

# BUKU RAMALAN SPM TERBAIK!

PASTI  
SKOR

.COM.MY

**KIMIA**



PASTISKOR 2025

# Hi! Selamat Datang Ke PastiSkor

1. Buku ini disediakan melalui analisis soalan-soalan SPM sebenar, soalan-soalan percubaan SPM 2025 dan input guru yang berwibawa.

Hanya soalan-soalan yang penting, mungkin berulang dan mempunyai peluang yang tinggi untuk keluar dalam SPM disediakan dalam buku ini.

2. Buku ini mengandungi **Ramalan SPM 2025, Analisis soalan percubaan SPM 2025 dan Tiga(3) set soalan kertas 2 dengan jawapan lengkap.**
3. Cara menggunakan buku ini :

## **Langkah 1**

Beri tumpuan pada topik-topik ramalan yang disertakan dalam buku ini.

## **Langkah 2**

Sila jawab semua soalan dan semak jawapan anda dengan skema pemarkahan yang disertakan.

**Semoga Berjaya  
Daripada Semua Tenaga Pengajar Di Pastiskor!!**

PASTISKOR 2025

**RAMALAN KIMIA KERTAS 2 SPM 2025**

| BAB                                         | TINGKATAN 4                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 : Jirim dan Struktur Atom                 | 2.3 Struktur Atom (ms 32)<br>2.4 Isotop dan penggunaannya (ms 37)                                                                                                                                                                                                                                                                                                                                                                            |
| 3 : Konsep Mol, Formula dan Persamaan Kimia | 3.4 Persamaan Kimia (ms 69) <ul style="list-style-type: none"><li>soalan pengiraan (wajib keluar)</li></ul>                                                                                                                                                                                                                                                                                                                                  |
| 4 : Jadual Berkala Unsur                    | 4.6 Unsur dalam kala 3 (ms 96)<br>4.7 Unsur peralihan (ms 101)                                                                                                                                                                                                                                                                                                                                                                               |
| 5 : Ikatan Kimia                            | 5.2 Ikatan Ion (ms 111)<br>5.3 Ikatan Kovalen (ms 114)<br>5.7 Sebatian ion dan sebatian kovalen (ms 122)                                                                                                                                                                                                                                                                                                                                     |
| 6 : Asid, Bes dan Garam                     | 6.3 Kekuatan asid dan alkali (ms 149) <ul style="list-style-type: none"><li>monoprotik vs diprotik</li></ul> 6.6 Larutan piawai (ms 162)<br>6.9 Penyediaan garam (ms 178) <ul style="list-style-type: none"><li>garam tidak terlarut</li></ul> 6.10 Tindakan haba ke atas garam (ms 190)                                                                                                                                                     |
| 7 : Kadar Tindak Balas                      | 7.2 Faktor yang mempengaruhi kadar tindak balas (ms 230) <ul style="list-style-type: none"><li>saiz bahan tindak balas</li></ul> 7.3 Aplikasi faktor yang mempengaruhi kadar tindak balas dalam kehidupan (ms 240) <ul style="list-style-type: none"><li>luas permukaan ketulan vs serbuk</li></ul> 7.4 Teori perlanggaran (ms 243) <ul style="list-style-type: none"><li>kesan saiz bahan tindak balas ke atas kadar tindak balas</li></ul> |
| 8 : Bahan Buatan dalam Industri             | 8.1 Aloj dan kepentingannya (ms 252) <ul style="list-style-type: none"><li>perbezaan logam tulen dan aloj</li></ul> 8.3 Komposisi kaca dan kegunaannya (ms 26)<br>8.4 Bahan komposit dan kepentingannya (ms 265) <ul style="list-style-type: none"><li>mengenalpasti bahan komposit</li></ul>                                                                                                                                                |

**RAMALAN KIMIA KERTAS 2 SPM 2025**

| BAB                             | TINGKATAN 5                                                                                                                                                                                                                                                                                                                   |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 : Keseimbangan Redoks         | 1.1 Pengoksidaan dan penurunan (ms 4)<br>1.3 Sel kimia (ms 27)<br>1.4 Sel elektrolisis (ms 31) <ul style="list-style-type: none"><li>faktor yang mempengaruhi elektrolisis</li></ul>                                                                                                                                          |
| 2 : Sebatian Karbon             | 2.3 Sifat kimia dan saling pertukaran sebatian antara siri homolog (ms 80) <ul style="list-style-type: none"><li>pertukaran sebatian alkohol</li></ul> 2.4 Isomer dan penamaan mengikut IUPAC (ms 101)                                                                                                                        |
| 3 : Termokimia                  | 3.1 Perubahan haba dalam tindak balas <ul style="list-style-type: none"><li>tindak balas eksotermik</li></ul> 3.2 Haba tindak balas (ms 120) <ul style="list-style-type: none"><li>haba peneutralan</li><li>haba pembakaran</li></ul>                                                                                         |
| 4 : Polimer                     | 4.1 Polimer (ms 144) <ul style="list-style-type: none"><li>perbezaan polimer asli dan polimer sintetik</li></ul> 4.2 Getah asli (ms 151) <ul style="list-style-type: none"><li>Sifat getah asli</li></ul> 4.3 Getah sintetik (ms 159) <ul style="list-style-type: none"><li>perbezaan getah asli dan getah sintetik</li></ul> |
| 5 : Kimia Konsumer dan Industri | 5.2 Bahan pencuci (ms 169) <ul style="list-style-type: none"><li>perbezaan antara dua agen pencuci</li><li>saponifikasi</li></ul> 5.4 Ubat-ubatan dan bahan kosmetik (ms 181) <ul style="list-style-type: none"><li>ubat tradisional vs ubat moden</li></ul>                                                                  |

