



**2023**  
**KIMIA**  
**PRAKTIS TOPIKAL**  
**KERTAS 1 & KERTAS 2**  
**TINGKATAN 5**

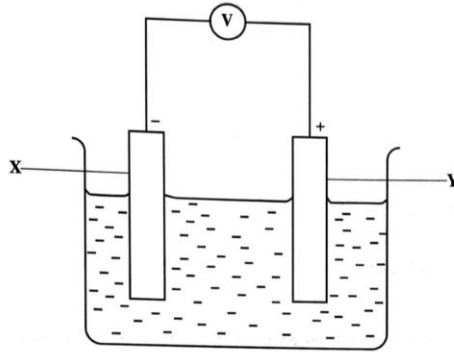
**Unit Kimia**

**Bahagian Pendidikan Menengah MARA**

**BAB 1 : KESEIMBANGAN REDOKS**

1 (Q18, SPM 2021)

Rajah 13 menunjukkan suatu sel kimia.  
*Diagram 13 shows a chemical cell.*



Rajah / Diagram 13

Antara yang berikut, proses manakah yang betul berlaku di **X** dan **Y**?  
*Which of the following is the correct process that occurs at **X** and **Y**?*

	<b>X</b>	<b>Y</b>
<b>A</b>	Kehilangan oksigen <i>Loss of oxygen</i>	Menerima oksigen <i>Gain of oxygen</i>
<b>B</b>	Pertambahan nombor pengoksidaan <i>Increase in oxidation number</i>	Pengurangan nombor pengoksidaan <i>Decrease in oxidation number</i>
<b>C</b>	Menerima elektron <i>Gains of electrons</i>	Kehilangan elektron <i>Loss of electrons</i>
<b>D</b>	Menerima hidrogen <i>Gains of hydrogen</i>	Kehilangan hidrogen <i>Loss of hydrogen</i>

2 (Q19, SPM 2021)

Logam M bertindak balas dengan asid hidroklorik untuk menghasilkan garam dan gas hidrogen.

Apakah tindak balas yang berlaku pada logam M?

*Metal M reacts with hydrochloric acid to produce salt and hydrogen gas.*

*What is the reaction that occurs on metal M?*

- A** Penurunan  
*Reduction*
- B** Pengoksidaan  
*Oxidation*
- C** Pemendakan  
*Precipitation*
- D** Peneutralan  
*Neutralisation*

3 (Q20, SPM 2021)

Campuran metana dan klorin bertindak balas apabila terdedah kepada cahaya matahari. Persamaan berikut mewakili tindak balas tersebut.

*A mixture of methane and chlorine reacts when it is exposed to sunlight. The following equation represents the reaction.*



Bahan manakah yang diturunkan dalam tindak balas itu?

*Which substance is reduced in the reaction?*

- A CH<sub>4</sub>
- B Cl<sub>2</sub>
- C CH<sub>3</sub>Cl
- D HCl

4 (Q13, SPM 2022)

Persamaan berikut mewakili satu tindak balas redoks.

*The following equation represents a redox reaction.*



Antara yang berikut, pasangan bahan tindak balas manakah yang sepadan dengan tindak balasnya?

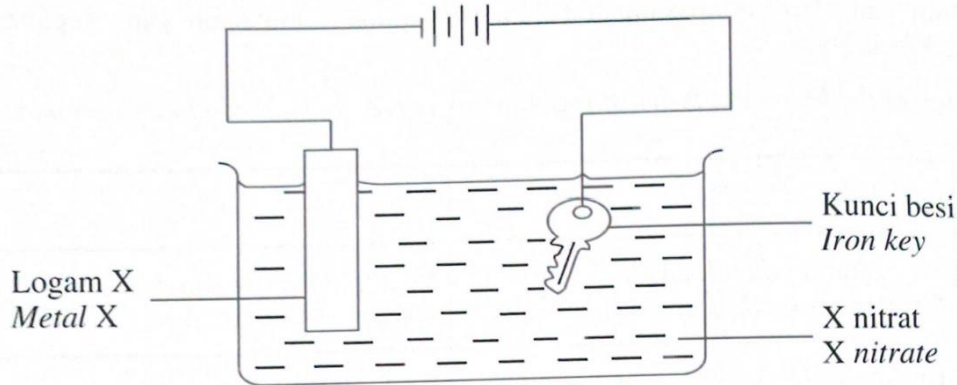
*Which of the following pairs of reactants are correctly matched to its reaction?*

- |          | <b>NH<sub>3</sub></b>  | <b>CuO</b>   |
|----------|--|--|
| <b>A</b> | Mengalami pengoksidaan<br><i>Undergoes oxidation</i>                     | Mengalami penurunan<br><i>Undergoes reduction</i>                        |
| <b>B</b> | Bertindak sebagai agen pengoksidaan<br><i>Acts as an oxidizing agent</i> | Bertindak sebagai agen penurunan<br><i>Acts as a reducing agent</i>      |
| <b>C</b> | Mengalami penurunan<br><i>Undergoes reduction</i>                        | Bertindak sebagai agen pengoksidaan<br><i>Acts as an oxidizing agent</i> |
| <b>D</b> | Bertindak sebagai agen penurunan<br><i>Acts as a reducing agent</i>      | Mengalami pengoksidaan<br><i>Undergoes oxidation</i>                     |

5 (Q14, SPM 2022)

Rajah 6 menunjukkan susunan radas bagi satu eksperimen yang dijalankan oleh sekumpulan murid untuk mengkaji satu proses secara elektrolisis.

*Diagram 6 shows an apparatus set-up of an experiment that is carried out by a group of students to study a process through electrolysis.*



Rajah / Diagram 6

Selepas 10 minit, didapati tiada perubahan yang berlaku.

Apakah langkah yang perlu diambil untuk mengatasi masalah itu?

*After 10 minutes, it is found that there are no changes.*

*Which of the following steps should be taken to overcome the problem?*

Diberi sebahagian daripada Siri Keupayaan Elektrod Piawai:

*Given that a part of Standard Electrode Potential Series:*

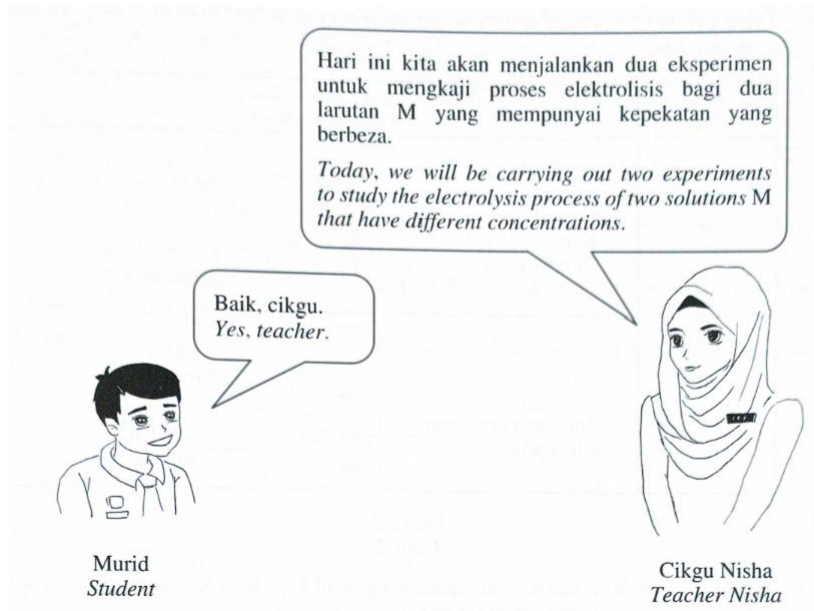
Persamaan sel setengah <i>Half-cell equation</i>	$E^0 / V$ (298 K)
$Fe^{2+} + 2e^- \rightleftharpoons Fe$	- 0.44
$2H^+ + 2e^- \rightleftharpoons H_2$	- 0.00
$X^{2+} + 2e^- \rightleftharpoons X$	+ 0.34
$O_2 + 2H_2O + 4e^- \rightleftharpoons 4OH^-$	+ 0.40

- A** Menambahkan air ke dalam X nitrat  
*Add water into X nitrate*
- B** Menggosok kunci besi dengan kertas pasir  
*Rub the iron key with sandpaper*
- C** Menukarkan kunci besi sebagai katod manakala logam X sebagai anod  
*Change iron key as cathode while metal X as anode*
- D** Menggantikan logam X dengan logam yang mempunyai nilai  $E^0$  yang lebih negatif  
*Replace metal X with a metal that has a more negative  $E^0$  value*

6 (Q15, SPM 2022)

Rajah 7 menunjukkan perbualan antara guru dan muridnya.

*Diagram 7 shows a conversation between a teacher and her student.*



Rajah / Diagram 7

Apakah larutan M jika hasil tindak balas yang berbeza terbentuk di anod apabila eksperimen itu dijalankan?

*What is solution M if different products are formed at the anode when the experiment is carried out?*

- A** Asid sulfurik  
*Sulphuric acid*
- B** Asid hidroklorik  
*Hydrochloric acid*
- C** Asid karbonik  
*Carbonic acid*
- D** Asid nitrik  
*Nitric acid*

7 (Q16, SPM 2022)

Jadual 2 menunjukkan dua set susunan radas bagi suatu eksperimen untuk menyadur dua jenis bahan.

Table 2 shows two sets of apparatus set-up for an experiment to electroplate two types of substances.

Set Set	Susunan radas Apparatus set-up
P	
Q	

Jadual / Table 2

Antara yang berikut, padanan manakah yang betul bagi jenis larutan yang digunakan dan pemerhatian di katod dalam setiap set?

Which of the following is the correct match of the type of solution used and the observation at cathode in each set?

	Larutan Solution		Pemerhatian Observation	
	X	Y	P	Q
<b>A</b>	Argentum nitrat <i>Silver nitrate</i>	Kumprum(II) sulfat <i>Copper(II) sulphate</i>	Pepejal kelabu terenal <i>Grey solid is deposited</i>	Pepejal perang terenal <i>Brown solid is deposited</i>
<b>B</b>	Kumprum(II) sulfat <i>Copper(II) sulphate</i>	Argentum nitrat <i>Silver nitrate</i>	Pepejal perang terenal <i>Brown solid is deposited</i>	Pepejal kelabu terenal <i>Grey solid is deposited</i>
<b>C</b>	Kumprum(II) sulfat <i>Copper(II) sulphate</i>	Ferum(II) nitrat <i>Iron(II) nitrate</i>	Pepejal kelabu terenal <i>Grey solid is deposited</i>	Pepejal perang terenal <i>Brown solid is deposited</i>
<b>D</b>	Ferum(II) nitrat <i>Iron(II) nitrate</i>	Argentum nitrat <i>Silver nitrate</i>	Pepejal perang terenal <i>Brown solid is deposited</i>	Pepejal kelabu terenal <i>Grey solid is deposited</i>

8 (Q9, SPMRSM 2021)

Apakah keupayaan elektrod piawai?  
*What is a standard electrode potential?*

- A** Beza keupayaan yang terhasil apabila wujud keseimbangan antara logam dan larutan akueus ionnya dalam sel setengah  
*The potential difference produced when an equilibrium is established between metal and its ions aqueous solution in a half-cell*
- B** Beza keupayaan yang terhasil apabila wujud keseimbangan antara dua larutan akueus dalam sel setengah  
*The potential difference produced when an equilibrium is established between two aqueous solutions in a half-cell*
- C** Beza keupayaan di mana pengoksidaan berlaku di elektrod  
*The potential difference as oxidation occurs at the electrode*
- D** Beza keupayaan di mana penurunan berlaku di elektrod  
*The potential difference as reduction occurs at the electrode*

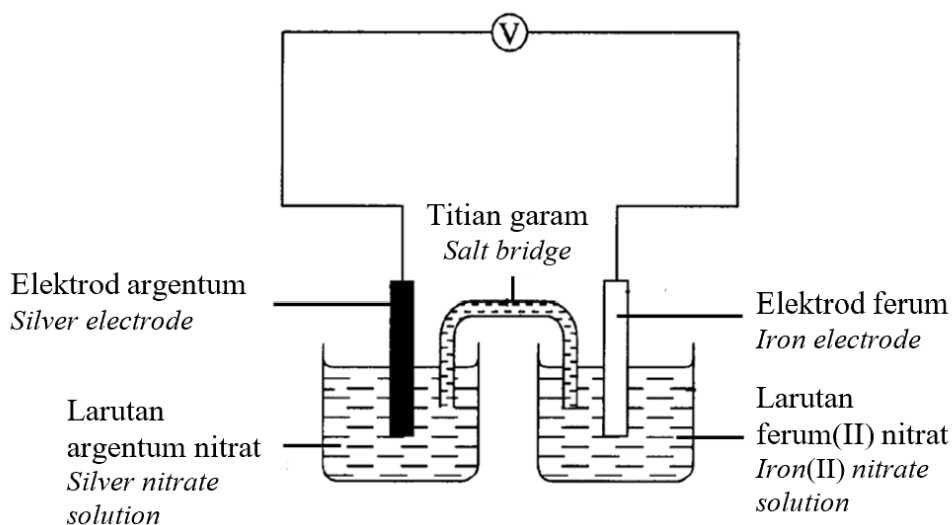
9 (Q10, SPMRSM 2021)

Dalam tindak balas redoks, pengoksidaan dan penurunan berlaku secara serentak. Antara berikut yang manakah melibatkan penurunan?  
*In a redox reaction, oxidation and reduction occur simultaneously. Which of the following involves a reduction?*

- A** Atom aluminium menerima oksigen  
*Aluminium atom gains oxygen*
- B** Atom barium kehilangan elektron  
*Barium atom loses electron*
- C** Hidrogen sulfida kehilangan hidrogen  
*Hydrogen sulphide loses hydrogen*
- D** Atom klorin menerima elektron  
*Chlorine atom gains electron*

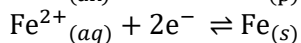
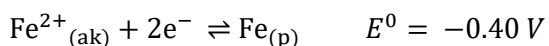
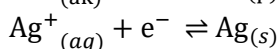
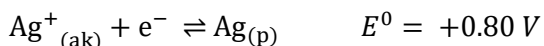
10 (Q26, SPMRSM 2021)

Rajah 7 menunjukkan susunan radas bagi satu sel kimia.  
Diagram 7 shows the apparatus set-up for a voltaic cell.

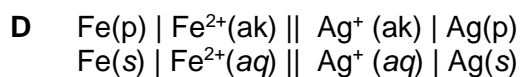
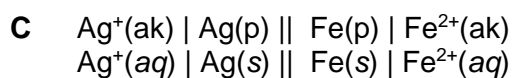
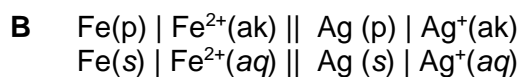
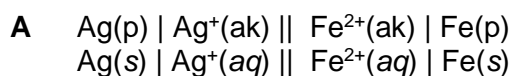


Rajah / Diagram 7

Diberi nilai keupayaan elektrod berikut.  
Given the following electrode potential values.



Apakah notasi sel untuk sel kimia tersebut?  
What is the cell notation of the voltaic cell?

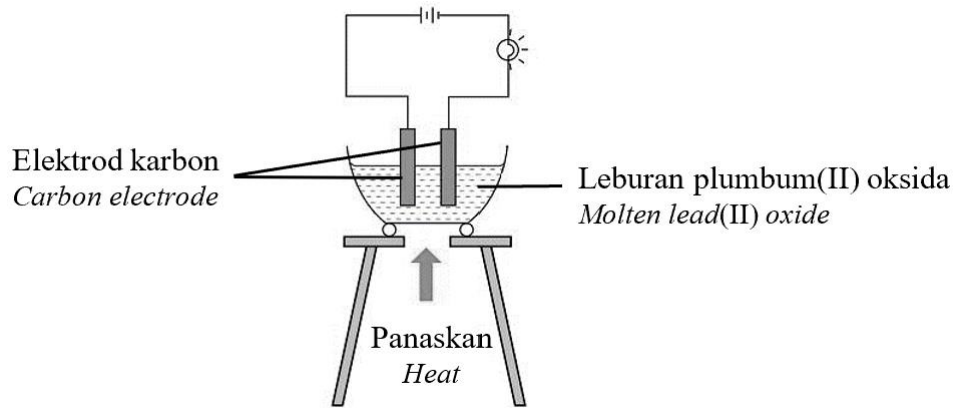




11 (Q35, SPMRSM 2021)

Rajah 13 menunjukkan susunan radas bagi elektrolisis leburan plumbum (II) oksida, PbO.

Diagram 13 shows the apparatus set-up for electrolysis of molten lead (II) oxide, PbO.



Rajah / Diagram 13

Antara setengah persamaan berikut, yang manakah berlaku di anod dan katod?

Which of the following half equations take place at anode and cathode?

	<b>Anod Anode</b>	<b>Katod Cathode</b>
<b>A</b>	$\text{Pb}^{2+} + 2\text{e}^{-} \rightarrow \text{Pb}$	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^{-}$
<b>B</b>	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^{-}$	$2\text{H}^{+} + 2\text{e}^{-} \rightarrow \text{H}_2$
<b>C</b>	$\text{Pb}^{2+} + 2\text{e}^{-} \rightarrow \text{Pb}$	$2\text{H}^{+} + 2\text{e}^{-} \rightarrow \text{H}_2$
<b>D</b>	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^{-}$	$\text{Pb}^{2+} + 2\text{e}^{-} \rightarrow \text{Pb}$

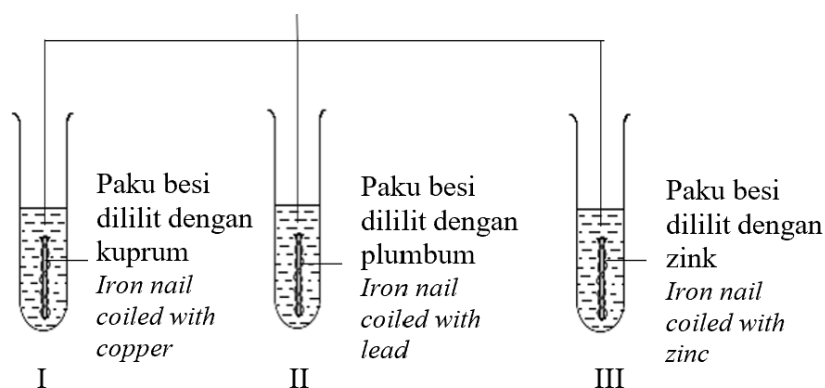
12 (Q36, SPMRSM 2021)

Rajah 14 menunjukkan susunan radas untuk mengkaji kesan logam lain terhadap pengurangan besi.

