padu V dan 2V dengan betul</p> <p>P1 <i>Correct axes with label and unit</i> P2 <i>Correct shape of graph</i> P3 <i>Correct label for Set I, II and III ; volume V and 2V</i></p> <p>Contoh jawapan / Sample answer</p> <p>Isi padu gas hidrogen (cm³)</p>  <p>Nota : Accept V = 600 cm³ and 2V = 1200 cm³</p> | 1 1 1 | 3 |

| | | | |
|--|-------|--|----|
| | (iii) | <p>[Dapat membandingkan dan menerangkan perbezaan kadar tindak balas antara Set I dan Set II, Set II dan Set III dengan betul]</p> <p><i>[Able to compare and explain the difference in the rate of reaction between Set I and Set II, Set II and Set III correctly]</i></p> <p><u>Set I dan Set II</u></p> <p>P1 Kadar tindak balas Set I lebih tinggi berbanding Set II 1</p> <p>P2 Asid sulfurik dalam Set I adalah asid diprotik manakala asid hidroklorik dalam Set II adalah asid monoprotik // 1</p> <p>Kepekatan ion H^+ dalam Set I adalah dua kali ganda daripada Set II</p> <p>P3 <u>Bilangan ion hidrogen/H^+ per unit isipadu</u> dalam Set I adalah dua kali ganda 1</p> <p>P4 Frekuensi perlanggaran antara ion hidrogen/H^+ dan atom zink di dalam Set I lebih tinggi 1</p> <p>P5 Frekuensi perlanggaran berkesan antara ion hidrogen/H^+ dan atom zink di dalam Set I lebih tinggi. 1</p> <p><u>Set I and Set III</u></p> <p>P1 <i>Rate of reaction for Set I is higher than Set II</i></p> <p>P2 <i>Sulphuric acid in Set I is diprotic acid while hydrochloric acid in Set II is a monoprotic acid // The concentration of hydrogen/H^+ ion in Set I is twice/doubled of Set II</i></p> <p>P3 <u><i>The number of hydrogen ions/H^+ per unit volume in Set I is doubled</i></u></p> <p>P4 <i>Frequency of collision between hydrogen ion/H^+ and zinc atom in Set I is higher</i></p> <p>P5 <i>Frequency of effective collision between hydrogen ion/H^+ and zinc atom in Set I is higher.</i></p> <p><u>Set II dan III</u></p> <p>P1 Kadar tindak balas Set II lebih tinggi berbanding Set III 1</p> <p>P2 Serbuk zink dalam Set II mempunyai jumlah luas permukaan yang lebih besar 1</p> <p>P3 Jumlah luas permukaan yang terdedah kepada perlanggaran adalah lebih besar dalam Set II 1</p> <p>P4 Frekuensi perlanggaran antara ion hidrogen/H^+ dan atom zink dalam Set II lebih tinggi 1</p> <p>P5 Frekuensi perlanggaran berkesan di antara ion hidrogen/H^+ dan atom zink di dalam Set II lebih tinggi 1</p> | 10 |
|--|-------|--|----|

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|--|--|---|--------------|-----------|
| | | <p><u>Set II and Set III</u></p> <p>P1 <i>Rate of reaction in Set II is higher than Set III</i></p> <p>P2 <i>Zinc powder in Set II has a smaller size / larger total surface area</i></p> <p>P3 <i>Larger total surface area exposed to collision in Set II</i></p> <p>P4 <i>Frequency of collision between hydrogen ion/H⁺ and zinc atom is higher in Set II</i></p> <p>P5 <i>Frequency of effective collision between hydrogen ion/H⁺ and zinc atom is higher in Set II</i></p> <p>Note :</p> <ol style="list-style-type: none">1. <i>Specific type of particles only mention once in P4</i>2. <i>Penalty increases once</i> | | |
| | | | Total | 20 |