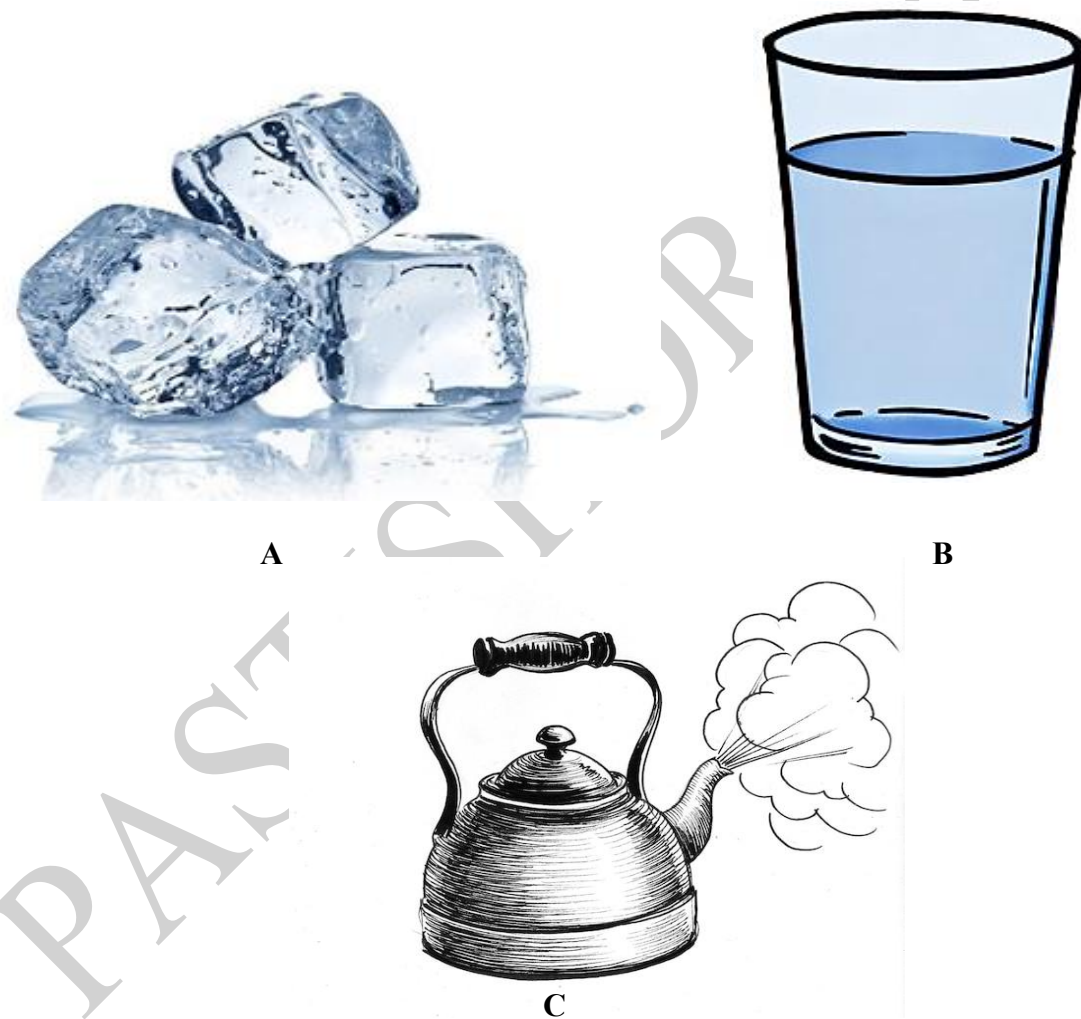
## ANALISIS KIMIA PERCUBAAN KERTAS 2 SPM 2025