*Diagram 14 shows the apparatus set-up to study the effect of other metals on the rusting of iron.*

Larutan agar-agar panas + fenolftalein + larutan heksasianoferat(III)

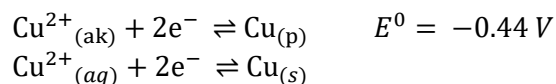
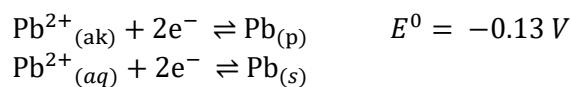
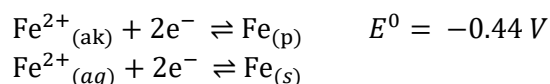
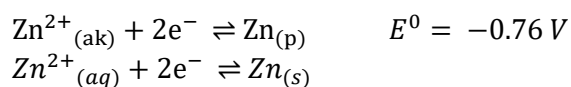
*Hot agar solution + phenolphthalein + potassium hexacyanoferrate(III) solution*



Rajah / Diagram 14

Diberi nilai keupayaan elektrod berikut.

*Given the following electrode potential value.*



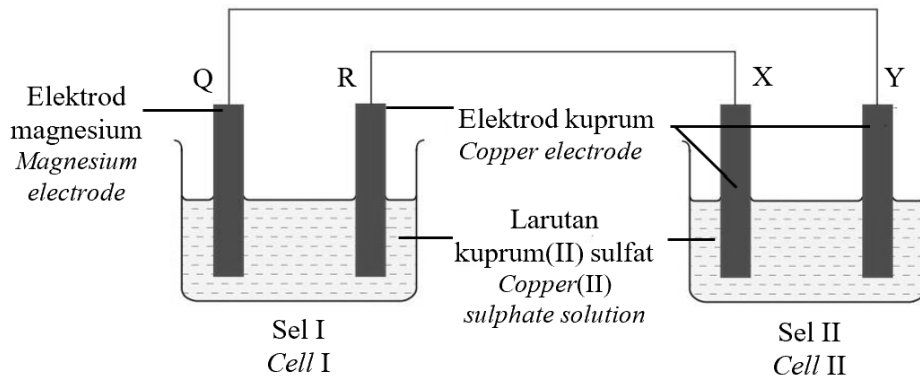
Dalam tabung uji manakah tompok biru dapat diperhatikan?

*In which test tubes the blue spots can be observed?*

- A** I dan II  
I and II
- B** I dan III  
I and III
- C** II dan III  
II and III

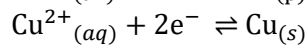
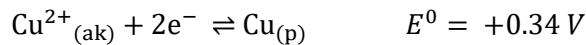
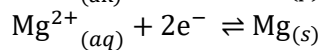
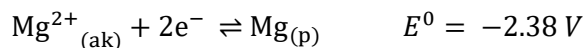
13 (Q40, SPMRSM 2021)

Rajah 18 menunjukkan susunan radas bagi gabungan dua sel.  
*Diagram 18 shows the apparatus set-up for a combination of two cells.*



Rajah / Diagram 18

Diberi nilai keupayaan elektrok berikut.  
*Given the following electrode potential value.*



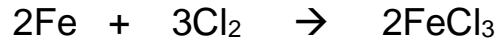
Antara berikut, pernyataan manakah yang betul?  
*Which of the following statements are true?*

- I Gelembung gas tidak berwarna dihasilkan di elektrod X  
*Bubbles of colourless gas is produce at electrode X*
- II Elektrod R dan elektrod Y menipis  
*Electrode R and electrode Y become thinner*
- III Elektrod X dan elektrod Q ialah anod  
*Electrode X and electrode Q are anode*
- IV Warna biru larutan kuprum(II) sulfat di dalam Sel II tidak berubah  
*Blue colour of copper(II) sulphate solution in Cell II remains unchanged.*

- A I dan II  
*I and II*
- B I dan III  
*I and III*
- C II dan IV  
*II and IV*
- D III dan IV  
*III and IV*

14 (Q8, SPMRSM 2022)

Persamaan di bawah mewakili tindak balas antara ferum dan gas klorin.  
*The following equation represents the reaction between iron and chlorine gas.*



Apakah perubahan nombor pengoksidaan bagi klorin?  
*What is the change in oxidation number of chlorine?*

- A +2 → +3
- B -2 → -3
- C -1 → 0
- D 0 → -1

15 (Q10, SPMRSM 2022)

Rajah 4 menunjukkan relau bagas yang digunakan untuk megekstrak ferum dari bijihnya.  
*Diagram 4 shows the blast furnace used to extract iron from its ore.*



Rajah 4  
Diagram 4

Manakah antara persamaan kimia berikut mewakili tindak balas di Zon 2?  
*Which of the following chemical equation represents the reaction in Zone 2?*

- A  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$
- B  $\text{C} + \text{CO}_2 \rightarrow 2\text{CO}$
- C  $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
- D  $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$

16 (Q35, SPMRSM 2022)

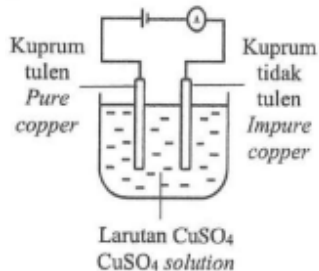
Kuprum yang diekstrak dari kuprum pirit mempunyai darjah ketulenan yang rendah dan perlu ditulenan melalui elektrolisis.

Manakah antara berikut merupakan susunan alat radas yang bolrh digunakan untuk menulenan kuprum tersebut?

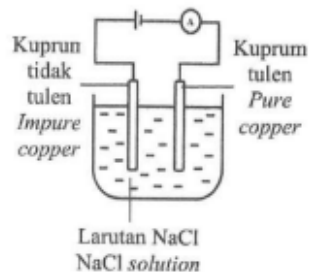
*The extracted copper from copper pyrite has low degree of purity and needs to purified through electrolysis.*

*Which of the following apparatus set-up can be used to purify the copper?*

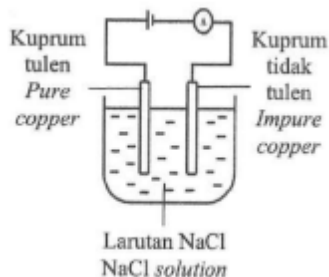
A



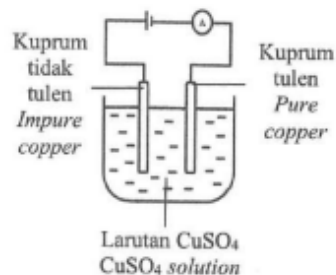
B



B



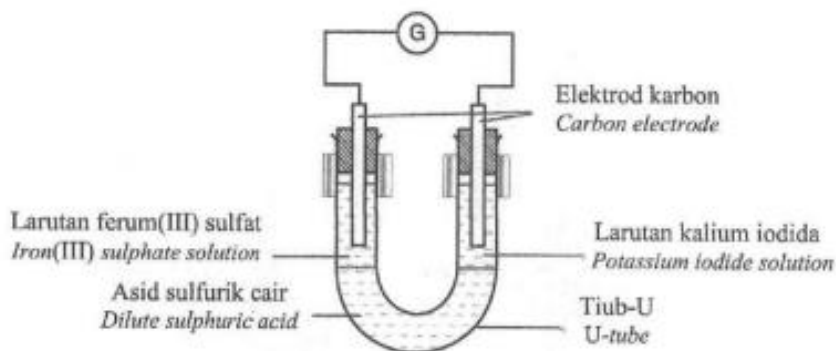
D



17 (Q39, SPMRSM 2022)

Rajah 23 menunjukkan susunan radas untuk mengkaji tindak balas antara larutan ferum(III) sulfat dengan larutan kalium iodida.

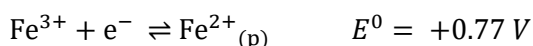
Diagram 23 shows the apparatus set-up to investigate the reaction between iron(III) sulphate solution with potassium iodide solution.



Rajah / Diagram 23

Diberi nilai keupayaan elektrod piawai berikut.

Given the following standard electrode potential value.



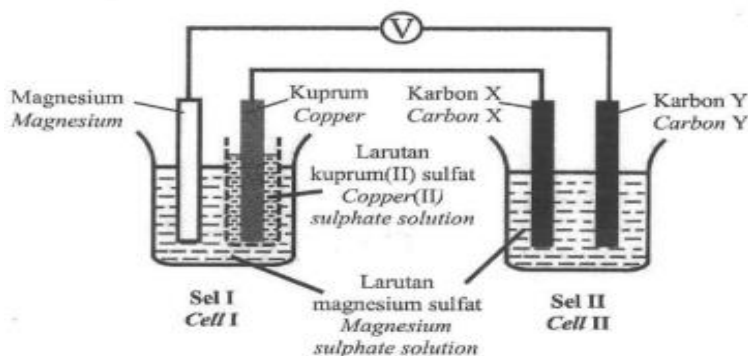
Antara yang berikut, yang manakah perubahan warna bagi kedua-dia larutan itu?

Which of the following is the color change of the two solutions?

	<b>Larutan ferum(III) sulfat</b> <b>Iron(III) sulphate solution</b>	<b>Larutan kalium iodide</b> <b>Potassium iodide solution</b>
<b>A</b>	Perang kepada hijau <i>Brown to green</i>	Tak berwarna kepada perang <i>Colourless to brown</i>
<b>B</b>	Hijau kepada perang <i>Green to brown</i>	Ungu kepada tak berwarna <i>Purple to colourless</i>
<b>C</b>	Perang kepada hijau <i>Brown to green</i>	Jingga kepada hijau <i>Orange to green</i>
<b>D</b>	Hijau kepada perang <i>Green to brown</i>	Jingga kepada hijau <i>Orange to green</i>

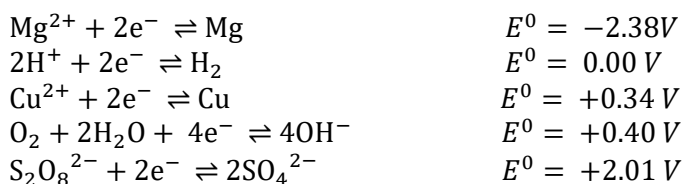
18 (Q40, SPM 2022)

Rajah 24 menunjukkan dua jenis sel.  
Diagram 24 shows two types of cells.



Rajah / Diagram 24

Diberi nilai keupayaan elektrod piawai berikut.  
Given the following standard electrode potential value.



Antara berikut, yang manakah benar?  
Which of the following is correct?

	Mg	Cu	Karbon X Carbon X	Karbon Y Carbon Y
<b>A</b>	Elektrod magnesium menebal <i>Magnesium electrode becomes thicker</i>	Elektrod kuprum menipis <i>Copper electrode becomes thinner</i>	Tiada perubahan <i>No change</i>	Gelembung gas tidak berwarna terhasil <i>Bubbles of colorless gas is produced</i>
<b>B</b>	Elektrod magnesium menipis <i>Magnesium electrode becomes thinner</i>	Elektrod kuprum menebal <i>Copper electrode becomes thicker</i>	Gelembung gas tidak berwarna terhasil <i>Bubbles of colorless gas is produced</i>	Tiada perubahan <i>No change</i>

<b>C</b>	Ion magnesium menerima elektron <i>Magnesium ion receives electron</i>	Atom kuprum menyingkirkan elektron <i>Copper atom releases electron</i>	Ion hidrogen mengalami penurunan <i>Hydrogen ion undergoes reduction</i>	Ion hidroksida mengalami pengoksidaan <i>Hydroxide ion undergoes oxidation.</i>
<b>D</b>	Atom magnesium menyingkirkan elektron <i>Magnesium atom releases electron</i>	Ion kuprum(II) menerima elektron <i>Copper(II) ion receives electron</i>	Ion hidroksida mengalami pengoksidaan <i>Hydroxide ion undergoes oxidation.</i>	Ion hidrogen mengalami penurunan <i>Hydrogen ion undergoes reduction</i>

**19** (Q9, SBP 2021)

Antara logam berikut, yang manakah diekstrak dari bijihnya melalui tindak balas penurunan oleh karbon?

*Which of the following metals is extracted from its ore through reduction reaction by carbon?*

- A** Merkuri  
*Mercury*
- B** Natrium  
*Sodium*
- C** Plumbum  
*Lead*
- D** Argentum  
*Silver*

**20** (Q29, SBP 2021)

Apakah nombor pengoksidaan X dalam ion  $X_2O_8^{2-}$ ?

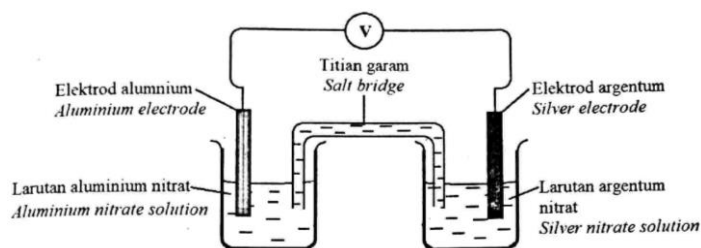
*What is the oxidation number of X in  $X_2O_8^{2-}$  ion?*

- A** -2
- B** +2
- C** +4
- D** +7



21 (Q36, SBP 2021)

Rajah 36 menunjukkan susunan radas bagi satu sel kimia.  
Diagram 36 shows an apparatus set-up of a voltaic cell.



Rajah / Diagram 36

Jadual 36 menunjukkan nilai keupayaan elektrod piawai,  $E^0$  bagi beberapa sel setengah.

Table 36 shows the standard electrode potential values,  $E^0$  for some half-cells.

Sel setengah Half-cell	Nilai $E^0$ (V) $E^0$ value (V)
$\text{Al}^{3+} + 3\text{e}^- \rightleftharpoons \text{Al}$	-1.66
$\text{Ag}^+ + \text{e}^- \rightleftharpoons \text{Ag}$	+0.80

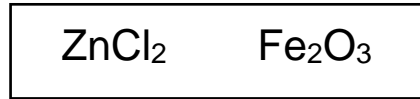
Apakah notasi sel bagi sel tersebut?

What is the cell notation for the cell?

- A**  $\text{Al}^{3+} (\text{ak}, 1.0 \text{ mol dm}^{-3}) | \text{Al}(\text{p}) || \text{Ag}(\text{p}) | \text{Ag}^+ (\text{ak}, 1.0 \text{ mol dm}^{-3})$   
 $\text{Al}^{3+} (\text{aq}, 1.0 \text{ mol dm}^{-3}) | \text{Al}(\text{s}) || \text{Ag}(\text{s}) | \text{Ag}^+ (\text{aq}, 1.0 \text{ mol dm}^{-3})$
- B**  $\text{Al}(\text{p}) | \text{Al}^{3+} (\text{ak}, 1.0 \text{ mol dm}^{-3}) || \text{Ag}^+ (\text{ak}, 1.0 \text{ mol dm}^{-3}) | \text{Ag}(\text{p})$   
 $\text{Al}(\text{s}) | \text{Al}^{3+} (\text{aq}, 1.0 \text{ mol dm}^{-3}) || \text{Ag}^+ (\text{aq}, 1.0 \text{ mol dm}^{-3}) | \text{Ag}(\text{s})$
- C**  $\text{Ag}^+ (\text{ak}, 1.0 \text{ mol dm}^{-3}) | \text{Ag}(\text{p}) || \text{Al}(\text{p}) | \text{Al}^{3+} (\text{ak}, 1.0 \text{ mol dm}^{-3})$   
 $\text{Ag}^+ (\text{aq}, 1.0 \text{ mol dm}^{-3}) | \text{Ag}(\text{s}) || \text{Al}(\text{s}) | \text{Al}^{3+} (\text{aq}, 1.0 \text{ mol dm}^{-3})$
- D**  $\text{Ag}(\text{p}) | \text{Ag}^+ (\text{ak}, 1.0 \text{ mol dm}^{-3}) || \text{Al}^{3+} (\text{ak}, 1.0 \text{ mol dm}^{-3}) | \text{Al}(\text{p})$   
 $\text{Ag}(\text{s}) | \text{Ag}^+ (\text{aq}, 1.0 \text{ mol dm}^{-3}) || \text{Al}^{3+} (\text{aq}, 1.0 \text{ mol dm}^{-3}) | \text{Al}(\text{s})$

22 (Q25, SBP 2022)

Rajah 4 menunjukkan formula kimia bagi dua sebatian.  
*Diagram 4 shows the chemical formulae of two compounds.*



Rajah / Diagram 4

Antara berikut, yang manakah merupakan nombor pengoksidaan bagi zink dan ferum dalam sebatian ini?

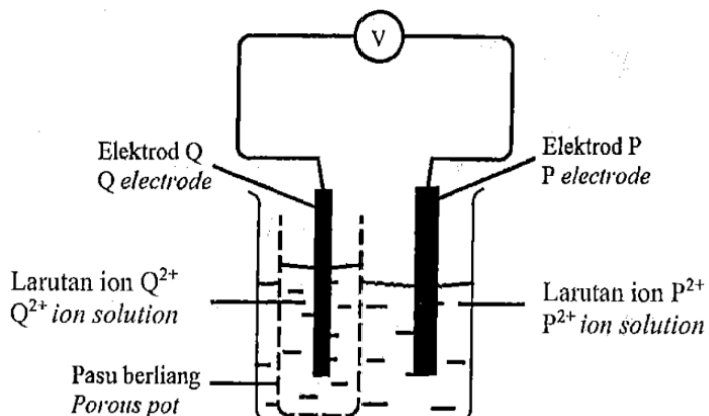
*Which of the following are the oxidation number of zinc and iron in the compounds?*

	<b>Zink</b> <b>Zinc</b>	<b>Ferum</b> <b>Iron</b>
<b>A</b>	+1	+2
<b>B</b>	+1	+3
<b>C</b>	+2	+2
<b>D</b>	+2	+3

23 (Q34, SBP 2022)

Rajah 9 menunjukkan susunan radas yang digunakan untuk mengkaji tindak balas redoks dalam satu sel kimia.

Diagram 9 shows the apparatus set-up to investigate a redox reaction in a chemical cell.



Rajah / Diagram 9

Jadual 3 menunjukkan nilai keupayaan elektrod piawai bagi beberapa sel setengah.

Table 3 shows the standard electrode potential values for some half-cells.

Sel Setengah Half-cell	Nilai $E^0$ (V) $E^0$ value (V)
$P^{2+} + 2e^- \rightleftharpoons P$	-2.38
$2H^+ + 2e^- \rightleftharpoons H_2$	0.00
$Q^{2+} + 2e^- \rightleftharpoons Q$	+0.34

Jadual / Table 3

Antara yang berikut, pernyataan manakah yang betul bagi sel kimia itu?  
Which of the following statements is correct about the chemical cell?