| | | | | |
|-----|--|---|--|---|
| (b) | | <p>[Dapat menerangkan perbezaan nilai pH bagi ketiga-tiga asid dengan betul] [Able to explain the difference in the pH values for the three acids correctly]</p> <p>Contoh jawapan / Sample answer:</p> <p>P1 Asid hidroklorik merupakan asid monoprotik kuat // mengion lengkap dalam air menghasilkan satu ion H^+ per molekul asid. 1</p> <p>P2 Asid sulfurik merupakan asid diprotik kuat // mengion lengkap dalam air menghasilkan dua ion H^+ per molekul asid 1</p> <p>P3 Asid etanoik merupakan asid monoprotik lemah// mengion secara separa lengkap dalam air menghasilkan satu ion H^+ per molekul asid dengan kepekatan yang rendah 1</p> <p>P4 Kepekatan ion H^+ bagi asid sulfurik adalah dua kali ganda berbanding dalam asid hidroklorik manakala kepekatan ion H^+ asid etanoik adalah paling rendah 1</p> <p>P5 Semakin tinggi kepekatan ion H^+, semakin rendah nilai pH 1</p> <p>P1 <i>Hydrochloric acid is a strong monoprotic acid // ionise completely in water to produce one H^+ ion per acid molecule</i></p> <p>P2 <i>Sulphuric acid is a strong diprotic acid // ionise completely in water to produce two H^+ ion per acid molecule</i></p> <p>P3 <i>Ethanoic acid is a weak monoprotic acid // ionise partially in water to produce one H^+ ion per acid molecule</i></p> <p>P4 <i>The concentration of H^+ ion in sulphuric acid is the twice / double than in hydrochloric acid while the concentration H^+ ion in ethanoic acid is the lowest</i></p> <p>P5 <i>The higher the concentration of H^+, the lower the pH value</i></p> | | 5 |
| (c) | | <p>[Dapat menghitung isi padu larutan piawai dengan betul] [Able to calculate the volume of standard solution correctly]</p> <p>P1 Langkah pengiraan</p> <p>P2 Isi padu larutan piawai berserta unit yang betul</p> <p>P1 <i>Calculation steps</i></p> <p>P2 <i>Volume of standard solution with correct unit</i></p> | | 2 |

| | | | | |
|--|-----|---|----------------------------|---|
| | | <p>Jawapan / Answer</p> <p>P1 $M_1V_1 = M_2V_2$ (2.0)(V₁) = (0.2)(250)</p> <p>P2 $V_1 = 25 \text{ cm}^3 // 0.025 \text{ dm}^3$</p> | 1 | |
| | (d) | (i) <p>[Dapat menyatakan sebab dan cara mengatasi dengan betul] <i>[Able to state a reason and method to overcome correctly]</i></p> <p>P1 Sebab yang betul P2 Cara mengatasi</p> <p>P1 <i>Correct reason</i> P2 <i>Method to overcome</i></p> <p>Contoh jawapan / Sample answer:</p> <p>P1 Tanah adalah berasid P2 Tambahkan/Taburkan serbuk kapur tohor / batu kapur / [sebarang bes lemah]</p> <p>P1 <i>Soil is acidic</i> P2 <i>Add powdered lime / limestone // [any weak base]</i></p> | 1 1 | 2 |
| | | (ii) <p>[Dapat menghuraikan satu eksperimen untuk menghasilkan garam magnesium sulfat dan menuliskan persamaan kimia dengan betul] <i>[Able to describe an experiment to produce magnesium sulphate salt in the laboratory and to write the chemical equations involved in the reactions correctly]</i></p> <p><u>Prosedur</u></p> <p>P1 Sukat/Masukkan [25 – 200] cm³ larutan natrium karbonat, Na₂CO₃ [0.2 - 2.0] mol dm⁻³ dan tuang ke dalam bikar</p> <p>P2 Tambah/tuang [25 – 200] cm³ larutan magnesium nitrat, Mg(NO₃)₂ [0.2 - 2.0] mol dm⁻³ ke dalam bikar mengandungi larutan natrium karbonat, Na₂CO₃</p> <p>P3 Kacau dan turas campuran. Bilas mendakan dengan air suling</p> <p>P4 $\text{Na}_2\text{CO}_3 + \text{Mg}(\text{NO}_3)_2 \rightarrow \text{MgCO}_3 + 2\text{NaNO}_3$</p> <p>P5 Masukkan (25-100 cm³) asid sulfurik [0.2 - 1.0] mol dm⁻³ ke dalam bikar</p> <p>P6 Tambahkan mendakan/pepejal yang terhasil/MgCO₃ ke dalam bikar</p> <p>P7 $\text{MgCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2\text{O} + \text{CO}_2$</p> | 1 1 1 1 1 1 | 8 |

[Lihat halaman sebelah

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|--|--|--|---|-----------|
| | | <p>P8 Panaskan larutan sehingga tepu dan sejukkan. Turaskan campuran dan keringkan pepejal/hablur garam yang terhasil dengan menggunakan kertas turas</p> <p><i>Procedure</i></p> <p>P1 <i>Measure/ Pour</i> [25 – 200] cm³ sodium carbonate, Na₂CO₃ [0.2 - 2.0] mol dm⁻³ solution and pour into a beaker</p> <p>P2 <i>Pour/Add</i> [25 – 200] cm³ magnesium nitrat, Mg(NO₃)₂ [0.2 - 2.0] mol dm⁻³ solution and pour into a beaker containing sodium carbonate, Na₂CO₃ solution</p> <p>P3 <i>Stir and filter the mixture. Rinse the precipitate with distilled water</i></p> <p>P4 $\text{Na}_2\text{CO}_3 + \text{Mg}(\text{NO}_3)_2 \rightarrow \text{MgCO}_3 + 2\text{NaNO}_3$</p> <p>P5 <i>Pour</i> [25- 100 cm³] sulphuric acid [0.2 - 1.0] mol dm⁻³ into a beaker</p> <p>P6 <i>Add the precipitate/ solid formed/ MgCO₃ into the beaker</i></p> <p>P7 $\text{MgCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2\text{O} + \text{CO}_2$</p> <p>P8 <i>Heat the solution until saturated and cool. Filter the mixture and dry the solid / salt crystal using filter papers</i></p> | 1 | |
| | | JUMLAH | | 20 |