|                        | 1                                            | 2                                                   | 3                                                   | 4                                          | 5                                              | 6                                   | 7                                                     | 8                                                              | 9                                                    | 10                                                       | 11                                                                   |
|------------------------|----------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|--------------------------------------------|------------------------------------------------|-------------------------------------|-------------------------------------------------------|----------------------------------------------------------------|------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------|
| <b>Selangor</b>        | T4B3<br>Melting point                        | T4B8<br>Glass                                       | T4B3<br>Subatomic particles<br>Electron arrangement | T4B4<br>Period 3                           | T5B1<br>Redox reaction                         | T5B3<br>Heat of combustion          | T4B7<br>Rate of reaction                              | T5B5<br>Soap                                                   | T4B6<br>Neutralisation                               | T5B4<br>Polymer                                          | T5B2<br>Carbon compound                                              |
| <b>Johor</b>           | T4B8<br>Alloy                                | T5B5<br>Green Technology                            | T5B1<br>Extraction                                  | T5B3<br>Heat of combustion                 | T4B6<br>Properties of acid<br>pH value         | T4B4<br>Period 3                    | T5B5<br>Food additives                                | T4B5<br>Ionic bond                                             | T4B6<br>Standard solution<br>Effect of heat on salts | T4B7<br>Rate of reaction                                 | T5B1<br>Redox reaction<br>Voltaic cell                               |
| <b>Kedah</b>           | T4B5<br>Chemical bond                        | T4B3<br>Empirical formula                           | T4B3<br>Subatomic particles<br>Isotopes             | T4B4<br>Group 1                            | T4B7<br>Rate of reaction                       | T5B2<br>Carbon compound             | T5B1<br>Redox reaction                                | T5B4<br>Polymer                                                | T5B3<br>Heat of displacement                         | T4B8/T5B5<br>Ceramic<br>Food additives<br>Cleaning agent | T4B6<br>Standard solution<br>Salt + Heat                             |
| <b>Kelantan</b>        | T4B5<br>Chemical bond                        | T4B3<br>Subatomic particles<br>Electron arrangement | T4B3<br>Empirical formula<br>Chemical formula       | T4B6<br>pH value<br>Phenolphthalein        | T4B4<br>Period 3                               | T5B4<br>Polymer<br>Rubber           | T5B1<br>Redox reaction                                | T5B2<br>Carbon compound                                        | T4B7<br>Rate of reaction                             | T5B3<br>Heat of neutralisation                           | T5B5/T4B8<br>Cleaning agents<br>Nanotechnology<br>Medicines<br>Alloy |
| <b>Melaka</b>          | T4B6<br>Qualitative analysis                 | T4B8<br>Alloy<br>Glass                              | T5B4<br>Polymer<br>Rubber                           | T5B5<br>Soap<br>Medicines                  | T4B4<br>Group 1<br>Period 3                    | T4B7<br>Rate of reaction            | T5B2<br>Carbon compound                               | T4B6<br>Neutralisation<br>Salt<br>Acid                         | T5B3<br>Exothermic reaction<br>Heat of displacement  | T4B4/B3<br>Periodic table<br>Chemical compound           | T5B1<br>Electrolysis<br>Rusting                                      |
| <b>Negeri Sembilan</b> | T4B3<br>Melting point<br>Subatomic particles | T4B4<br>Group 17                                    | T4B5<br>Chemical bond                               | T5B4<br>Polymer<br>Latex                   | T4B8<br>Alloy                                  | T5B3<br>Heat of combustion          | T5B5<br>Cleaning agent<br>Medicines<br>Food additives | T5B1<br>Electrolysis<br>Rusting                                | T4B7<br>Rate of reaction                             | T5B2<br>Carbon compound                                  | T4B6<br>Preparation of salt<br>Soluble and insoluble salts           |
| <b>Perak</b>           | T5B5<br>Cosmetics                            | T4B4<br>Group 17                                    | T5B4<br>Polymer<br>Latex                            | T4B8<br>Ceramic<br>Glass                   | T4B3<br>Empirical formula                      | T5B1<br>Extraction<br>Electrolysis  | T5B3<br>Heat of combustion                            | T4B6<br>Preparation of salt                                    | T4B5/B6<br>Covalent bond<br>Solubility of salt       | T4B7<br>Rate of reaction<br>Collision Theory             | T5B2<br>Carbon compound                                              |
| <b>Perlis</b>          | T4B4<br>Group 1<br>Group 17                  | T5B2<br>Isomer                                      | T4B3<br>Subatomic particle                          | T4B5<br>Covalent bond                      | T4B3<br>Molecular formula<br>Chemical equation | T4B6<br>Soluble and insoluble salts | T4B8<br>Composite material<br>Glass                   | T5B3<br>Heat of combustion                                     | T4B7<br>Rate of decomposition/reaction               | T5B4<br>Polymer<br>Synthetic rubber                      | T5B1<br>Extraction<br>Metal corrosion                                |
| <b>T'ganu</b>          | T5B5<br>Medicines                            | T4B3<br>Subatomic particle<br>Melting point         | T5B4<br>Polymer                                     | T4B43<br>Molar volume<br>Empirical formula | T4B7<br>Rate of reaction                       | T4B4<br>Period 3                    | T5B1<br>Transfer of e at a distance                   | T5B3<br>Heat of precipitation<br>Method to help injured player | T4B6<br>pH value<br>Electrical conductivity of salt  | T4B5<br>Ionic and covalent compound                      | T5B2<br>Carbon compound                                              |