- A Ion hidrogen diturunkan  
Hydrogen ion is reduced
- B Ion  $Q^{2+}$  adalah agen pengoksidaan  
 $Q^{2+}$  ion is an oxidising agent
- C Bacaan voltmeter yang terhasil ialah 2.04 V  
Voltmeter reading produced is 2.04 V
- D Nombor pengoksidaan bagi P berubah dari +2 kepada 0  
Oxidation number of P changes from +2 to 0

**BAB 2 : SEBATIAN KARBON**

1 (Q21, SPM 2021)

Antara yang berikut, yang manakah isomer bagi  $C_4H_9OH$ ?  
*Which of the following are the isomers for  $C_4H_9OH$ ?*

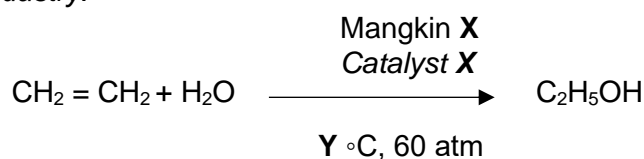
- I Propan-2-ol  
*Propan-2-ol*
- II Butan-1-ol  
*Butan-1-ol*
- III 2-metilpropan-2-ol  
*2-methylpropan-2-ol*
- IV 2-metilbutan-2-ol  
*2-methylbutan-2-ol*

- A I dan II  
*I and II*
- B I dan IV  
*I and IV*
- C II dan III  
*II and III*
- D III dan IV  
*III and IV*

2 (SPM 2021 Q22)

Persamaan berikut mewakili tindak balas penghidratan etena untuk menghasilkan etanol secara industri.

*The following equation represents the hydration of ethene to produce ethanol in industry.*



Apakah X dan Y?

*What are X and Y?*

- |          | <b>X</b>   | <b>Y</b> |
|----------|--|----------|
| <b>A</b> | Nikel<br><i>Nickel</i>                             | 180      |
| <b>B</b> | Ferum<br><i>Iron</i>                               | 450      |
| <b>C</b> | Asid fosforik<br><i>Phosphoric acid</i>            | 300      |
| <b>D</b> | Asid sulfurik pekat<br>Concentrated sulphuric acid | 180      |

3 (Q23, SPM 2021)

Sebatian Q mempunyai sifat-sifat berikut.  
*Compound Q has the following properties.*

- Tidak mengkonduksi elektrik  
*Cannot conduct electricity*
- Tidak larut dalam air  
*Insoluble in water*
- Menyahwarna kalium manganat(VII) berasid  
*Decolourise acidified potassium manganate (VII)*

Apakah sebatian Q?  
*What is compound Q?*

- A** Asid etanoik  
*Ethanoic Acid*
- B** Etanol  
*Ethanol*
- C** Etena  
*Ethene*
- D** Etana  
*Ethane*

4 (Q24, SPM 2021)

Formula molekul berikut mewakili satu sebatian karbon yang terbentuk daripada tindak balas antara sebatian X dan sebatian Y.  
*The following molecular formula represents a carbon compound formed from the reaction between compounds X and Y.*



Apakah sebatian X dan sebatian Y?  
*What are compounds X and Y?*

	<b>Sebatian X</b> <b>Compound X</b>	<b>Sebatian Y</b> <b>Compound Y</b>
<b>A</b>	CH <sub>3</sub> CH <sub>2</sub> COOH	CH <sub>3</sub> CH <sub>2</sub> OH
<b>B</b>	CH <sub>3</sub> CH <sub>2</sub> COOH	CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> OH
<b>C</b>	CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	CH <sub>3</sub> CH <sub>2</sub> OH
<b>D</b>	CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> COOH	CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> OH

5 (Q36, SPM 2021)

Formula empirik bagi suatu hidrokarbon ialah  $\text{CH}_2$ .  
*The empirical formula of a hydrocarbon is  $\text{CH}_2$ .*

Apakah formula molekul bagi hidrokarbon itu?

[Jisim atom relatif: C = 12, H = 1; Jisim molar hidrokarbon =  $56 \text{ g mol}^{-1}$ ]

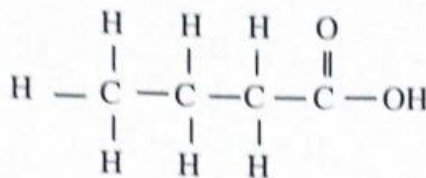
*What is the molecular formula of the hydrocarbon?*

[Relative atomic mass: C=12, H= 1; Molar mass of hydrocarbon =  $56 \text{ g mol}^{-1}$ ]

- A  $\text{C}_4\text{H}_8$
- B  $\text{C}_4\text{H}_{10}$
- C  $\text{C}_2\text{H}_4$
- D  $\text{C}_2\text{H}_6$

6 (Q17, SPM 2022)

Rajah 8 menunjukkan formula struktur bagi sebatian X.  
*Diagram 8 shows a structural formula of compound X.*



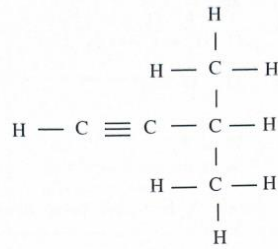
Rajah / Diagram 8

Apakah hasil yang terbentuk apabila X bertindak balas dengan alcohol yang mempunyai 3 atom karbon setiap molekul?

*What is the product formed when X reacts with alcohol that has 3 carbon atoms per molecule?*

- A Propanol  
*Propanol*
- B Asid butanoic  
*Butanoic acid*
- C Propil butanoate  
*Propyl butanoate*
- D Butil propanoate  
*Butyl propanoate*

- 7 (SPM 2022 Q18)  
Rajah 9 menunjukkan formula struktur bagi satu hidrokarbon Q.  
*Diagram 9 shows a structural formula of a hydrocarbon Q.*

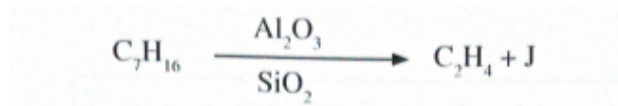


Rajah / Diagram 9

Apakah nama Q?  
*What is the name of Q?*

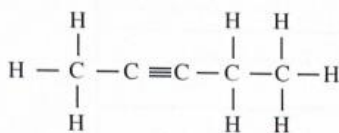
- A 2-metilbut – 3 – una  
*2-methylbut – 3 – yne*
- B 3-metilbut-1-una  
*3-methylbut-1-yne*
- C 1,1-dimetilprop-2-una  
*1,1 – dimethylprop-2-yne*
- D 3,3-dimetilprop-1-una  
*3,3- dimethylprop-1-yne*
- 8 (SPM 2022 Q19)

Persamaan berikut mewakili satu proses untuk menghasilkan  $\text{C}_2\text{H}_4$  dan J.  
*The following equation represents a process to produce  $\text{C}_2\text{H}_4$  and J.*

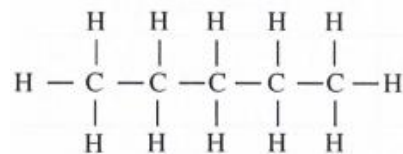


Apakah formula struktur bagi J?  
*What is the structural formula of J?*

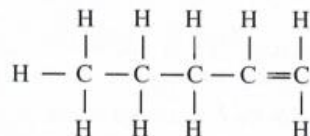
A



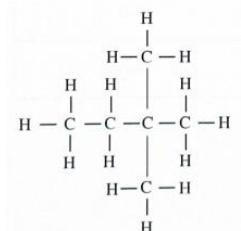
C



B



D



9 (SPM 2022 Q20)

Antara yang berikut, pasangan manakah yang betul bagi formula molekul dan jenis ikatan bagi alkuna?

*Which of the following pairs is correct for the molecular formula and type of bond of alkyne?*

	<b>Formula molekul</b> <i>Molecular formula</i>	<b>Jenis Ikatan</b> <i>Type of bond</i>
<b>A</b>	C <sub>3</sub> H <sub>6</sub>	Ikatan ganda dua <i>Double bond</i>
<b>B</b>	C <sub>4</sub> H <sub>6</sub>	Ikatan ganda dua <i>Double bond</i>
<b>C</b>	C <sub>5</sub> H <sub>8</sub>	Ikatan ganda tiga <i>Triple bond</i>
<b>D</b>	C <sub>6</sub> H <sub>12</sub>	Ikatan ganda tiga <i>Triple bond</i>

10 (Q21, SPM 2022)

Antara yang berikut, keadaan manakah yang digunakan dalam proses penghidratan etena?

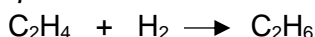
*Which of the following conditions are used in the hydration process of ethene?*

	<b>Mungkin</b> <i>Catalyst</i>	<b>Suhu (°C)</b> <i>Temperature (°C)</i>
<b>A</b>	Asid sulfuric pekat <i>Concentrated sulphuric acid</i>	27
<b>B</b>	Asid fosforik <i>Phosphoric acid</i>	300
<b>C</b>	Nikel <i>Nickel</i>	180
<b>D</b>	Ferum <i>Iron</i>	450

11 (Q11, SPMRSM 2021)

Persamaan berikut mewakili tidak balas penambahan bagi suatu alkena.

*The following equation represents addition reaction of an alkene.*



Apakah mangkin yang digunakan dalam tindak balas ini?

*What is the catalyst used in the reaction?*

- A** Ferum  
*Iron*
- B** Nikel  
*Nickel*
- C** Kuprum(II) sulfat  
*Copper(II) sulphate*
- D** Mangan(IV) oksida  
*Manganese(IV) oxide*



12 (Q12, SPMRSM 2021)

Antara pasangan sebatian berikut, manakah yang dikelaskan dalam siri homolog yang sama?

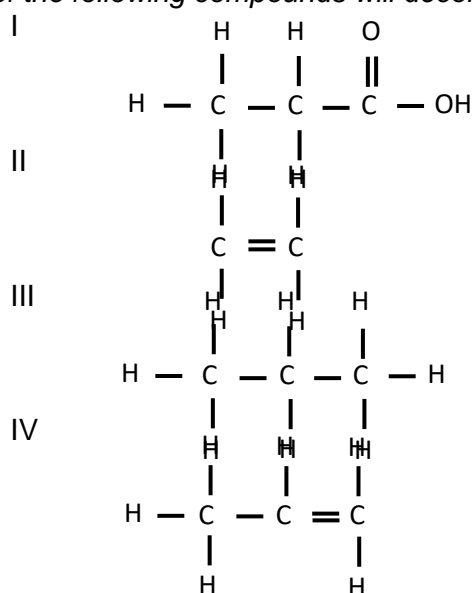
*Which of the following pair of compounds is classified in the same homologous series?*

	Sebatian I Compound I	Sebatian II Compound II
A	$C_2H_4$	$C_3H_6$
B	$C_2H_6$	$C_3H_6$
C	$C_2H_5OH$	$CH_3COOH$
D	$CH_3COOCH_3$	$C_2H_5COOH$

13 (SPMRSM 2021 Q27)

Antara sebatian berikut, yang manakah akan menyahwarnakan air bromin?

*Which of the following compounds will decolourise bromine water?*

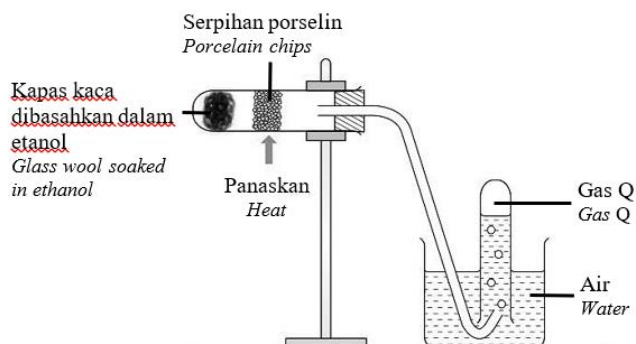


- A I dan II  
I and II
- B I dan III  
I and III
- C II dan IV  
II and IV
- D III dan IV  
III and IV

14 (Q38, SPMRSM 2021)

Rajah 16 menunjukkan susunan radas bagi tindak balas untuk menghasilkan gas Q. Gas Q boleh terbakar dengan lengkap dalam kehadiran oksigen berlebihan.

Diagram 16 shows the apparatus set-up for the reaction to produce gas Q. Gas Q can be burnt completely in excess oxygen.



Rajah / Diagram 16

Apakah gas Q dan persamaan kimia bagi pembakaran lengkap tersebut?  
What is gas Q and the chemical equation for the complete combustion?

	Gas Q Gas Q	Chemical equation for complete combustion Persamaan kimia bagi pembakaran lengkap
A	Etanol Ethanol	$C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$
B	Etena Ethene	$C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$
C	Etanol Ethanol	$C_2H_5OH + 2O_2 \longrightarrow 2CO + 3H_2O$
D	Etena Ethene	$C_2H_4 + 2O_2 \longrightarrow 2CO + 2H_2O$

**BAB 3 : TERMOKIMIA**

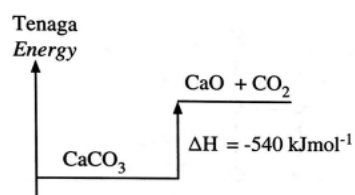
1. (Q25, SPM 2021)

Persamaan berikut mewakili tindak balas penguraian bagi kalsium karbonat,  $\text{CaCO}_3$ .  
*The following equation represents the decomposition reaction of calcium carbonate,  $\text{CaCO}_3$ .*

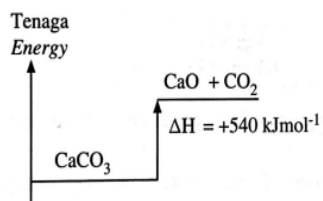


Haba yang diserap apabila 1 mol  $\text{CaCO}_3$  terurai ialah  $540 \text{ kJmol}^{-1}$ .  
Gambar rajah aras tenaga yang manakah betul bagi tindak balas itu?  
*Heat absorbed when 1 mol of  $\text{CaCO}_3$  decomposed is  $540 \text{ kJmol}^{-1}$ .  
Which energy level diagram is correct for the reaction?*

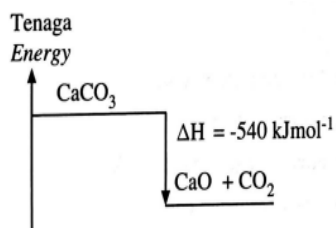
**A**



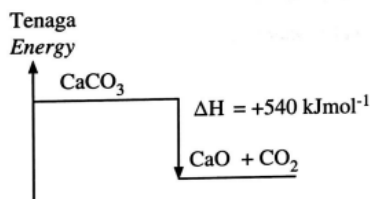
**B**



**C**



**D**



2 (Q26, SPM 2021)

Persamaan kimia yang manakah mewakili tindak balas yang menghasilkan haba paling tinggi?

*Which chemical equation represents the reaction that produces the highest heat?*

- A  $\text{HCl} + \text{NaOH} \longrightarrow \text{NaCl} + \text{H}_2\text{O}$
- B  $\text{HCl} + \text{NH}_4\text{OH} \longrightarrow \text{NH}_4\text{Cl} + \text{H}_2\text{O}$
- C  $\text{H}_2\text{SO}_4 + 2\text{NaOH} \longrightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$
- D  $\text{H}_2\text{SO}_4 + 2\text{NH}_4\text{OH} \longrightarrow (\text{NH}_4)_2\text{SO}_4 + 2\text{H}_2\text{O}$

3 (Q37, SPM 2021)

Maklumat berikut menunjukkan keputusan bagi suatu eksperimen untuk menentukan haba pembakaran bahan api X.

*The following information shows the results of an experiment to determine the heat of combustion of fuel X.*

Jisim bahan api X yang terbakar = 18.0 g

*Mass of fuel X burnt = 18.0 g*

Isi padu air dalam bekas kuprum = 250.0 cm<sup>3</sup>

*Volume of water in the copper container = 250.0 cm<sup>3</sup>*

Peningkatan suhu = 16.0 °C

*Increase in temperature = 16.0 °C*

Berapakah haba pembakaran bahan api X?

[Jisim molar bahan api X = 180 g mol<sup>-1</sup>;

Muatan haba tentu air = 4.2 Jg<sup>-1</sup> °C<sup>-1</sup>;

ketumpatan air = 1.0 g cm<sup>-3</sup>]

*What is the heat of combustion of fuel X?*

[*Molar mass of fuel X = 180 g mol<sup>-1</sup>;*

*Specific heat capacity of water = 4.2 Jg<sup>-1</sup> °C<sup>-1</sup>;*

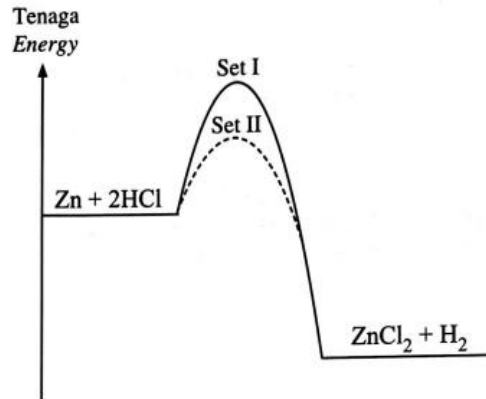
*Density of water = 1.0 g cm<sup>-3</sup>]*

- A - 1.68 kJmol<sup>-1</sup>
- B - 18.00 kJmol<sup>-1</sup>
- C - 168.00 kJmol<sup>-1</sup>
- D - 180.00 kJmol<sup>-1</sup>

4 (Q39, SPM 2021)

Rajah 20 menunjukkan suatu gambar rajah arcs tenaga yang diperolehi daripada dua set eksperimen.

Diagram 20 shows energy profile diagram that obtained from two sets of experiment.



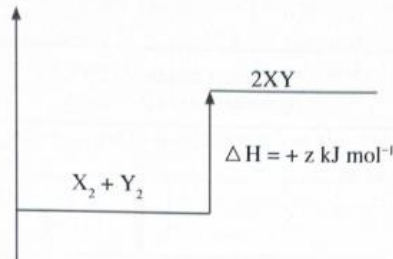
Antara yang berikut, pernyataan manakah yang betul tentang Set I dan Set II?

Which of the following statements are correct about Set I and Set II?