Tamat Peraturan Pemarkahan

**JSU SIJIL PENDIDIKAN MRSM
KIMIA KERTAS 2, 2024**

| NO. | TOPIK | PK01 | KK01 | KK02 | KK03 | KK04/ KK05 | MARKAH |
|------------------|---------------------------------------|---|--------------------------------|---|--|----------------|------------|
| SECTION A | | | | | | | |
| 1 | Konsep Mol, Formula & Persamaan Kimia | 3 | 2 | - | - | - | 5 |
| | | 1(a)(i) [1m] 1(a)(ii) [1m] 1(a)(iii) [1m] | 1(b) [2m] | - | - | - | |
| 2 | Polimer | 3 | 2 | - | - | - | 5 |
| | | 2(a)(i) [1m] 2(a)(iii) [1m] 2(b)(i) [1m] | 2(a)(ii) [1m] 2(b)(ii) [1m] | - | - | - | |
| 3 | Ikatan Kimia | 1 | 1 | 4 | - | - | 6 |
| | | 3(b) [1m] | 3(a) [1m] | 3(c) [2m] 3(d) [2m] | - | - | |
| 4 | Bahan Buatan Dalam Industri | 1 | 2 | 4 | - | - | 7 |
| | | 4(a)(i) [1m] | 4(a)(ii) [2m] | 4 (b) [2m] 4 (c) [2m] | - | - | |
| 5 | Jirim & Struktur Atom | 1 | 1 | 4 | 2 | - | 8 |
| | | 5(a)(i) [1m] | 5(a)(iii) [1m] | 5(a)(ii) [2m] 5(c) [2m] | 5(b) [2m] | - | |
| 6 | Sebatian Karbon | 1 | 1 | 4 | 3 | - | 9 |
| | | 6(a)(i) [1m] | 6(b)(i) [1m] | 6(a)(ii) [1m] 6(b)(ii) [1m] 6(c)(ii) [2m] | 6(c)(i) [1m] 6(c)(iii) [2m] | - | |
| 7 | Jadual Berkala Unsur | 1 | 1 | 3 | 3 | 2 | 10 |
| | | 7(a)(i) [1m] | 7(a)(ii) [1m] | 7(a)(ii) [1m] 7(c)(iii) [2m] | 7(b) [1m] 7(c)(ii) [2m] | 7(c)(i) [2m] | |
| 8 | Keseimbangan Redoks | 1 | 1 | 3 | 2 | 3 | 10 |
| | | 8(a)(i) [1m] | 8(b)(i) [1m] | 8(a)(ii) [2m] 8(a)(iii) [1m] | 8(a)(iv) [1m] 8(b)(ii) [2m] | 8(b)(iii) [2m] | |
| SECTION B | | | | | | | |
| 9 | Termokimia | 2 | 2 | 6 | 10 | - | 20 |
| | | 9(a)(i) [2m] | 9(a)(ii) [1m] 9(b)(i) [1m] | 9(a)(i) [1m] 9(a)(iii) [2m] 9(b)(i) [3m] | 9(a)(ii) [2m] 9(b)(ii) [6m] 9(a)(i) [2m] | - | |
| 10 | Kadar Tindak Balas | 2 | 2 | 6 | 10 | - | 20 |
| | | 10(a) [2m] | 10(a) [1m] 10(b) [1m] | 10(b)(i) [3m] 10(b)(ii) [3m] | 10(b)(iii) [10m] | - | |
| SECTION C | | | | | | | |
| 11 | Asid, Bes dan Garam | 1 | 2 | 4 | 5 | 8 | 20 |
| | | 11(a)(i) [1m] | 11(c)(i) [2m] | 11(a)(ii) [2m] 11(b) [2m] | 11(a)(iii) [5m] | 11(c)(ii) [8m] | |
| | | 15 | 15 | 32 | 25 | 13 | 100 |

**Aras kesukaran R:S:T = 5:3:2
R=50 m : S=30 m : T=20 m**