**KIMIA KERTAS 2**  
**SET 1**  
**BAHAGIAN A**

Jawab **semua** soalan.  
*Answer **all** questions.*

1. Rajah 1 menunjukkan keadaan tiga jirim, A, B, dan C, bagi suatu bahan yang sama  
*Diagram 1 shows the state of three matters, A, B, and C, of the same substance.*



- (a) Apakah jenis zarah yang terdapat dalam B?  
*What type of particle is found in B?*

[1 markah / 1 mark]

- (b) Namakan proses yang berlaku apabila keadaan fizikal C bertukar kepada A.  
*Name the process when physical state C changes to A.*

[1 markah / 1 mark]

- (c) Nyatakan keadaan fizikal bagi C  
*State the physical state of C.*

[1 markah / 1 mark]

- (d) Apabila B berubah kepada C, nyatakan perubahan bagi:  
*When B changes to C, state the changes in:*

- (i) tenaga haba  
*heat energy*

- (ii) daya tarikan antara zarah  
*the force of attraction between the particles*

[2 markah / 2 marks]

2. Jadual 2 menunjukkan bilangan proton, elektron, dan neutron dalam zarah L, M, N, O, dan P.  
*Table 2 shows the number of protons, electrons, and neutrons in particles L, M, N, O, and P.*

| Zarah<br><i>Particle</i> | Bilangan proton<br><i>Number of protons</i> | Bilangan elektron<br><i>Number of electrons</i> | Bilangan neutron<br><i>Number of neutrons</i> |
|--------------------------|---------------------------------------------|-------------------------------------------------|-----------------------------------------------|
| L                        | 5                                           | 5                                               | 6                                             |
| M                        | 8                                           | 8                                               | 10                                            |
| N                        | 8                                           | 10                                              | 8                                             |
| O                        | 17                                          | 18                                              | 18                                            |
| P                        | 19                                          | 18                                              | 20                                            |

Jadual 2 / *Table 2*

- (a) Tuliskan susunan elektron bagi zarah L.  
*Write the electron arrangement of particle L.*

\_\_\_\_\_

[1 markah / 1 mark]

- (b) Nyatakan satu zarah yang wujud sebagai anion.  
*State one particle that exists as an anion.*

\_\_\_\_\_

[1 markah / 1 mark]

- (c) Berapakah nombor nukleon bagi zarah O?  
*What is the nucleon number of particle O?*

\_\_\_\_\_

[1 markah / 1 mark]

- (d) Berdasarkan Jadual 2, nyatakan pasangan zarah yang menunjukkan sifat isotop.  
Terangkan.  
*Based on Table 2, state which pair of particles shows isotope properties. Explain.*

\_\_\_\_\_  
\_\_\_\_\_  
[2 markah / 2 marks]

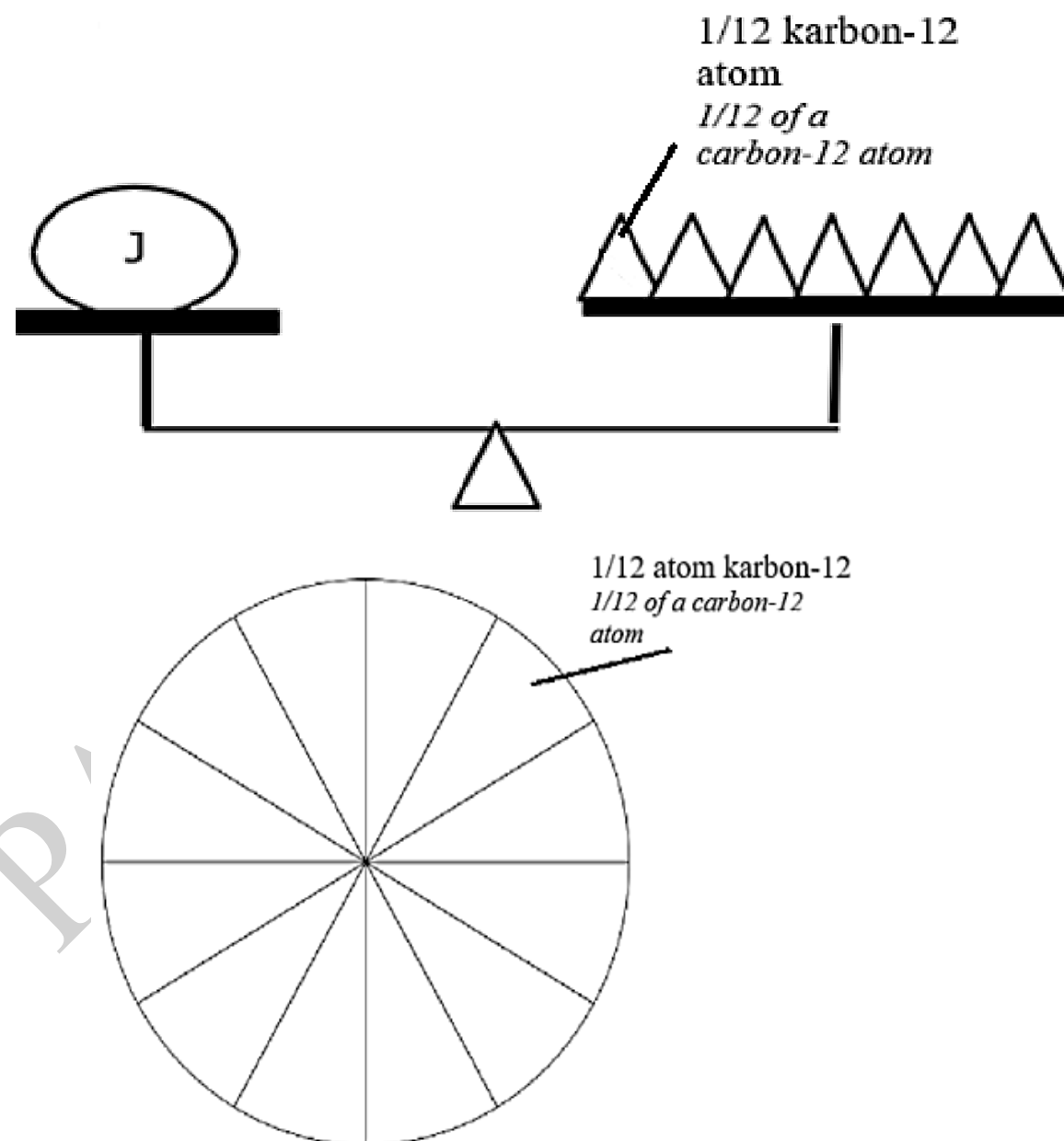
3. Atom sangat kecil dan adalah mustahil untuk menimbang jisim atom menggunakan sebarang neraca elektronik. Oleh itu, ahli kimia menggunakan konsep ‘jisim atom relatif’ untuk menganggar jisim satu atom.