	Set I	Set II
<b>A</b>	Tindak balas membebaskan haba tanpa kehadiran mangkin <i>The reaction releases heat without the presence of catalyst</i>	Tindak balas membebaskan haba dengan kehadiran mangkin <i>The reaction releases heat with the presence of catalyst</i>
<b>B</b>	Tindak balas membebaskan haba dengan kehadiran mangkin <i>The reaction releases heat with the presence of catalyst</i>	Tindak balas membebaskan haba tanpa kehadiran mangkin <i>The reaction releases heat without the presence of catalyst</i>
<b>C</b>	Tindak balas menyerap haba dengan kehadiran mangkin <i>The reaction absorbed heat with the presence of catalyst</i>	Tindak balas menyerap haba tanpa kehadiran mangkin <i>The reaction absorbed heat without the presence of catalyst</i>
<b>D</b>	Tindak balas menyerap haba tanpa kehadiran mangkin <i>The reaction absorbed heat without the presence of catalyst</i>	Tindak balas menyerap haba dengan kehadiran mangkin <i>The reaction absorbed heat with the presence of catalyst</i>

5 (Q22, SPM 2022)

Rajah 10 menunjukkan gambar rajah aras tenaga bagi satu tindak balas kimia.  
*Diagram 10 shows the energy level diagram of a chemical reaction.*



Antara yang berikut, pernyataan manakah yang menerangkan tindak balas itu?  
*Which of the following statements explains the reaction?*

- A** Tindak balas antara  $X_2$  dan  $Y_2$  membentuk  $XY$  adalah tindak balas eksotermik.  
*Reaction between  $X_2$  and  $Y_2$  form  $XY$  is an exothermic reaction.*
  - B** Apabila 1 mol  $X_2$  dan 1 mol  $Y_2$  bertindak balas membentuk 2 mol  $XY$ , sebanyak  $z$  kJ tenaga haba dibebaskan.  
*When 1 mole of  $X_2$  and 1 mole of  $Y_2$  react to form 2 moles of  $XY$ ,  $z$  kJ of heat energy is released.*
  - C** Jumlah kandungan tenaga bagi  $X_2$  dan  $Y_2$  lebih tinggi daripada jumlah kandungan tenaga bagi  $XY$ .  
*Total energy content for  $X_2$  and  $Y_2$  is higher than total energy content for  $XY$ .*
  - D** Semasa  $X_2$  dan  $Y_2$  bertindak balas, suhu campuran menurun.  
*When  $X_2$  dan  $Y_2$  react, the temperature of mixture decreases.*
- 6 (Q24, SPM 2022)

Tindak balas antara asid X dan larutan natrium hidroksida membebaskan haba sebanyak 114 kJ manakala tindak balas antara asid Z dan larutan natrium hidroksida membebaskan haba sebanyak 57 kJ.

Antara yang berikut, padanan manakah yang betul tentang asid itu?

*The reaction between acid X and sodium hydroxide solution released 114 kJ of heat while the reaction between acid Z and sodium hydroxide solution released 57 kJ of heat.*

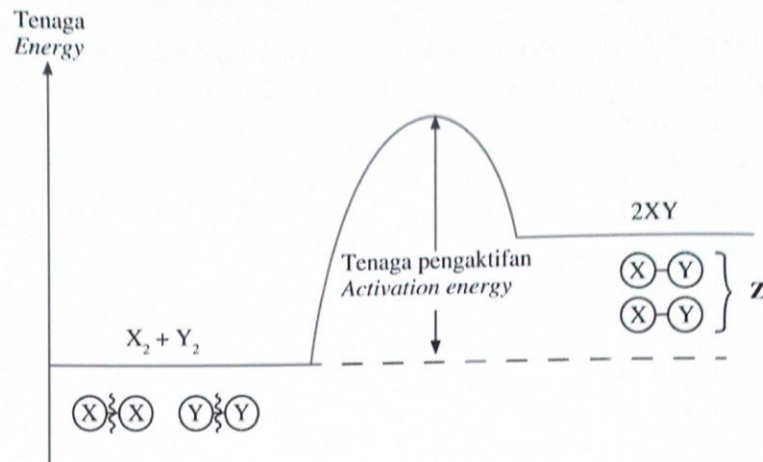
*Which of the following pairs are correct about the acids?*

	<b>X</b>	<b>Z</b>	<b>Kebesan asid Z</b> <b>Basicity of acid Z</b>
<b>A</b>	Asid hidroklorik <i>Hydrochloric acid</i>	Asid sulfurik <i>Sulphuric acid</i>	Diprotik <i>Diprotic</i>
<b>B</b>	Asid etanoik <i>Ethanoic acid</i>	Asid hidroklorik <i>Hydrochloric acid</i>	Monoprotik <i>Monoprotic</i>
<b>C</b>	Asid sulfurik <i>Sulphuric acid</i>	Asid hidroklorik <i>Hydrochloric acid</i>	Monoprotik <i>Monoprotic</i>
<b>D</b>	Asid etanoik <i>Ethanoic acid</i>	Asid sulfurik <i>Sulphuric acid</i>	Diprotik <i>Diprotic</i>

7 (Q36, SPM 2022)

Rajah 19 menunjukkan gambar rajah pemutusan dan pembentukan ikatan dalam suatu tindak balas.

Diagram 19 shows the diagram of the breakage and formation of bonds in a reaction.



Rajah / Diagram 19

Jadual 3 menunjukkan tenaga ikatan kimia bagi tiga ikatan.

Table 3 shows the chemical bond energy for three bonds.

<b>Ikatan Bond</b>	<b>Tenaga ikatan (kJ mol<sup>-1</sup>) Bond energy (kJ mol<sup>-1</sup>)</b>
X – X	160
X – Y	201
Y – Y	204

Jadual / Table 3

Apakah nilai **Z**?

What is the value of **Z**?

- A -38 kJ mol<sup>-1</sup>
- B +38 kJ mol<sup>-1</sup>
- C -163 kJ mol<sup>-1</sup>
- D +163 kJ mol<sup>-1</sup>

8 (Q37, SPM 2022)

Apakah nilai bahan api bagi butan-1-ol?

[Diberi haba pembakaran butan-1-ol =  $-2675 \text{ kJ mol}^{-1}$  .

jisim atom relatif: H = 1, C = 12, O = 16]

*What is the heat value for butan-1-ol?*

*[Given that heat of combustion of butan-1-ol =  $-2675 \text{ kJ mol}^{-1}$ ;*

*Relative atomic mass: H = 1, C = 12, O = 16]*

- A  $55.73 \text{ kJ g}^{-1}$
- B  $46.93 \text{ kJ g}^{-1}$
- C  $41.15 \text{ kJ g}^{-1}$
- D  $36.15 \text{ kJ g}^{-1}$

9 (Q38, SPM 2022)

Persamaan berikut mewakili tindak balas pembentukan sejenis garam.

*The following equation represents the reaction of formation of a type of salt.*



Berapakah jisim mendakan yang terbentuk apabila  $100 \text{ cm}^3$  bagi setiap larutan dicampurkan dan suhu campuran tindak balas meningkat sebanyak  $3^\circ\text{C}$ ?

[Muatan haba tentu larutan,  $C = 4.2 \text{ J }^\circ\text{C}^{-1}$ ; Ketumpatan larutan =  $1 \text{ g cm}^{-3}$ ;

Jisim

atom relatif: Ba = 137, S = 32, Na = 23, O = 16, N = 14]

*What is the mass of the precipitate formed when  $100 \text{ cm}^3$  of each solution is added and the temperature of the reaction mixture increases by  $3^\circ\text{C}$ ?*

*Specific heat capacity,  $C = 4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ ; Density of solution =  $1 \text{ g cm}^{-3}$*

*Relative atomic mass: Ba = 137, S = 32, Na = 23, O = 16, N = 14]*

- A 2.55 g
- B 6.99 g
- C 10.20 g
- D 13.98 g



10 (Q13, SPMRSM 2021)

Antara bahan kimia berikut, yang manakah akan merendahkan suhu apabila dilarutkan dalam air?

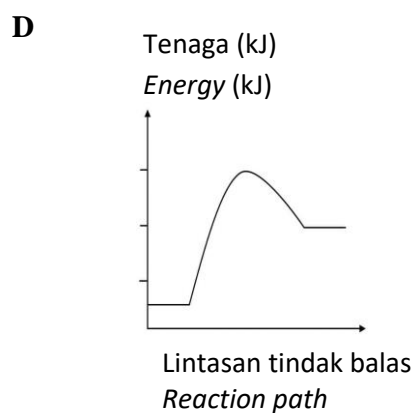
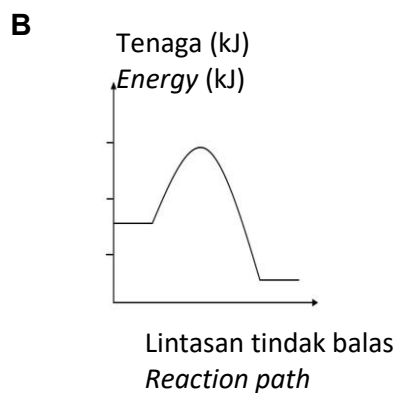
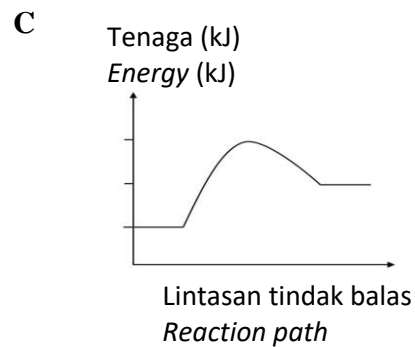
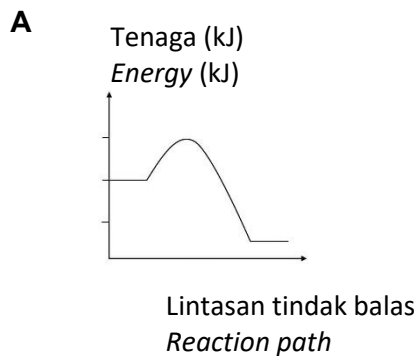
*Which of the following chemicals will lower the temperature when dissolved in water?*

- A** Natrium oksida  
*Sodium oxide*
- B** Kalium hidroksida  
*Potassium hydroxide*
- C** Kuprum(II) sulfat  
*Copper(II) sulphate*
- D** Ammonium nitrat  
*Ammonium nitrate*

11 (Q24, SPMRSM 2021)

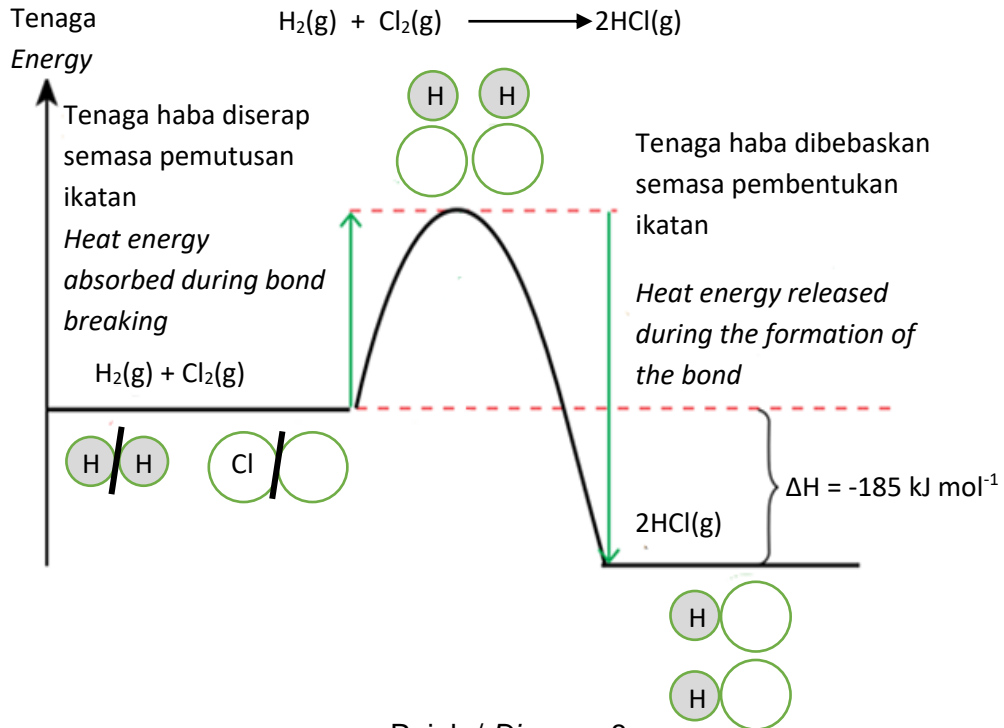
Antara berikut, gambar rajah profil tenaga yang manakah menunjukkan tenaga pengaktifan paling tinggi?

*Which of the following energy profile diagram shows the highest activation energy?*



12 (Q28, SPMRSM 2021)

Rajah 8 menunjukkan gambar rajah profil tenaga bagi suatu tindak balas.  
*Diagram 8 shows the energy profile diagram of a reaction.*



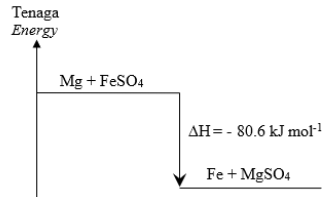
Pernyataan manakah yang betul mengenai gambar rajah profil tenaga itu?  
*Which statement is correct about the energy profile diagram?*

- A** Tenaga haba diserap untuk memutuskan ikatan bahan tindak balas adalah lebih tinggi  
*Heat energy absorbed to break the bonds in the reactants is greater*
- B** Tenaga haba yang dibebaskan semasa pembentukan ikatan adalah lebih rendah  
*Heat energy released during the formation of bonds is lower*
- C** Tenaga haba diserap untuk pemutusan ikatan bahan tindak balas adalah 679 kJ  
*Heat energy absorbed to break the bonds in the reactants is 679 kJ*
- D** Tenaga haba yang dibebaskan semasa pembentukan ikatan ialah 432 kJ  
*Heat energy released during the formation of bonds is 432 kJ*

13 (Q37, SPMRSM 2021)

Rajah 15 menunjukkan gambar rajah aras tenaga bagi tindak balas penyesaran antara serbuk magnesium dan larutan ferum(II) sulfat.

Diagram 15 shows the energy level diagram of the displacement reaction between magnesium powder and iron(II) sulphate solution.



Rajah / Diagram 15

Berapakah kenaikan suhu, jika 50 cm<sup>3</sup> larutan ferum(II) sulfat 0.25 mol dm<sup>-3</sup> ditindak balaskan dengan magnesium berlebihan?

[Muatan haba tentu larutan = 4.2 J g<sup>-1</sup> °C<sup>-1</sup>]

What is the increase in temperature if 50 cm<sup>3</sup> of 0.25 mol dm<sup>-3</sup> iron(II) sulphate solution is reacted with excess magnesium?

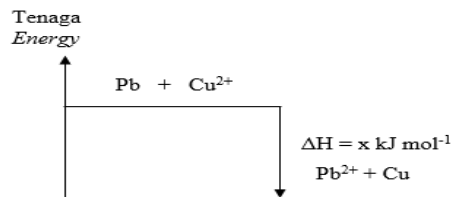
[Specific heat capacity of the solution = 4.2 J g<sup>-1</sup> °C<sup>-1</sup>]

- A 0.048 °C
- B 0.48 °C
- C 4.8 °C
- D 48.0 °C

14 (Q25, SPMRSM 2022)

Rajah 15 menunjukkan gambarajah aras tenaga bagi satu tindak balas.

Diagram 15 shows the energy level diagram for a reaction.



Rajah 15  
Diagram 15

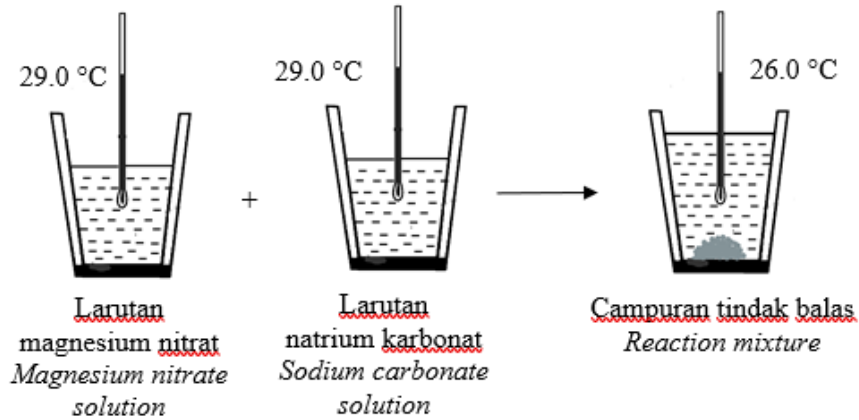
Antara berikut, yang manakah benar?

Which of the following is correct?

	<b>Penerangan Explanation</b>	<b>Perubahan haba Heat change</b>
<b>A</b>	Ion kuprum(II) dioksidakan <i>Copper(II) ion is oxidized</i>	Haba dibebaskan <i>Heat is released</i>
<b>B</b>	Atom plumbum mengalami pengoksidaan <i>Lead atom undergoes oxidation</i>	Haba dibebaskan <i>Heat is released</i>
<b>C</b>	Ion kuprum(II) adalah satu agen penurunan <i>Copper(II) ion is a reducing agent</i>	Haba diserap <i>Heat is absorbed</i>
<b>D</b>	Atom plumbum menerima electron <i>Lead atom receives electrons</i>	Haba diserap <i>Heat is absorbed</i>

15 (Q27, SPMRSM 2022)

Rajah 17 menunjukkan susunan radas untuk menentukan haba tindak balas.  
*Diagram 17 shows the apparatus set-up to determine the heat of reaction.*



Rajah 17  
*Diagram 17*

Manakah antara pernyataan berikut adalah benar?  
*Which of the following statement is true?*

- I. Pembentukan ikatan berlaku.  
*Bond formation occurs.*
  - II. Suhu menurun semasa tindak balas berlaku.  
*The temperature decreases during the reaction.*
  - III. Nilai  $\Delta H$  dalam tindak balas ini adalah negatif.  
*The value of  $\Delta H$  for the reaction is negative.*
  - IV. Jumlah kandungan tenaga hasil tindak balas lebih tinggi daripada jumlah kandungan tenaga bahan tindak balas.  
*The total energy content of the products is higher than the total energy content of the reactants.*
- A** I dan II  
*I and II*
- B** I dan III  
*I and III*
- C** II dan IV  
*II and IV*
- D** III dan IV  
*III and IV*

16 (Q36, SPMRSM 2022)

Nilai bahan api arang kayu ialah  $34 \text{ kJ g}^{-1}$ .

Hitung jisim arang kayu yang diperlukan untuk mendidihkan  $2.0 \text{ dm}^3$  air.