Rajah 3 menunjukkan perbandingan jisim atom J dengan  $\frac{1}{12}$  atom karbon – 12.

*An atom is very small, and it is impossible to weigh its mass using an electronic balance.*

*Thus, chemists use the concept of ‘relative atomic mass’ to estimate its mass.*

*Diagram 3 compares atom J with  $\frac{1}{12}$  of a carbon-12 atom.*



- (a) Mengapakah karbon-12 dipilih sebagai piawai dalam menganggar jisim satu atom?

*Why is carbon-12 chosen as a standard to estimate the mass of an atom?*

[1 markah / 1 mark]

- (b) Berdasarkan Rajah 3, nyatakan jisim atom relatif bagi atom J.

*Based on Diagram 3, state the relative atomic mass of atom J.*

[1 markah / 1 mark]

- (c) Dalam satu eksperimen, J dibakar dalam gas oksigen berlebihan menghasilkan J oksida,  $J_2O$ .

*In an experiment, J is burned in excess oxygen gas to produce J oxide,  $J_2O$ .*

- (i) Tulis satu persamaan kimia bagi tindak balas ini.

*Write a chemical equation for the reaction.*

[2 markah / 2 marks]

- (ii) Dengan menggunakan jisim atom relatif atom J daripada jawapan anda dalam 3 (b), hitung jisim J yang diperlukan untuk bertindak balas lengkap dengan 0.2 mol gas oksigen.

*By using the relative atomic mass of atom J from your answer in 3 (b), calculate the mass of J needed to react completely with 0.2 mol of oxygen gas.*

[2 markah / 2 marks]

4. Jadual 4 menunjukkan maklumat komposisi bagi kaca J dan K yang digunakan secara luas dalam kehidupan seharian.  
*Table 4 shows the information on the composition of glasses J and K that are widely used in daily life.*

| Jenis kaca<br><i>Type of glass</i> | Komposisi<br><i>Composition</i>                                                                                                                                      |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| J                                  | Bahan X, natrium karbonat, kalsium karbonat<br><i>Substance X, sodium carbonate, calcium carbonate</i>                                                               |
| K                                  | Bahan X, natrium karbonat, kalsium karbonat, boron oksida, aluminium oksida<br><i>Substance X, sodium carbonate, calcium carbonate, boron oxide, aluminium oxide</i> |

Jadual 4 / *Table 4*

- (a) Berdasarkan Jadual 4,  
*Based on Table 4,*

- (i) nyatakan bahan X.  
*state substance X.*

[1 markah / 1 mark]

- (ii) nyatakan jenis kaca J dan K.  
*state the type of glass J and K.*

J:

K:

[2 markah / 2 marks]

- (b) Rajah 4 menunjukkan bekas yang boleh digunakan oleh Puan Rahmah untuk menyimpan jeruk mangga.  
*Diagram 4 shows the containers that can be used by Puan Rahmah to share the pickled mango.*



Balang kaca  
*Glass jar*



Bekas logam  
*Metal container*

Rajah 4 / *Diagram 4*

Pilih satu bekas yang sesuai untuk menyimpan jeruk mangga supaya tahan lebih lama. Wajarkan jawapan anda.  
*Choose one suitable container to store the pickled mango so that it will last longer. Justify your answer.*

[2 markah / 2 marks]

- (c) Dalam penghasilan gentian kaca, kaca dipanaskan sehingga cair dan dilalukan kepada lubang-lubang yang halus. Cadangkan bagaimana sifat gentian kaca dapat diperkukuhkan untuk membuat gentian optik.

Nyatakan satu sifat gentian optik.

*In the production of glass fibre, the glass is heated until it melts and is passed through fine holes. Suggest how the properties of glass fibre can be strengthened to form optical fibre.*

*State one property of optical fibre.*

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[2 markah / 2 marks]

5. Rajah 5 menunjukkan satu pingat yang diperbuat daripada gangsa.  
*Diagram 5 shows a medal made from bronze.*



Rajah 5 / Diagram 5

- (a) Apakah maksud aloi?  
*What is the meaning of alloy?*

---

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[1 markah / 1 mark]

- (b) Nyatakan logam utama yang ada dalam gangsa.  
*State the main metal present in bronze.*

---

[1 markah / 1 mark]

- (c) Bandingkan kekerasan logam utama yang dinyatakan di 5(b) dan gangsa.  
Terangkan jawapan anda.  
*Compare the hardness of the main metal stated in 5(b) and bronze. Explain your answer.*

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[3 markah / 3 marks]

- (d) Rajah 5.1 menunjukkan satu lampu hiasan yang digantung pada siling.  
*Diagram 5.1 shows a chandelier.*



Rajah 5.1 / Diagram 5.1

- (i) Namakan jenis kaca yang sesuai digunakan untuk menghasilkan lampu hiasan ini.  
*Name the suitable type of glass to make the chandelier.*

---

[1 markah / 1 mark]

- (ii) Nyatakan **dua** sifat jenis kaca yang dinyatakan di 5(d)(i).  
*State **two** properties of the type of glass mentioned in 5(d)(i).*

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[2 markah / 2 marks]

6. Jadual 6 menunjukkan dua eksperimen yang dijalankan untuk mengkaji faktor yang mempengaruhi kadar tindak balas.  
*Table 6 shows two experiments carried out to study the factor that affects the rate of reaction.*

| Eksperimen<br><i>Experiment</i> | Susunan radas<br><i>Set-up of apparatus</i>                                                                                                                                                             | Masa yang diambil untuk mengumpul 60cm <sup>3</sup> gas (s)<br><i>Time taken to collect 60cm<sup>3</sup> of gas</i> |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| I                               | <p>Ketulan zink berlebihan<br/><i>Excess zinc granules</i></p> <p>50 cm<sup>3</sup> asid hidroklorik<br/>1.0 mol dm<sup>-3</sup><br/>50 cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup> hydrochloric acid</p> | 120                                                                                                                 |
| II                              | <p>Serbuk zink berlebihan<br/><i>Excess zinc powder</i></p> <p>50 cm<sup>3</sup> asid hidroklorik<br/>1.0 mol dm<sup>-3</sup><br/>50 cm<sup>3</sup> of 1.0 mol dm<sup>-3</sup> hydrochloric acid</p>    | 80                                                                                                                  |

Jadual 6 / Table 6

- (a) Nyatakan satu faktor yang dapat mempengaruhi kadar tindak balas.  
*State one factor that can affect the rate of reaction.*
- (b) Nyatakan satu sebab mengapa isipadu akhir gas yang diperolehi dalam eksperimen I dan II adalah sama.  
*State one reason why the final volume of gas obtained in experiments I and II are the same.*

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[1 markah / 1 mark]

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[1 markah / 1 mark]

- (c) Hitung kadar tindak balas purata bagi:  
*Calculate the average rate of reaction for:*

(i) Eksperimen I  
*Experiment I*

(ii) Eksperimen II  
*Experiment II*

- (d) Tuliskan persamaan kimia bagi eksperimen itu.  
*Write a chemical equation for the experiment.*

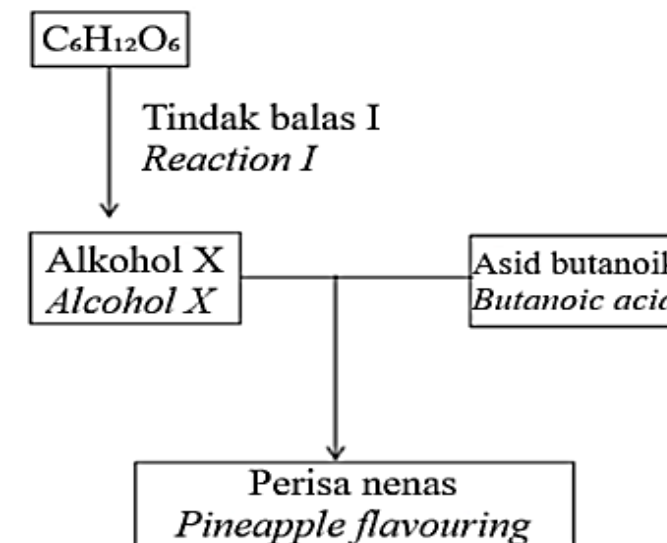
[2 markah / 2 marks]