[Muatan haba tentu air =  $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ , Ketumpatan air =  $1 \text{ g cm}^{-3}$   
Suhu air pada keadaan bilik =  $27.0 \text{ }^\circ\text{C}$ ]

*The fuel value of charcoal is  $34 \text{ kJ g}^{-1}$ .*

*Calculate the mass of charcoal needed to boil  $2.0 \text{ dm}^3$  of water.*

[*Heat capacity of water =  $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ , Density of water =  $1 \text{ g cm}^{-3}$   
Temperature of water at room temperature =  $27.0 \text{ }^\circ\text{C}$ ]*

- A 18 g
- B 16 g
- C 12 g
- D 7 g

17 (Q14, SBP 2021)

Antara proses berikut, yang manakah menyerap haba daripada persekitaran?

*Which of the following processes absorbs heat from surroundings?*

- A Respirasi  
*Respiration*
- B Pengaratan  
*Rusting*
- C Pembakaran  
*Combustion*
- D Fotosintesis  
*Phototynthesis*

18 (Q26, SBP 2021)

Antara berikut, persamaan kimia yang manakah mewakili tindak balas yang menghasilkan haba peneutralan yang paling tinggi?

*Which of the following chemical equations represents a reaction that produces the highest heat of neutralisation?*

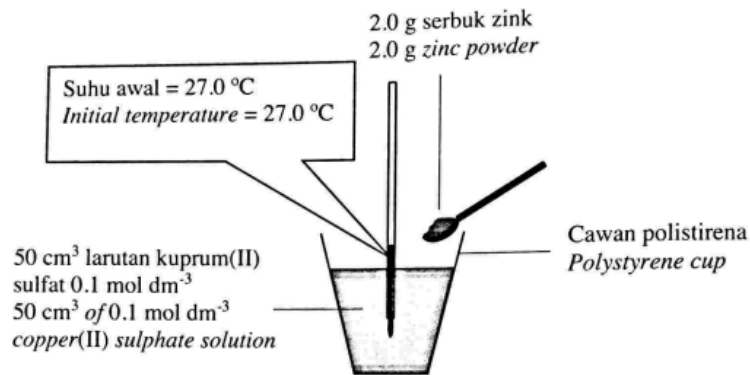
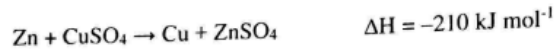
- A  $\text{HCl} + \text{NH}_3 \longrightarrow \text{NH}_4\text{Cl}$
- B  $\text{HCl} + \text{NaOH} \longrightarrow \text{NaCl} + \text{H}_2\text{O}$
- C  $\text{CH}_3\text{COOH} + \text{NH}_3 \longrightarrow \text{CH}_3\text{COONH}_4$
- D  $\text{CH}_3\text{COOH} + \text{NaOH} \longrightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O}$

19 (Q37, SBP 2021)

Rajah 37 menunjukkan susunan radas untuk menentukan haba penyesaran kuprum.

Persamaan termokimia berikut mewakili tindak balas tersebut.

Diagram 37 shows an apparatus set-up to determine the heat of displacement of copper. The following thermochemical equation represents the reaction.



Rajah/ Diagram 37

Berapakah suhu tertinggi yang dicapai dalam tindak balas itu?

[Jisim atom relatif: Zn = 65; Muatan haba tentu bagi larutan = 4.2 J g⁻¹ °C⁻¹;

Ketumpatan larutan = 1.0 g cm⁻³]

What is the highest temperature reached in the reaction?

[Relative atomic mass: Zn = 65; Specific heat capacity of solution = 4.2 J g⁻¹ °C⁻¹; Density of solution = 1.0 g cm⁻³]

- A 5.0 °C
- B 30.0 °C
- C 32.0 °C
- D 57.0 °C

20 (Q13, SBP 2022)

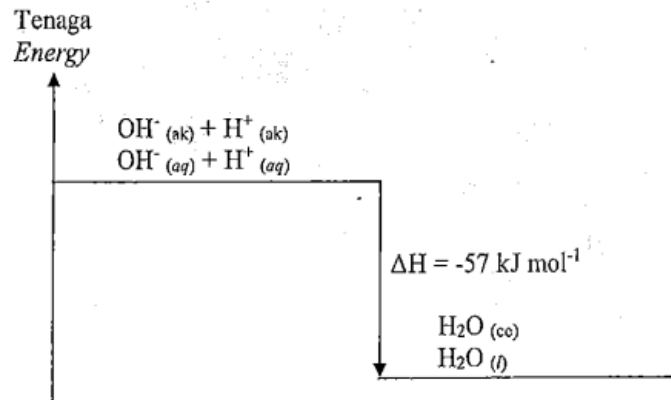
Antara yang berikut, tindak balas manakah yang membebaskan tenaga haba ke persekitaran?

Which of the following reactions releases heat energy to the surroundings?

- A Memanaskan garam zink nitrat  
Heating of zinc nitrate salt
- B Melarutkan pepejal ammonium nitrat dalam air  
Dissolving solid ammonium nitrate in water
- C Melarutkan pepejal natrium hidroksida dalam air  
Dissolving solid sodium hydroxide in water
- D Menambahkan natrium hidrogen karbonat ke dalam asid hidroklorik  
Adding sodium hydrogen carbonate into hydrochloric acid

21 (Q27, SBP 2022, Q27)

Rajah 6 menunjukkan satu gambar rajah aras tenaga.  
Diagram 6 shows the energy level diagram.



Rajah/ Diagram 6

Antara berikut, pernyataan manakah yang betul tentang gambar rajah aras tenaga ini?

Which of the following statements is correct about the energy level diagram?

- A Suhu meningkat semasa tindak balas  
*The temperature increases during reaction*
- B 57 kJ tenaga diperlukan untuk tindak balas ini  
*57 kJ of energy is needed for the reaction*
- C Jumlah kandungan tenaga hasil tindak balas lebih tinggi daripada bahan tindak balas  
*The total energy content of the product is higher than the reactant*
- D Tenaga haba yang diserap untuk memecahkan ikatan dalam bahan tindak balas lebih tinggi daripada tenaga haba yang dibebaskan semasa pembentukan ikatan.  
*The heat energy absorbed to break the bonds in the reactants is higher than the heat energy released during bond formation.*

22 (Q31, SBP 2022)

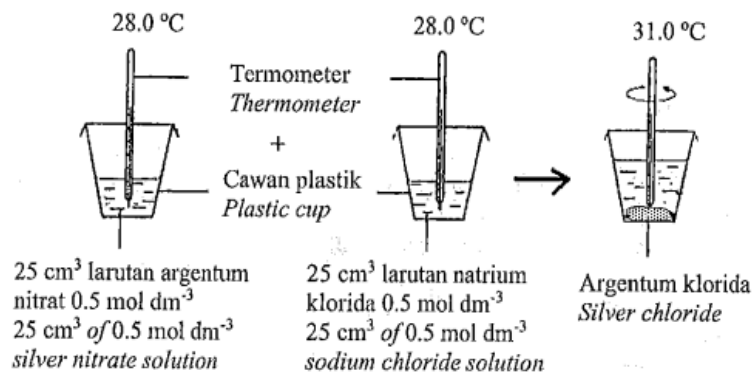
Encik Aaron mendapati ais kering dalam kotak aiskrim bertukar menjadi wasap. Apakah proses dan perubahan tenaga haba yang terjadi kepada ais kering itu?  
*Mr. Aaron found that the dry ice in the box of ice cream cake change into fumes. What is the process and heat energy change occurred to the dry ice?*

	<b>Proses Process</b>	<b>Perubahan tenaga haba Heat energy change</b>
<b>A</b>	Pengendapan <i>Deposition</i>	Tenaga haba dibebaskan <i>Heat energy is released</i>
<b>B</b>	Pemejalwapan <i>Sublimation</i>	Tenaga haba diserap <i>Heat energy is absorbed</i>
<b>C</b>	Pengendapan <i>Deposition</i>	Tenaga haba diserap <i>Heat energy is absorbed</i>
<b>D</b>	Pemejalwapan <i>Sublimation</i>	Tenaga haba dibebaskan <i>Heat energy is released</i>

23 (Q38, SBP 2022)

Rajah 10 menunjukkan susunan radas untuk menentukan haba pemendakan argentum klorida.

*Diagram 10 shows the apparatus set-up to determine the heat of precipitation of silver chloride.*



Rajah/ Diagram 10

Berapakah haba pemendakan argentum klorida?

[Muatan haba tentu bagi larutan =  $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ ;

Ketumpatan larutan =  $1.0 \text{ g cm}^{-3}$ ]

*What is the heat of precipitation of silver chloride?*

[*Specific heat capacity of solution =  $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ ;*

*Density of solution =  $1.0 \text{ g cm}^{-3}$ ]*

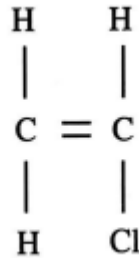
- A** -  $6.3 \text{ kJ mol}^{-1}$
- B** -  $12.6 \text{ kJ mol}^{-1}$
- C** -  $25.2 \text{ kJ mol}^{-1}$
- D** -  $50.4 \text{ kJ mol}^{-1}$



**BAB 4 : POLIMER**

1 (Q27, SPM 2021)

Rajah 14 menunjukkan formula struktur suatu monomer.  
*Diagram 14 shows a structural formula of a monomer.*



Rajah / Diagram 14

*Antara yang berikut, yang manakah persamaan antara monomer tersebut dengan polimernya?*

*Which of the following is the similarity between the monomer and its polymer?*

- A Formula molekul ialah  $\text{C}_2\text{H}_3\text{Cl}$   
*Molecular formula is  $\text{C}_2\text{H}_3\text{Cl}$*
- B Mempunyai ikatan ganda dua antara atom-atom karbon  
*Have double bond between carbon atoms*
- C Mempunyai atom karbon, atom hidrogen dan atom klorin  
*Contain carbon atom, hydrogen atom and chlorine atom*
- D Bilangan atom karbon dalam molekul  
*Number of carbon atoms in the molecule*

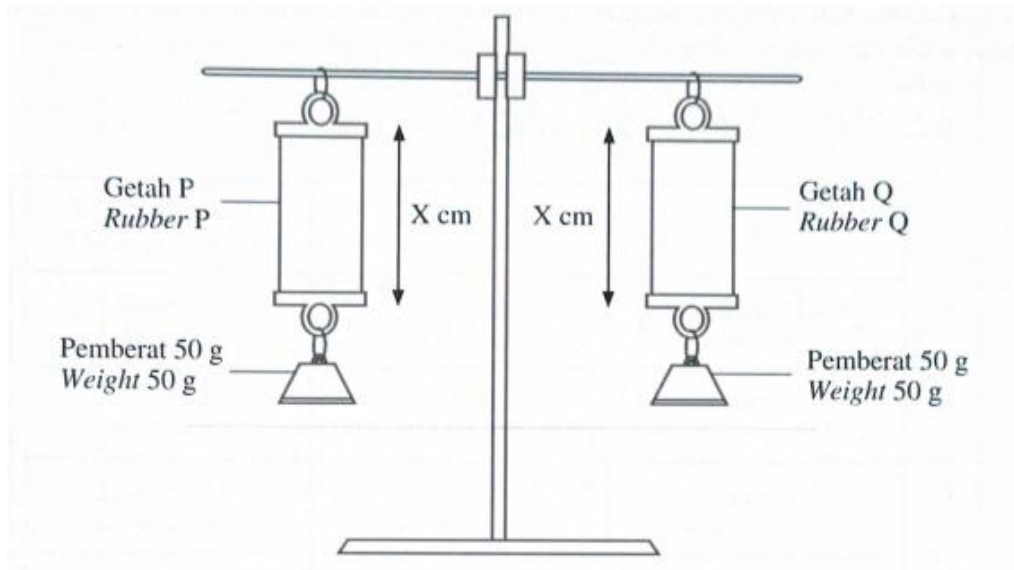
2 (Q28, SPM 2021)

Bahan manakah mempercepatkan penggumpalan lateks?

*Which substance speeds up the coagulation of latex?*

- A Air  
*Water*
- B Metanol  
*Methanol*
- C Larutan ammonia  
*Ammonia solution*
- D Asid metanoik  
*Methanoic acid*

- 3 (Q25, SPM 2022)  
Rajah 12 Menunjukkan susunan radas bagi menentukan kekenyalan untuk dua jenis bahan.  
*Diagram 12 shows the apparatus set-up to determine the elasticity for two types of substances.*

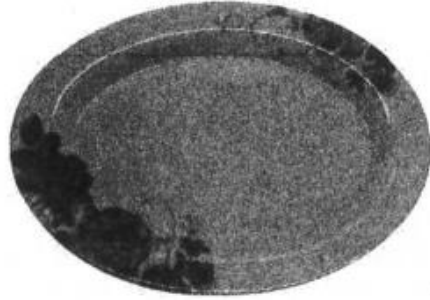


Didapati Q memanjang manakala P tidak memanjang selepas pemberat itu dikeluarkan. Apakah Q?  
*It was found that Q elongated while P did not after the weight was removed. What is Q?*

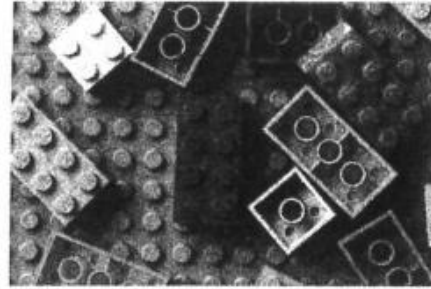
- A Poliisoprena  
*Polyisoprene*
- B Polikloroprena  
*Polychloroprene*
- C Getah silikon  
*Silicone rubber*
- D Getah nitril  
*Nitrile rubber*

4 (Q29, SPMRSM 2021)

Rajah 9 menunjukkan dua produk polimer dengan ciri yang berbeza.  
*Diagram 9 shows two products of polymer with different characteristics.*



Pinggan melamin  
*Melamine plate*



Permainan blok binaan  
*Building block toys*

Rajah / Diagram 9

*Antara berikut, yang manakah paling baik menerangkan ciri kedua-dua polimer?*

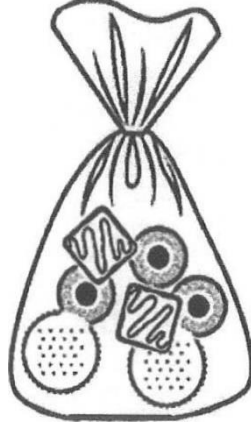
*Which of the following best explains the characteristic of both polymers?*

- A** Termoplastik lebih keras dari termoset  
*Thermoplastic is harder than thermoset*
- B** Termoplastik tidak melebur bila dipanaskan tetapi termoset melebur biladipanaskan dan mengeras bila disejukkan  
*Thermoplastic does not melt when heated but thermoset melts when heated and solidify when cooled*
- C** Termoplastik mempunyai rangkai silang antara rantai polimer tetapi termosettiada  
*Thermoplastic has cross-links between polymer chain but thermoset does not*
- D** Termoplastik boleh diacu berulang kali tetapi termoset hanya boleh diacu sekali sahaja  
*Thermoplastic can be moulded repeatedly, but thermoset can only be moulded once*

5 (Q28, SPMRSM 2022)

Diagram 18 menunjukkan jenis polimer yang digunakan sebagai bahan pembungkusan.

*Diagram 18 shows the types of polymers that is used as a packaging material.*



Rajah / Diagram 18

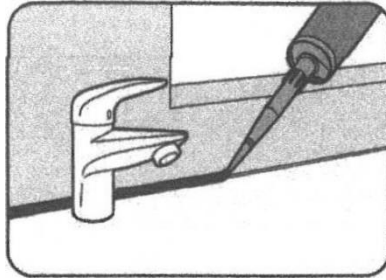
Manakah yang berikut menerangkan mengapa bahan pembungkus tersebut mencemarkan alam sekitar?

*Which of the following explains why the packaging material pollutes the environment?*

- I Terbiodegradasi  
*Biodegradable*
  - II Menyebabkan pembentukan alga  
*Cause the formation of algae*
  - III Membebaskan gas-gas toksik bila terbakar  
*Emitted toxic gases when burnt*
  - IV Menyebabkan sistem saliran terhalang dan banjir kilat  
*Cause blockage of drainage systems and flash flood*
- 
- A I dan II  
*I and II*
  - B I dan III  
*I and III*
  - C II dan IV  
*II and IV*
  - D III dan IV  
*III and IV*

6 (Q29, SPMRSM 2022)

Rajah 19 menunjukkan salah satu kegunaan getah sintetik.  
*Diagram 19 shows one of the uses of synthetic rubber.*



Rajah / Diagram 19

Manakah antara berikut adalah benar bagi getah sintetik tersebut?  
*Which of the following is true about the synthetic rubber?*

	Getah sintetik <i>Synthetic rubber</i>	Ciri-ciri <i>Characteristics</i>
A	Getah nitril <i>Nitrile rubber</i>	Tahan terhadap minyak dan pelarut <i>Oil and solvent resistance</i>
B	Getah stirena- butadiene <i>Styrene-butadiene rubber</i>	Tahan pelepasan dan tahan haba yang tinggi <i>Abrasion resistance and high heat resistance</i>
C	Getah silikone <i>Silicone rubber</i>	Tahan suhu yang tinggi dan bersifat lengai <i>High temperature resistance and inert</i>
D	Tiokol <i>Thiokol</i>	Tahan terhadap minyak dan pelarut <i>Oil and solvent resistance</i>

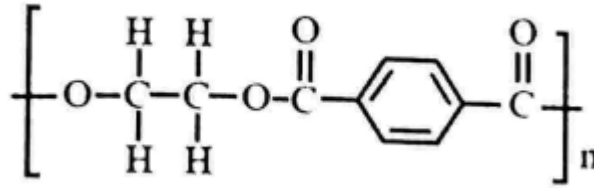
7 (Q15, SBP 2021)

Apakah kelebihan getah semula jadi berbanding getah sintetik?  
*What is the advantage of natural rubber compared to synthetic rubber?*

- A Tahan kepada bahan kimia  
*Resistant to chemicals*
- B Tahan kepada haba yang tinggi  
*Resistant to high heat*
- C Lebih tahan terhadap pengoksidaan  
*More resistant towards oxidation*
- D Mengambil masa singkat untuk terurai secara biologi  
*Takes a short time to decompose biologically*

8 (Q28, SBP 2021)

Rajah 28 menunjukkan formula struktur bagi polimer P.  
*Diagram 28 shows the structural formula of polymer P.*



Rajah / Diagram 28

Antara pernyataan berikut, yang manakah betul tentang polimer P?  
*Which of the following statements are correct about polymer P?*

- I Polimer P dihasilkan melalui tindak balas pempolimeran kondensasi  
*Polymer P is produced through condensation polymerisation reaction*
  - II Monomer bagi polimer P terdiri daripada siri homolog berbeza  
*Monomer of polymer P consists of different homologous series*
  - III Polivinil klorida dihasilkan daripada tindak balas yang sama dengan polimer P  
*Polyvinyl chloride is produced through the same type of reaction as polymer P*
  - IV Kumpulan berfungsi monomer bagi polimer P adalah ikatan Banda dua antara atom karbon  
*The functional group of the monomer of polymer P is double bond between carbon atoms*
- 
- A I dan II  
*I and II*
  - B I dan III  
*I and III*
  - C II dan III  
*II and III*
  - D II dan IV  
*II and IV*

9 (Q38, SBP 2021)

Dialog berikut menunjukkan perbincangan dalam satu mesyuarat antara pengurus dan pekerja kilang yang mengeluarkan produk berasaskan getah.  
*The following dialogue shows a discussion in a meeting between a manager and employee of a factory that produces rubber-based products.*

Pekerja kilang :                   Bos, tangan saya gatal disebabkan oleh pendedahan  
*Factory worker :*               berlebihan kepada sulfur semasa penghasilan produk  
berasaskan getah.  
*Boss, my hands are itchy due to over exposure to  
sulphur during the production of rubber-based  
products.*

Pengurus :                         Saya nasihatkan awak untuk segera berjumpa  
*Manager:*                         dengan doktor.  
*I advise you to see the doctor immediately.*

Pekerja kilang :                   Ok bos.  
*Factory worker :*               Ok boss.

Pengurus :                         Pada pendapat awak, apakah kaedah alternatif untuk  
*Manager :*                         mengatasi masalah tersebut?  
*In your opinion, what is the alternative method to  
overcome this problem?*

Penyelidik kilang :               Pasukan kami akan mencari kaedah tersebut secepat  
*Factory researcher :*           mungkin.  
*Our team will find the method as soon as possible.*

Apakah yang boleh dilakukan oleh penyelidik itu untuk menyelesaikan masalah tersebut?  
*What can the researcher do to overcome the problem?*

- A**   Gantikan dengan asid  
*Replace with acid*
- B**   Gantikan dengan stirena  
*Replace with Styrene*
- C**   Gantikan dengan oksida logam  
*Replace with metal oxide*
- D**   Gantikan dengan pelarut organik  
*Replace with organic solvent*

10 (Q14, SBP2022)

Antara yang berikut, manakah jenis polimer bagi melamin?  
*Which of the following is the type of polymer for melamine?*

- A Termoset  
*Thermosetting*
- B Elastomer  
*Elastomer*
- C Termoplastik  
*Thermoplastic*

11 (Q28, SBP2022)

Getah asli ialah polimer semula jadi yang dikenali sebagai poliisoprena.  
Antara berikut, yang manakah formula struktur bagi monomer getah asli?  
*Natural rubber is a natural polymer known as polyisoprene.*  
*Which of the following is the structural formula for the monomer of natural rubber?*

- A
$$\begin{array}{c} \text{H} \quad \text{H} \quad \text{CH}_3 \\ | \quad | \quad | \\ \text{H}-\text{C}-\text{C}=\text{C}-\text{H} \\ | \\ \text{H} \end{array}$$
- B
$$\begin{array}{c} \text{H} \quad \text{H} \quad \text{CH}_3 \quad \text{H} \\ | \quad | \quad | \quad | \\ \text{H}-\text{C}-\text{C}=\text{C}-\text{C}-\text{H} \\ | \quad \quad \quad | \\ \text{H} \quad \quad \quad \text{H} \end{array}$$
- C
$$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ | \quad | \quad | \\ \text{H}-\text{C}=\text{C}-\text{C}=\text{C}-\text{H} \\ \quad \quad \quad | \\ \quad \quad \quad \text{CH}_3 \end{array}$$
- D
$$\begin{array}{c} \text{H} \quad \text{H} \quad \text{CH}_3 \\ | \quad | \quad | \\ \text{H}-\text{C}=\text{C}-\text{C}=\text{C}-\text{H} \\ \quad \quad \quad | \\ \quad \quad \quad \text{H} \end{array}$$



BAB 5 : KIMIA KONSUMER DAN INDUSTRI

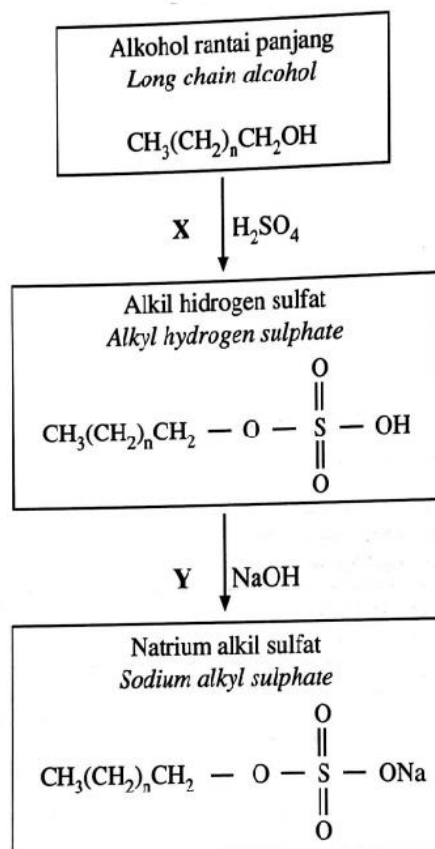
1 (Q29, SPM 2021)

Bahan tambah makanan manakah dipadankan dengan betul dengan contohnya? *Which food additives is matched correctly with its example?*

	Bahan tambah makanan <i>Food additive</i>	Contoh <i>Example</i>
A	Pengantioksida <i>Antioxidants</i>	Asid askorbik <i>Ascorbic acid</i>
B	Pewarna <i>Colouring</i>	Aspartam <i>Aspartame</i>
C	Pengawet <i>Preservatives</i>	Mononatrium glutamat <i>Monosodium glutamate</i>
D	Pemekat <i>Thickeners</i>	Sebatian Azo <i>Azo Compound</i>

2 (Q30, SPM 2021)

Rajah 15 menunjukkan satu proses dalam penyediaan suatu detergen.  
*Diagram 15 shows a process in the preparation of a detergent.*



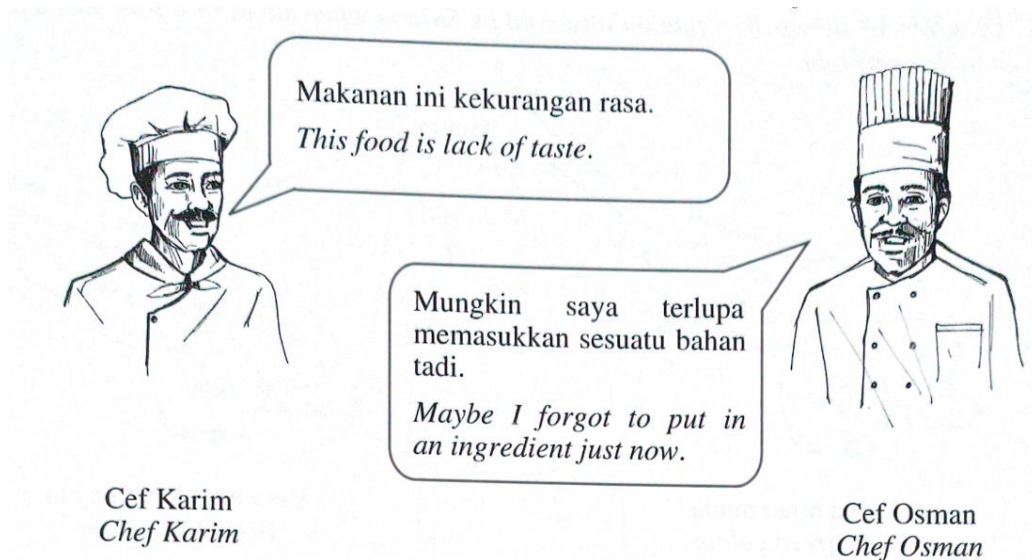
Rajah / Diagram 15

Apakah tindak balas X dan Y?  
*What are reactions X and Y?*

	X	Y
A	Pendehidratan <i>Dehydration</i>	Pensulfatan <i>Sulphation</i>
B	Pensulfatan <i>Sulphation</i>	Peneutralan <i>Neutralisation</i>
C	Peneutralan <i>Neutralisation</i>	Saponifikasi <i>Saponification</i>
D	Saponifikasi <i>Saponification</i>	Pendehidratan <i>Dehydration</i>

3 (Q26, SPM 2022)

Rajah 13 menunjukkan perbualan antara Cef Karim dan Cef Osman.  
*Diagram 13 shows a conversation between Chef Karim and Chef Osman.*



Rajah / Diagram 13

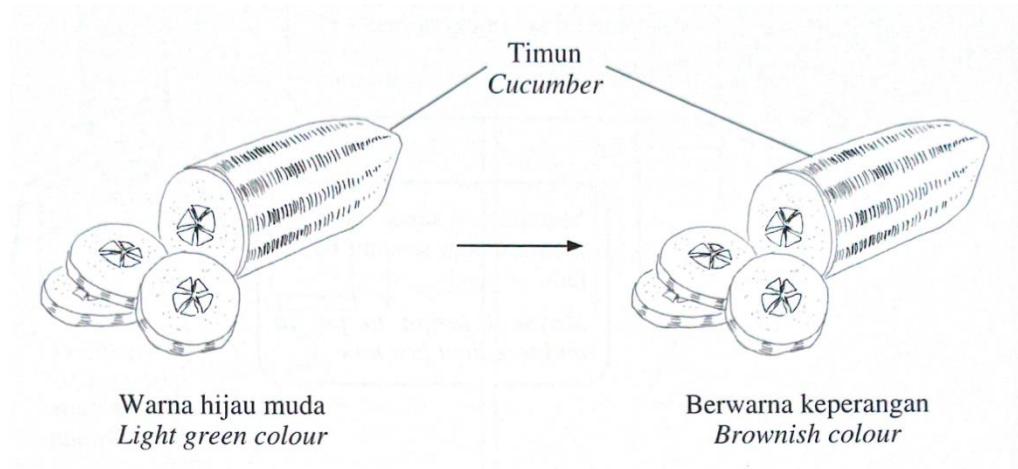
Antara yang berikut, bahan manakah yang dimaksudkan oleh Cef Osman?  
*Which of the following is the ingredient meant by Chef Osman?*

- A Aspartam  
*Aspartame*
- B Pektin  
*Pectin*
- C Lesitin  
*Lecithin*
- D Asid benzoik  
*Benzoic acid*

4 (Q27, SPM 2022)

Rajah 14 menunjukkan situasi yang diperhatikan oleh Suraya apabila hirisan sejenis buah dibiarkan di atas meja semalaman.

*Diagram 14 shows the situation observed by Suraya when slices of a fruit was left on a table overnight.*



Rajah / Diagram 14

Jika Suraya bercadang untuk menghasilkan produk kosmetik menggunakan buah tersebut, apakah jenis bahan asas lain yang perlu ditambah oleh Suraya untuk mengatasi masalah itu?

*If Suraya suggests to produce a cosmetic product using the fruit, what is another basic ingredient that should be added by Suraya to overcome that problem?*

- A Pengemulsi  
*Emulsifier*
- B Pemekat  
*Thickener*
- C Pengawet  
*Preservative*
- D Pelembap  
*Moisturiser*

5 (Q28, SPM 2022)

Rajah 15 menunjukkan sejenis produk daripada sebuah kilang.  
*Diagram 15 shows a type of product from a factory.*



Rajah / Diagram 15

Antara yang berikut, pernyataan manakah yang paling baik menerangkan bagaimana aplikasi teknologi nano dapat meningkatkan kualiti produk tersebut?

*Which of the following statements best explains how the application of nanotechnology can enhance the quality of the product?*

- A Menjadikan produk bersifat anti kedut  
*Make a product with anti wrinkles property*
- B Memastikan produk yang mudah meregang  
*Ensure a product that is easily stretchable*
- C Menghasilkan produk yang lebih kemas jahitannya  
*Manufacture a product that has more neat stitching*
- D Mengeluarkan produk dengan pelbagai warna yang lebih menarik  
*Produce a product with variety of more attractive colours*

6 (Q15, SPMRSM 2021)

Grafen mempunyai potensi yang sangat besar dalam industri bioperubatan, antaranya sebagai sensor dalam peranti untuk mengukur aras glukosa darah dengan kuantiti sampel yang kecil.

Pernyataan manakah yang paling baik menerangkan penggunaan grafen dalam pembuatan biosensor?

*Graphene has an enormous potential in biomedical industries, especially as sensor in a device to measure blood glucose level with a small quantity of sample.*

*Which statement best explains the use of graphene in making biosensor?*

- A Elektron bergerak lebih pantas  
*Electrons move faster*
- B Mempunyai luas permukaan yang besar  
*Has large surface area*
- C Lebih banyak elektron dapat dihasilkan  
*More electrons can be produced*
- D Mempunyai kekuatan mekanikal yang tinggi  
*Has high mechanical strength*

7 (Q30, SPMRSM 2021)

Rajah 10 menunjukkan potongan epal yang bertukar perang selepas 20 minit.  
*Diagram 10 shows a cut of apple that turns brown after 20 minutes.*



Rajah / Diagram 10

Mengapakah epal bertukar perang dan apakah jenis bahan tambah makanan yang sesuai digunakan untuk mengelakkannya?

*Why the apple turns brown and what is the suitable type of food additives can be used to prevent it?*

	<b>Sebab Reason</b>	<b>Bahan tambah makanan Food additives</b>
<b>A</b>	Pertumbuhan bakteria <i>The growth of bacteria</i>	Pengawet <i>Preservatives</i>
<b>B</b>	Pengoksidaan berlaku <i>Oxidation occurs</i>	Antioksidan <i>Antioxidants</i>
<b>C</b>	Kepekatan garam yang tinggi <i>High concentration of salt</i>	Perisa <i>Flavourings</i>
<b>D</b>	Sebatian azo wujud dalam epal <i>Azo compound presents in the apple</i>	Pewarna <i>Dyes</i>

8 (Q14, SPMRSM 2022)

Jadual 1 menunjukkan jenis dan fungsi bahan tambah makanan.

*Table 1 shows the types and functions of food additives.*

	<b>Jenis Type</b>	<b>Fungsi Functions</b>
<b>I</b>	Antioksidan <i>Antioxidant</i>	Mencegah ketengikan makanan yang berminyak atau berlemak <i>Prevent oily or greasy food from becoming rancid</i>
<b>II</b>	Perisa <i>Flavouring</i>	Meningkatkan rasa makanan <i>Enhances the flavour of foods</i>
<b>III</b>	Pengemulsi <i>Emulsifier</i>	Memberikan tekstur yang sekata dan licin <i>Gives uniformed and smooth texture</i>
<b>IV</b>	Pengawet <i>Preservative</i>	Menghalang tindakbalas pengoksidaan makanan bergaram oleh oksigen <i>Prevents oxidation of the salty food by oxygen</i>

Jadual / Table 1

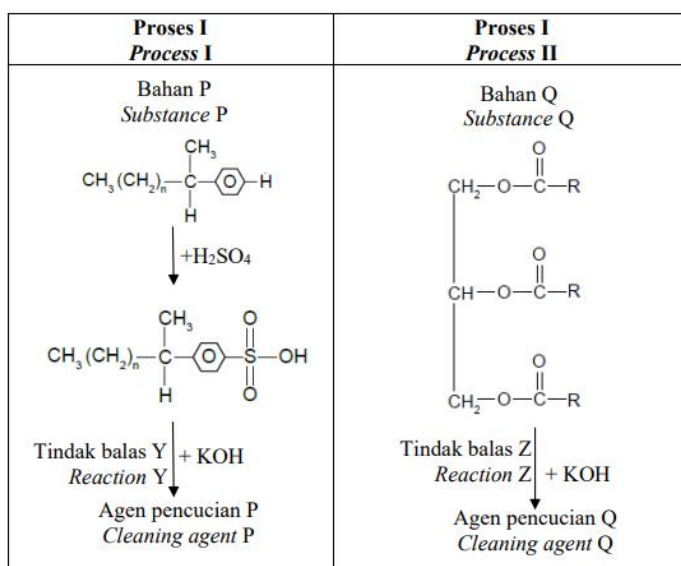
Antara pilihan jawapan di bawah yang manakah dipadankan dengan betul?  
*Which of the following are correctly matched?*

- A I dan II  
*I and II*
- B I dan III  
*I and III*
- C II dan IV  
*II and IV*
- D III dan IV  
*III and IV*

9 (Q24, SPMRSM 2022)

Rajah 14 menunjukkan proses dalam penyediaan dua jenis bahan pencuci berbeza.

*Diagram 14 shows processes in the preparation of two different types of cleaning agents.*



Rajah / *Diagram 14*

Apakah bahan P, bahan Q, tindak balas Y dan tindak balas Z?

*What are substance P, substance Q, reaction Y and reaction Z?*

	P	Q	Y	Z
<b>A</b>	Minyak sawit <i>Palm oil</i>	Alkil benzena <i>Alkyl benzene</i>	Pensulfonan <i>Sulphonation</i>	Peneutralan <i>Neutralisation</i>
<b>B</b>	Minyak sawit <i>Palm oil</i>	Alkil benzena <i>Alkyl benzene</i>	Pensulfonan <i>Sulphonation</i>	Saponifikasi <i>Saponification</i>
<b>C</b>	Alkil benzena <i>Alkyl benzene</i>	Minyak sawit <i>Palm oil</i>	Saponifikasi <i>Saponification</i>	Peneutralan <i>Neutralisation</i>
<b>D</b>	Alkil benzena <i>Alkyl benzene</i>	Minyak sawit <i>Palm oil</i>	Peneutralan <i>Neutralisation</i>	Saponifikasi <i>Saponification</i>

10 (Q11, SBP 2021)

Penemuan grafen membuka lembaran baru dalam bidang nanoteknologi. Pelbagai aplikasi sedia ada dapat ditambah baik atau diganti dengan grafen yang mempunyai ciri-ciri unggul dan istimewa.

Antara berikut, yang manakah betul tentang sifat fizik grafen?

*The discovery of graphene has opened a new chapter in the field of nanotechnology. Various existing applications can be improved or replaced with graphene that has superior and distinctive characteristics. Which of the following is correct about the physical property of graphene?*

- A Bersifat tidak telap  
Impermeable
- B Keras tetapi rapuh  
Hard but brittle
- C Penebat elektrik  
Electrical insulator
- D Penebat haba  
Heat insulator

11 (Q25, SBP 2021)

Puan Linda menggunakan kosmetik X pada wajahnya yang mengalami ruam dan iritasi. Dia juga mengalami kerosakan pada buah pinggang setelah lama menggunakan kosmetik X.