- (e) Bandingkan kadar tindak balas bagi Eksperimen I dan Eksperimen II. Terangkan jawapan anda.  
*Compare the rate of reaction between Experiment I and Experiment II. Explain your answer.*

[3 markah / 3 marks]

7. Rajah 7 menunjukkan carta alir bagi pembentukan perisa nanas dengan alkohol X dan asid butanoik.

*Diagram 7 shows the flow chart for the formation of pineapple flavour using alcohol X and butanoic acid.*



Rajah 7 / Diagram 7

- (a) Nyatakan nama tindak balas I.  
*State the name of reaction I.*

[1 markah / 1 mark]

- (b) Apakah kumpulan berfungsi bagi alkohol X?  
*What is the functional group of alcohol X?*

[1 markah / 1 mark]

- (c) Alkohol X dibakar dengan oksigen berlebihan untuk menghasilkan gas Y dan air. Tuliskan persamaan kimia seimbang bagi tindak balas tersebut.  
*Alcohol X is burned in excess oxygen gas to produce Y gas and water. Write a balanced chemical equation for the reaction.*

[1 markah / 1 mark]

(d) Jika 2.3 g alkohol X digunakan, hitung isipadu gas Y yang terhasil.

[1 mol gas menempati 24 dm<sup>3</sup> pada keadaan bilik]

*If 2.3 g of alcohol X is used, calculate the volume of Y gas produced.*

*[1 mol gas occupies 24 dm<sup>3</sup> at room temperature]*

[3 markah / 3 marks]

(e) Perisa nanas boleh dihasilkan melalui tindak balas antara alkohol X dengan asid butanoik.

*Pineapple flavour can be produced through the reaction between alcohol X and butanoic acid.*

(i) Namakan ester tersebut.

*Name the ester.*

[1 markah / 1 mark]

(ii) Cadangkan produk dalam industri makanan yang menggunakan ester di (e) (i).

*Suggest a product in the food industry that uses the ester in (e) (i).*

[1 markah / 1 mark]

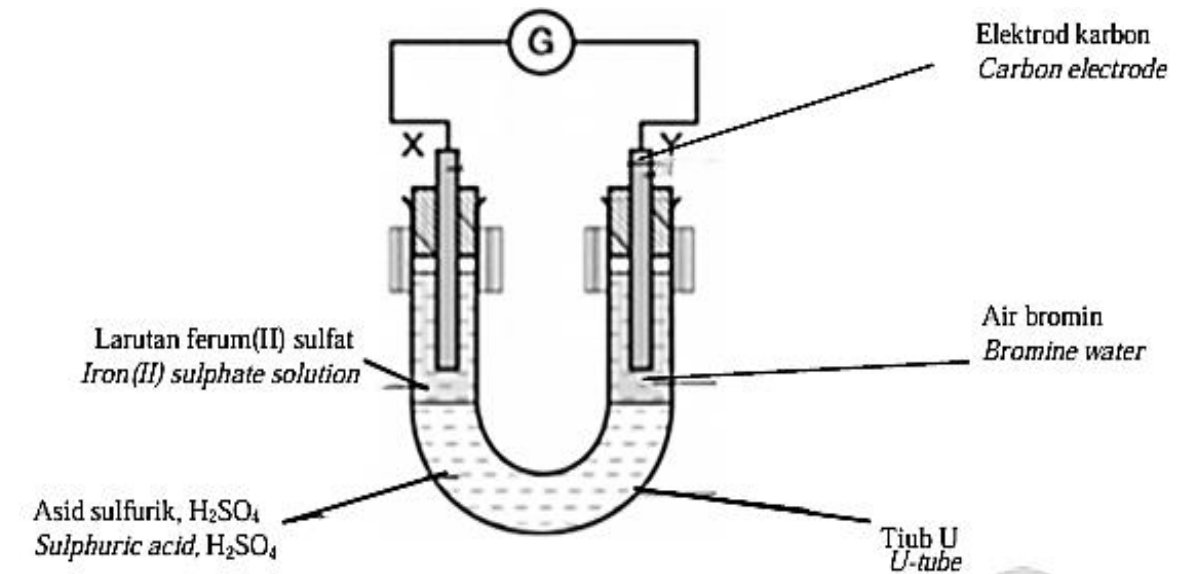
(iii) Wajarkan penggunaan ester dalam industri makanan.