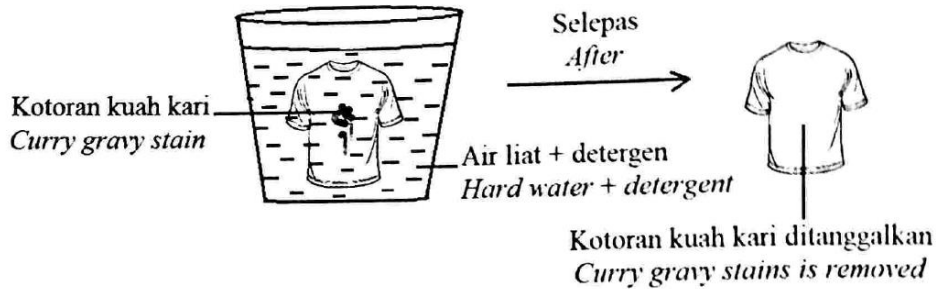
Apakah bahan kimia dalam kosmetik X yang menyebabkan kesan yang dialami oleh Puan Linda.

*Puan Linda applied cosmetic X on her face that had rashes and irritation. She also suffered kidney damage after using cosmetic X for a long time. Which of the following chemicals in cosmetic X causes the effect experienced by Puan Linda?*

- A Betamethasone valerate  
*Betamamethasone valerate*
- B Hidrokuinon  
*Hydroquinone*
- C Tretinoin  
*Tretinoin*
- D Merkuri  
*Mercury*

12 (Q30, SBP 2021)

Rajah 30 menunjukkan pemerhatian ke atas tindakan pencucian oleh detergen.  
*Diagram 30 shows the cleansing action of detergent.*



Rajah / Diagram 30

Antara berikut, yang manakah bahan tambah dalam detergen yang menyebabkan perubahan itu?

*Which of the following additives in detergent causes the changes?*

- A Pemutih optik  
Optical whitener
- B Enzim biologi  
Biological enzyme
- C Agen antienapan  
Anti-suspension agent
- D Agen pengawal buih  
Foam control agent

13 (Q15, SBP 2022)

Antara yang berikut, manakah turutan yang betul bagi rawatan air sisa menggunakan Teknologi Hijau?

*Which of the following is the correct sequence in waste water treatment using Green Technology?*

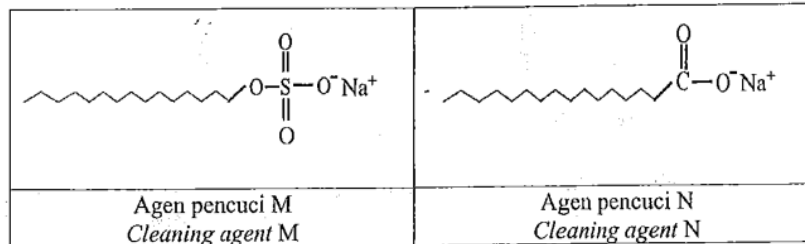
- A Pengasingan sisa pepejal → Proses elektro-penggumpalan → Proses pengasingan pepejal dan air sisa → Pengumpulan enapcemar  
*Screening of solid waste → Electrocoagulation process → Solid and wastewater settling process → Collection of sludge*
- B Pengasingan sisa pepejal → Proses pengasingan pepejal dan air sisa → Proses elektro-penggumpalan → Pengumpulan enapcemar  
*Screening of solid waste → Solid and waste water settling process → Electrocoagulation process → Collection of sludge*
- C Proses pengasingan pepejal dan air sisa → Pengumpulan enapcemat - Pengasingan sisa pepejal → Proses elektro-penggumpalan  
*Solid and waste water settling process → Collection of sludge → Screening of solid waste → Electrocoagulation process*
- D Proses pengasingan pepejal dan air sisa → Pengasingan sisa pepejal - Pengumpulan enapcemar → Proses elektro-penggumpalan  
*Solid and wastewater settling process → Screening of solid waste collection of sludge → Electrocoagulation process*



14 (Q29, SBP 2022)

Antara berikut, pernyataan manakah yang betul tentang agen pencuci M dan agen pencuci N?

*Diagram 7 shows the structural formulae of two cleaning agents. Which of the following statements is correct about cleaning agents M and N?*



Rajah / Diagram 7

- A** Agen pencuci M larut dalam gris manakala agen pencuci N tidak larut dalam gris  
*Cleaning agent M is soluble in grease while cleaning agent N is insoluble in grease*
- B** Agen pencuci M tidak berkesan dalam air berasid manakala agen pencuci N berkesan dalam air berasid  
*Cleaning agent M is not effective in acidic water while cleaning agent N is effective in acidic water*
- C** Agen pencuci M dihasilkan melalui saponifikasi manakala agen pencuci N dihasilkan melalui pengulfonan  
*Cleaning agent M is produced through saponification while cleaning agent N is produced through sulphation*
- D** Agen pencuci M tidak membentuk kekat dalam air liat manakala agen pencuci N membentuk kekat dalam air liat  
*Cleaning agent M does not form scum in hard water while cleaning agent N forms scum in hard water*

15 (Q30, SBP 2022)

Anisah mengalami hidung berair dan dia berasa tidak selesa dengan keadaan ini. Antara berikut, ubat manakah yang perlu dipreskripsi oleh doktor untuk mengatasi masalahnya?

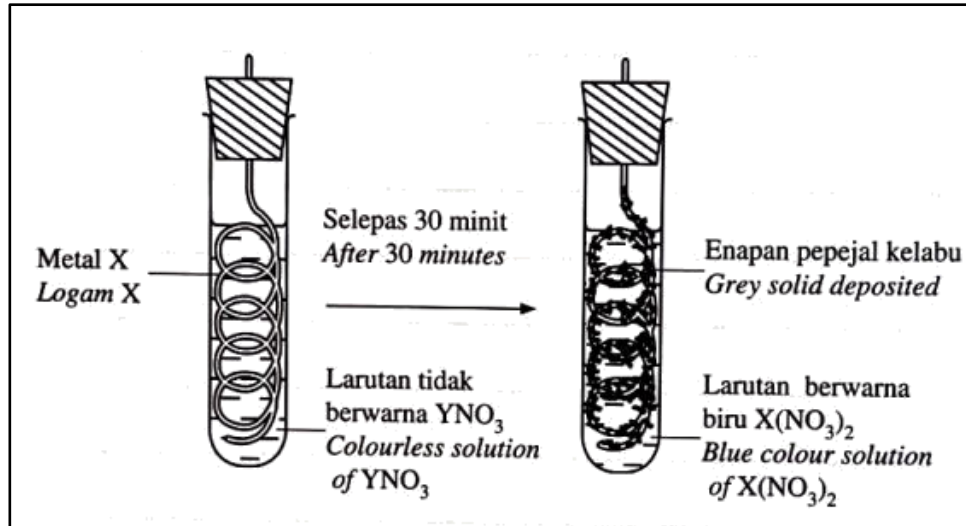
*Anisah experiences a runny nose and she feels uncomfortable with the situation. Which of the following medicines should be prescribed by the doctor to overcome her problem?*

- A** Aspirin  
*Aspirin*
- B** Streptomisin  
*Streptomycin*
- C** Antihistamin  
*Antihistamines*
- D** Klorpromazin  
*Chlorpromazine*

BAB 1: KESEIMBANGAN REDOKS

1 (Q11, SPM 2021)

- (a) Rajah 8.1 menunjukkan suatu eksperimen untuk mengkaji tindak balas redoks.  
*Diagram 8.1 shows the results of an experiment to study a redox reaction.*

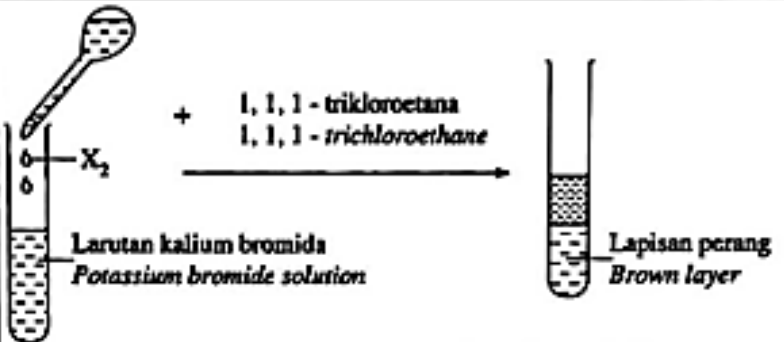
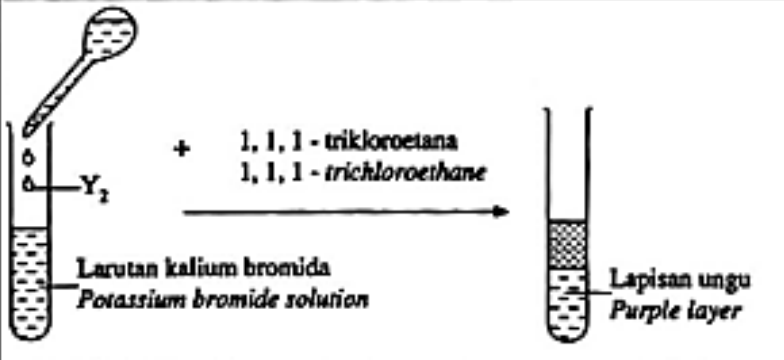
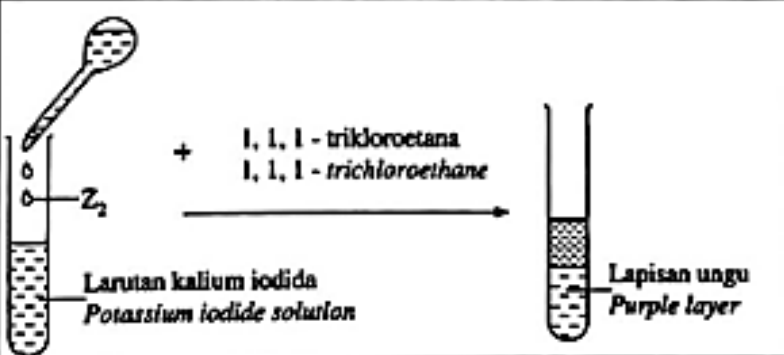


Rajah / Diagram 8.1

- (i) Apakah maksud bagi tindak balas redoks?  
*What is meant by redox reaction?*
- [1 markah]
- (ii) Berdasarkan Rajah 8.1, nyatakan logam X dan larutan  $YNO_3$ .  
Tulis persamaan kimia bagi tindak balas yang berlaku.  
*Based on Diagram 8.1, state metal X and  $YNO_3$  solution. Write the chemical equation for the redox reaction occurs.*

[4 markah]

- (b) Rajah 8.2 menunjukkan semua radas bagi mengkaji tindak balas redoks dalam penyésaran halogen.  
*Diagram 8.2 shows the apparatus set-up to study a redox reaction in displacement of halogen.*

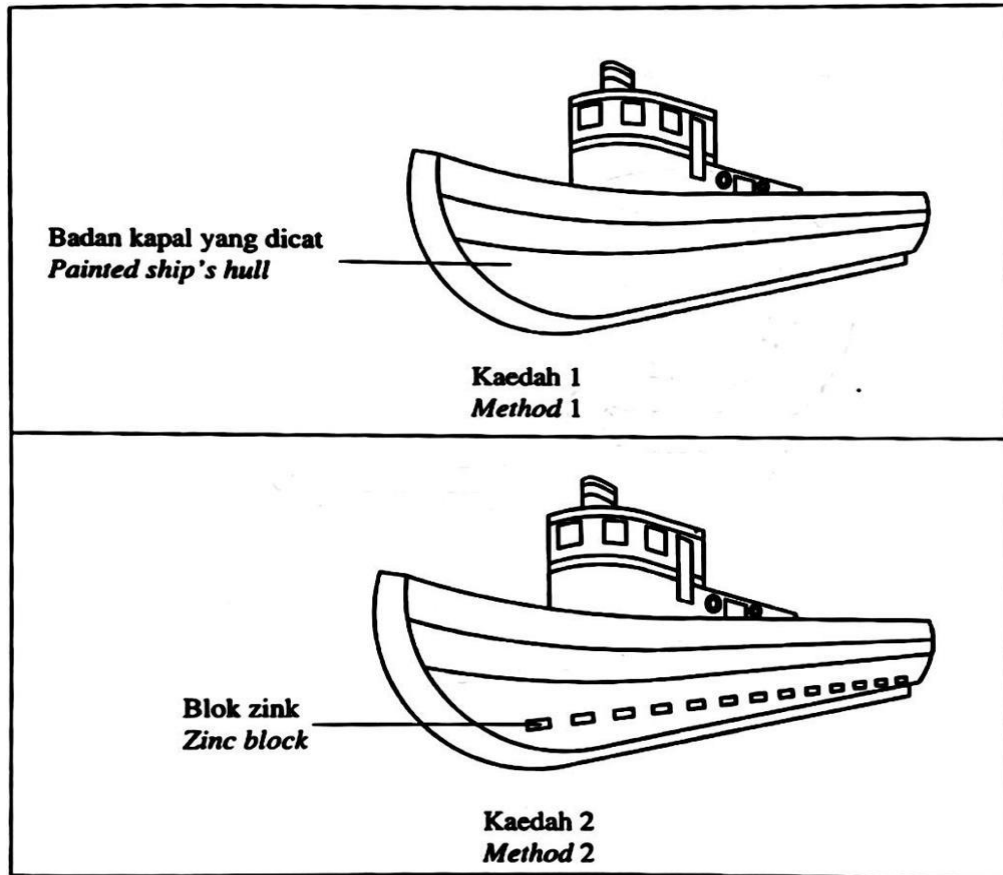
Eksperimen Experiment	Pemerhatian Observation
<p>I</p>  <p><math>X_2</math></p> <p>+ 1, 1, 1 - trikloroetana 1, 1, 1 - trichloroethane</p> <p>Larutan kalium bromida Potassium bromide solution</p> <p>Lapisan perang Brown layer</p>	
<p>II</p>  <p><math>Y_2</math></p> <p>+ 1, 1, 1 - trikloroetana 1, 1, 1 - trichloroethane</p> <p>Larutan kalium bromida Potassium bromide solution</p> <p>Lapisan ungu Purple layer</p>	
<p>III</p>  <p><math>Z_2</math></p> <p>+ 1, 1, 1 - trikloroetana 1, 1, 1 - trichloroethane</p> <p>Larutan kalium iodida Potassium iodide solution</p> <p>Lapisan ungu Purple layer</p>	

Rajah / Diagram 8.2

Berdasarkan Rajah 8.2, kenal pasti halogen X, Y dan Z. Pilih **dua** eksperimen di mana tindak balas redoks berlaku. Tulis setengah persamaan pengoksidaan dan setengah persamaan penurunan daripada satu eksperimen yang anda pilih.  
*Based on Diagram 8.2, identify halogens X, Y and Z. Choose **two** experiments which redox reaction occurs. Write the oxidation half equation and reduction half equation from one of the experiments that you have chosen.*

[7 markah]  
[7 mark]

- (c) Rajah 8.3 menunjukkan dua kaedah yang boleh digunakan untuk melindungi dasar sebuah kapal daripada terkakis.  
*Diagram 8.3 shows two methods that can be used to protect the hull of the ships from corrodes.*



Rajah / Diagram 8.3

Anda ditugaskan untuk menilai kaedah yang lebih sesuai untuk melindungi dasar kapal itu daripada terkakis.

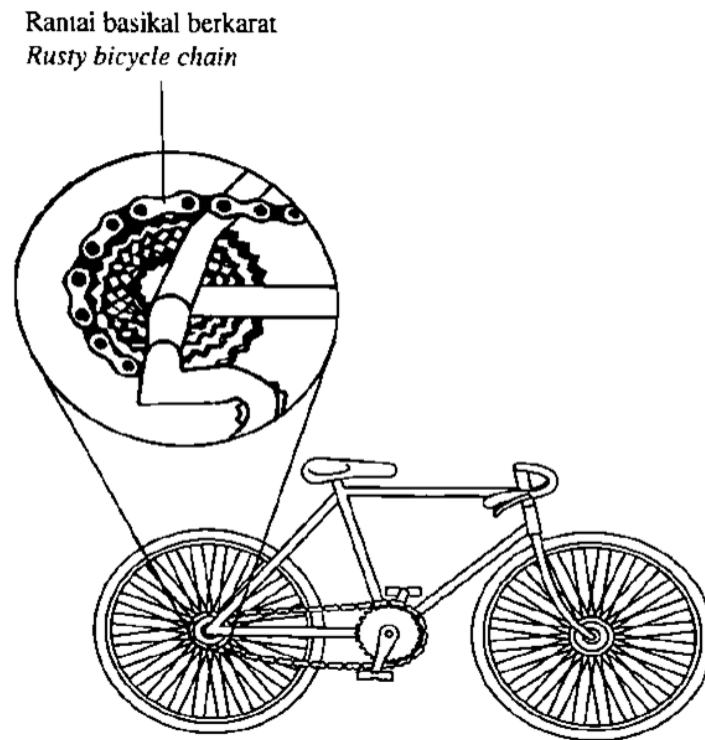
Nyatakan pilihan anda berdasarkan Rajah 8.3 dan wajarkan jawapan anda.

*You are assigned to evaluate which method is more suitable to protect the hull of the ship from corrodes.*

*State your choice based on the Diagram 8.3 and justify your answer.*

[2 markah]

- (d) Rajah 8.4 menunjukkan sebuah basikal lama yang tidak boleh bergerak disebabkan rantai basikal yang berkarat.  
*Diagram 8.4 shows an old bicycle which is unable to move due to the rusty chain.*



Rajah / Diagram 8.4

Cadangkan dan terangkan cara untuk mengatasi masalah tersebut supaya basikal itu boleh digunakan semula.