*Justify the use of ester in the food industry.*

[1 markah / 1 mark]

8. Rajah 8 menunjukkan susunan radas untuk mengkaji pemindahan elektron pada suatu jarak dalam tindak balas redoks.

*Diagram 8 shows the apparatus set-up to investigate electron transfer at a distance in redox reactions.*



Rajah 8 / Diagram 8

(a) Berdasarkan Rajah 8,  
*Based on Diagram 8,*

(i) Apakah fungsi asid sulfurik, H<sub>2</sub>SO<sub>4</sub>?  
*What is the function of sulphuric acid, H<sub>2</sub>SO<sub>4</sub>?*

[1 markah / 1 mark]

(ii) Tuliskan persamaan setengah untuk elektrod X dan Y.  
*Write the half equations for electrode X and Y.*

Elektrod X / *Electrode X*: \_\_\_\_\_

Elektrod Y / *Electrode Y*: \_\_\_\_\_

[2 markah / 2 marks]

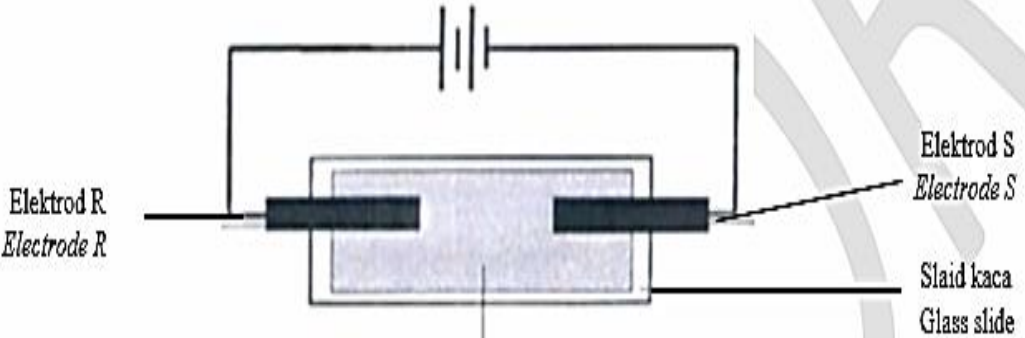
- (iii) Nyatakan perubahan nombor pengoksidaan bagi air bromin.  
*State the change in oxidation number for bromine water.*

[1 markah / 1 mark]

- (b) Lukis satu susunan radas berlabel yang dapat digunakan bagi eksperimen untuk mengkaji pemindahan elektron pada suatu jarak dengan menggunakan semua bahan dan radas dalam Rajah 8, kecuali tiub-U dan kaki retort. Larutan kalium iodida dan larutan kalium manganat (VII) berasid juga dibekalkan bagi menggantikan larutan ferum (II) sulfat dan air bromin. Beberapa radas lain yang sesuai boleh digunakan bagi mengubahsuai eksperimen ini. Tunjukkan arah pengaliran elektron dalam rajah yang dilukis.  
*Draw a labelled set-up of apparatus that could be used for an experiment to investigate the transfer of electrons at a distance using all the materials and apparatus in Diagram 8, except the U-tube and retort stand. Potassium iodide solution and acidified potassium manganate (VII) solution are given to replace iron (II) sulphate solution and bromine water. Any other suitable apparatus can be used to modify the experiment. Show the direction of electron flow in the drawn diagram.*

[3 markah / 3 marks]

- (c) Sehelai kertas litmus biru dicelupkan ke dalam larutan natrium klorida pekat, NaCl, dan diletakkan di atas sekeping slaid kaca. Dua elektrod karbon, R dan S, diletakkan di atas kertas litmus itu. Elektrod itu disambungkan kepada bateri seperti yang ditunjukkan dalam Rajah 8.1.  
*A piece of blue litmus paper is dipped into a concentrated sodium chloride solution, NaCl, and placed on a piece of glass slide. Two carbon electrodes, R and S, are placed on the litmus paper. The electrodes are connected to the battery as shown in Diagram 8.1.*



Rajah 8.1 / Diagram 8.1

Jadual 8 menunjukkan pemerhatian pada kertas litmus biru selepas 15 minit.  
*Table 8 shows the observation on the blue litmus paper after 15 minutes.*

| Elektrod<br><i>Electrode</i> | Pemerhatian pada kertas litmus biru selepas 15 minit<br><i>Observation on blue litmus paper after 15 minutes</i>       |
|------------------------------|------------------------------------------------------------------------------------------------------------------------|
| R                            | Kertas litmus biru bertukar merah dan kemudian dilunturkan<br><i>The blue litmus paper turns red and then bleaches</i> |
| S                            | Warna kertas litmus biru tidak berubah<br><i>The colour of blue litmus paper remains unchanged</i>                     |

| Nilai E° / <i>E° value</i>                                              |              |
|-------------------------------------------------------------------------|--------------|
| Na <sup>+</sup> + e <sup>-</sup> ⇌ Na                                   | E° = -2.71 V |
| 2H <sup>+</sup> + 2e <sup>-</sup> ⇌ H <sub>2</sub>                      | E° = 0.00 V  |
| O <sub>2</sub> + 2H <sub>2</sub> O + 4e <sup>-</sup> ⇌ 4OH <sup>-</sup> | E° = +0.40 V |
| Cl <sub>2</sub> + 2e <sup>-</sup> ⇌ 2Cl <sup>-</sup>                    | E° = +1.36 V |