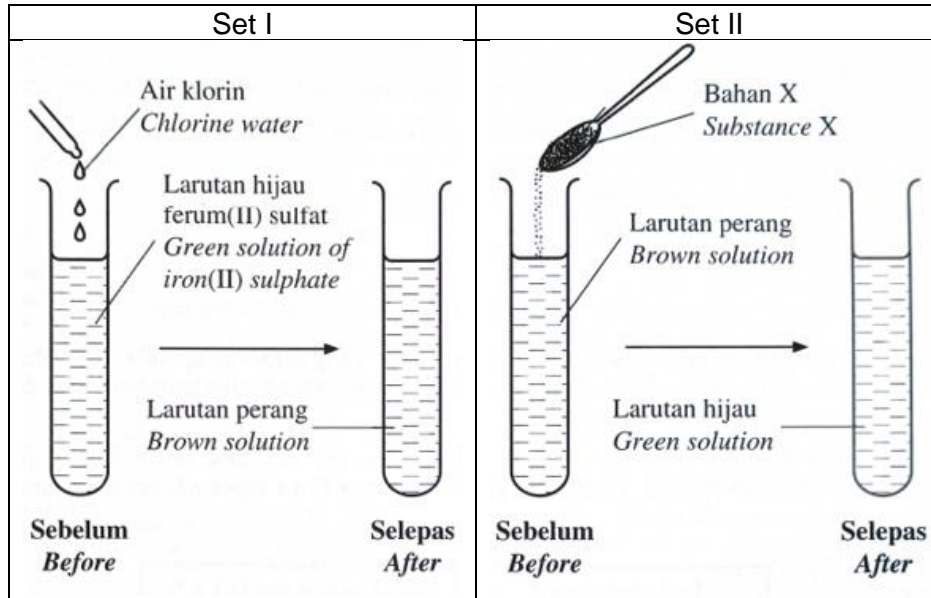
*Suggest and explain way to overcome the problem so that the bicycle can be used again.*

[6 markah]

2 (Q6, SPM 2022)

Rajah 4 menunjukkan dua tindak balas redoks bagi Set I and Set II. Larutan perang dari Set I digunakan untuk tindak balas dalam set II.

Diagram 4 shows two redox reactions for Set I and Set II. The brown solution from Set I is used for reaction in Set II.



Rajah / Diagram 4

- (a) Apakah maksud tindak balas redoks?  
*What is the meaning of redox reaction?*

.....  
[1 markah]

- (b) Berdasarkan Set I,  
*Based on Set I*
- (i) bahan manakah yang mengalami pengoksidaan?  
*which substance undergoes oxidation?*

.....  
[1 markah]

- (ii) tulis setengah persamaan bagi tindak balas pengoksidaan.  
*write half equation for the oxidation reaction.*

.....  
[1 markah]

- (iii) hitung nombor pengoksidaan bagi sulfur dalam larutan ferum(II) sulfat.  
*calculate the oxidation number of sulphur in iron(II) sulphate solution.*

[2 markah]

- (c) (i) Berdasarkan Rajah 4, cadangkan bahan X dan tentukan peranan larutan hijau dalam Set I dan larutan perang dalam Set II.  
*Based on Diagram 4, suggest substance X and determine the role of green solution in Set I and the role of brown solution in Set II.*

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

[3 markah]

- (ii) Tulis setengah persamaan bagi tindak balas yang berlaku pada bahan X.  
*Write half equation for the reaction that occurs on substance X.*

.....

[1 markah]

**3** (Q7, SPMRSM 2021)

Jadual 7 menunjukkan nilai keupayaan elektrodpiawai,  $E^0$  bagi beberapa sel setengah yang boleh digunakan untuk menjawab soalan-soalan berikut.

*Table 7 shows values of standard electrode potential,  $E^0$  for several half-cells that can be used to answer the following questions.*

<b>Half-cell equation <i>Persamaan sel setengah</i></b>	<b><math>E^0</math> (V)</b>
$Mg^{2+}(ak) + 2e \rightleftharpoons Mg(p)$ $Mg^{2+}(aq) + 2e \rightleftharpoons Mg(s)$	-2.38
$Sn^{2+}(ak) + 2e \rightleftharpoons Sn(p)$ $Sn^{2+}(aq) + 2e \rightleftharpoons Sn(s)$	-0.14
$Pb^{2+}(ak) + 2e \rightleftharpoons Pb(p)$ $Pb^{2+}(aq) + 2e \rightleftharpoons Pb(s)$	-0.13
$Cu^{2+}(ak) + 2e \rightleftharpoons Cu(p)$ $Cu^{2+}(aq) + 2e \rightleftharpoons Cu(s)$	+0.34
$Ag^+(ak) + e \rightleftharpoons Ag(p)$ $Ag^+(aq) + e \rightleftharpoons Ag(s)$	+0.80

**Jadual / Table 7**

- (a) Apakah yang dimaksudkan dengan tindak balas redoks?  
*What is meant by redox reaction?*

.....  
.....

[1 markah]

(b) Berdasarkan keupayaan elektrod piawai dalam Jadual 7,  
*Based on standard electrode potential in Table 7,*

(i) Nyatakan agen penurunan paling kuat.  
*State the strongest reducing agent.*

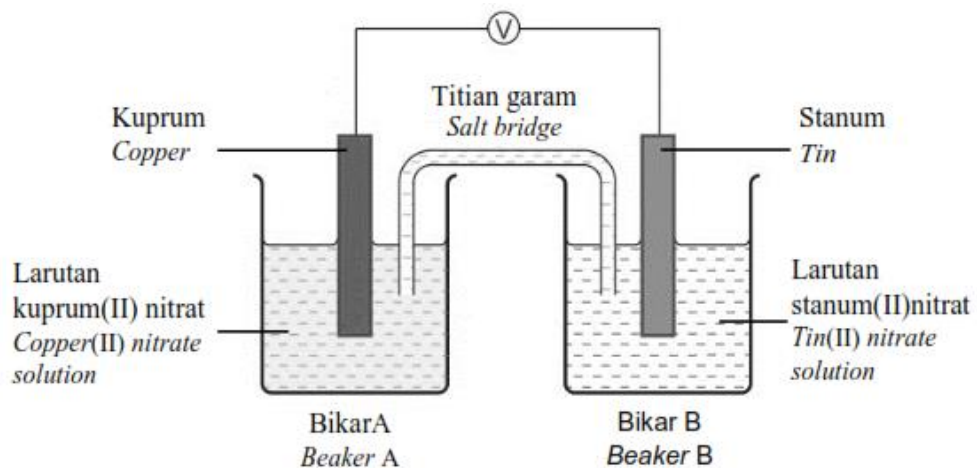
.....  
[1 markah]

(ii) Hitungkan nombor pengoksidaan bagi kromium dalam  $\text{Cr}_2\text{O}_7^{2-}$ .  
*Calculate the oxidation number of chromium in  $\text{Cr}_2\text{O}_7^{2-}$ .*

[1 markah]

(c) Rajah 7 menunjukkan sel kimia yang dihasilkan dengan menggabungkan dua sel setengah.

*Diagram 7 shows a chemical cell constructed by combining two half-cells.*



**Rajah / Diagram 7**

(i) Apakah yang akan anda perhatikan dalam Bikar A selepas 30 minit?  
*What would you observe in Beaker A after 30 minutes?*

.....  
[1 markah]

(ii) Elektrod yang manakah akan mengalami pengoksidaan?  
Terangkan jawapan anda berdasarkan keupayaan elektrod piawai.  
*Which electrode will undergo oxidation?  
Explain your answer in terms of standard electrode potential.*

.....  
[2 markah]



- (iii) Tuliskan notasi sel bagi sel kimia dalam Rajah 7 dan hitungkan nilai voltan sel,  $E^0_{\text{sel}}$  tersebut.  
*Write the cell notation for the voltaic cell in Diagram 7 and calculate the voltage of the cell,  $E^0_{\text{cell}}$ .*

[2 markah]

- (iv) Berdasarkan jawapan anda di 7(c)(iii), huraikan bagaimana anda dapat meningkatkan nilai voltan bagi sel kimia tersebut?  
*Based on your answer in 7(c)(iii), describe how can you increase the voltage of the cell?*

.....

.....

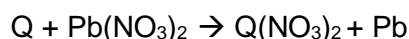
.....

[2 markah]

**4 (Q8, SPMRSM 2021)**

Persamaan kimia berikut mewakili tindak balas penyerasan antara logam Q dengan larutan plumbum(II) nitrat.

*The following chemical equation represents a displacement reaction between metal Q and lead(II) nitrate solution.*



Diberi nilai keupayaan elektrod berikut.

*Given the following electrode potential values.*

Zn <sup>2+</sup> (ak) + 2e ⇌ Zn(p) Zn <sup>2+</sup> (aq) + 2e ⇌ Zn(s)	E <sup>0</sup> = -0.76 V
Pb <sup>2+</sup> (ak) + 2e ⇌ Pb(p) Pb <sup>2+</sup> (aq) + 2e ⇌ Pb(s)	E <sup>0</sup> = -0.13 V
Cu <sup>2+</sup> (ak) + 2e ⇌ Cu(p) Cu <sup>2+</sup> (aq) + 2e ⇌ Cu(s)	E <sup>0</sup> = +0.34 V

- (a) (i) Cadangkan logam Q.  
*Suggest metal Q.*

.....

[1 markah]

- (ii) Habanya penyesaran bagi tindakbalas tersebut ialah  $-112 \text{ kJ mol}^{-1}$ .  
Hitungkan perubahan suhu apabila serbuk Q berlebihan ditambahkan kepada  $100 \text{ cm}^3$  larutan plumbum(II) nitrat  $0.5 \text{ mol dm}^{-3}$ .  
[Muatan haba tentu larutan =  $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ ;  
Ketumpatan larutan =  $1.0 \text{ g cm}^{-3}$ ]

*The heat of displacement for the reaction is  $-112 \text{ kJ mol}^{-1}$ .  
Calculate the change in temperature when excess Q powder is added to  $100 \text{ cm}^3$  of  $0.5 \text{ mol dm}^{-3}$  lead(II) nitrate solution.  
[Specific heat capacity of a solution =  $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ ;  
Density of solution =  $1.0 \text{ g cm}^{-3}$ ]*

[3 markah]

- (b) Jadual 8 menunjukkan haba peneutralan bagi tindakbalas antara larutan kalium hidroksida dengan dua jenis asid yang berlainan.  
*Table 8 shows the heat of neutralisation of the reaction between potassium hydroxide solution with two different types of acids.*

<b>Bahan tindak balas Reactants</b>	<b>Haba peneutralan (<math>\text{kJ mol}^{-1}</math>) Heat of neutralisation (<math>\text{kJ mol}^{-1}</math>)</b>
Asid R + larutan kalium hidroksida <i>Acid R + potassium hydroxide solution</i>	-55
Asid S + larutan kalium hidroksida <i>Acid S + potassium hydroxide solution</i>	-57

**Jadual / Table 8**

- (i) Cadangkan asid R dan asid S.  
*Suggest acid R and acid S.*

Asid R: .....  
*Acid R*

Asid S: .....  
*Acid S*

[2 markah]

- (ii) Berdasarkan jawapan di 8(b)(i), tuliskan persamaan termokimia bagi tindak balas antara asid R dengan larutan kalium hidroksida.  
*Based on your answer in 8(b)(i), write the thermochemical equation of the reaction between acid R and potassium hydroxide solution.*

.....

.....  
[2 markah]

- (iii) Nilai haba penutralan bagi kedua-dua tindak balas adalah berbeza. Terangkan mengapa.  
*The value of heat of neutralisation for both reactions are different. Explain why.*

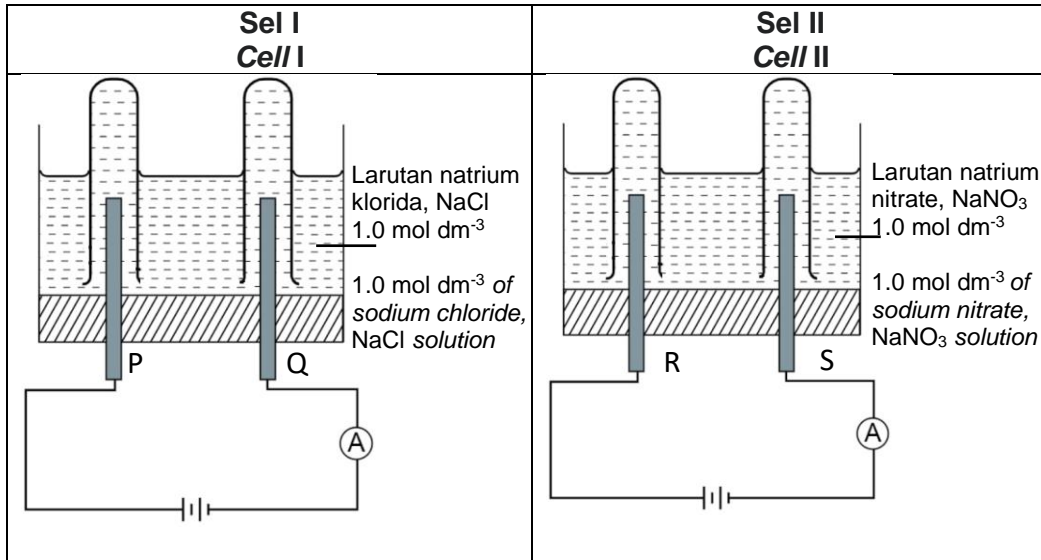
.....

.....  
[2 markah]

5 (Q8, SPMRSM 2022)

Rajah 8 menunjukkan elektrolisis larutan natrium klorida, NaCl dan natrium nitrat, NaNO<sub>3</sub> dengan menggunakan elektrod-elektrod karbon.

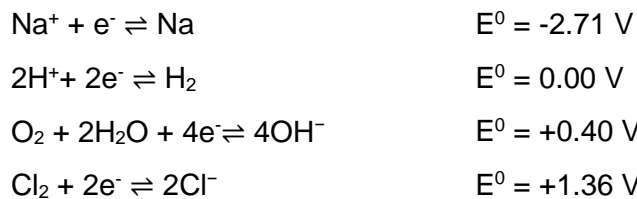
Diagram 8 shows the electrolysis of sodium chloride, NaCl solution and sodium nitrate, NaNO<sub>3</sub> solution using carbon electrodes.



Rajah / Diagram 8

Diberi nilai keupayaan elektrod piawai berikut.

Given the following standard electrode potential value.



(a) Berdasarkan Sel I,  
Based on Cell I,

(i) Nyatakan semua anion yang hadir dalam larutan natrium klorida, NaCl. State all anions present in sodium chloride, NaCl solution.

.....  
[1 markah]

(ii) Namakan hasil yang terbentuk pada elektrod P  
Name the product formed at electrode P.

.....  
[1 markah]

- (iii) Terangkan jawapan anda berdasarkan pemilihan ion yang dinyahcas di 8(a)(ii).  
*Explain your answer based on the selection of ions to be discharged in 8(a)(ii).*

[1 markah]

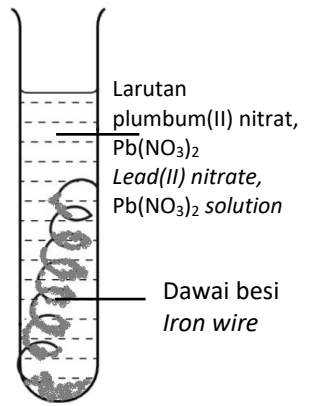
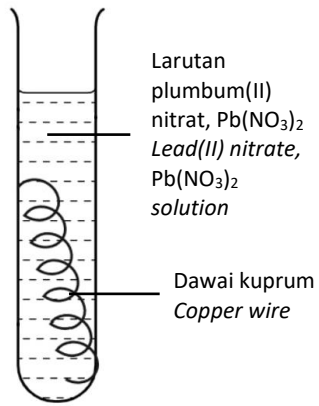
- (iii) Huraikan satu ujian kimia bagi menentusahkan hasil yang terbentuk pada elektrod P.  
*Describe a chemical test to verify the product formed at P electrode.*

[2 markah]

- (b) Tuliskan setengah persamaan pada elektrod R dalam Sel II.  
*Write half equation at R electrode in Cell II.*

[1 markah]

- (c) Jadual 8 menunjukkan suatu eksperimen untuk mengkaji tindak balas penyesanan logam.  
*Table 8 shows an experiment to investigate the displacement of metals.*

Tabung uji <i>Test tube</i>	I	II
	 <p style="text-align: center;">Larutan plumbum(II) nitrat, <math>Pb(NO_3)_2</math> <i>Lead(II) nitrate,</i> <math>Pb(NO_3)_2</math> solution</p> <p style="text-align: center;">Dawai besi <i>Iron wire</i></p>	 <p style="text-align: center;">Larutan plumbum(II) nitrat, <math>Pb(NO_3)_2</math> <i>Lead(II) nitrate,</i> <math>Pb(NO_3)_2</math> solution</p> <p style="text-align: center;">Dawai kuprum <i>Copper wire</i></p>
Pemerhatian <i>Observation</i>	Pepejal kelabu terbentuk <i>Grey solid formed</i>	Tiada perubahan <i>No changes</i>

Jadual / Table 8

- (i) Berdasarkan Jadual 8,  
Bandingkan dan terangkan perbezaan dalam pemerhatian.  
*Based on Table 8,  
Compare and explain the difference in the observations.*

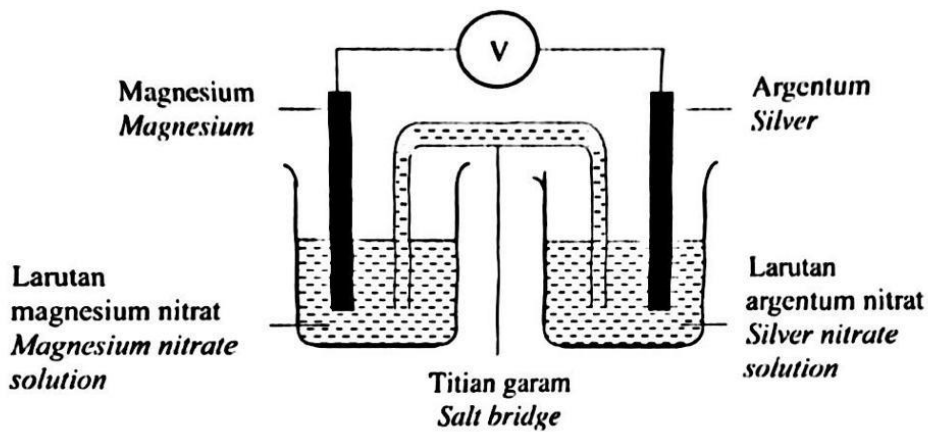
.....  
.....  
.....  
[3 markah]

- (ii) Berdasarkan jawapan anda di 8(c)(i), cadangkan satu langkah yang  
perlu diambil bagi memastikan tindak balas berlaku dalam tabung uji II.  
*Based on your answer in 8(c)(i), suggest an action to be taken to  
ensure reaction occurs in test tube II.*

.....  
.....  
[1 markah]

6 (Q11, SBP 2021)

Rajah 11.1 menunjukkan susunan radas bagi satu sel kimia.  
*Diagram 11.1 shows the apparatus set-up for a chemical cell.*



Rajah / Diagram 11.1

- (a) Apakah yang dimaksudkan dengan tindak balas redoks?  
*What is meant by redox reaction?*

.....  
[1 markah]

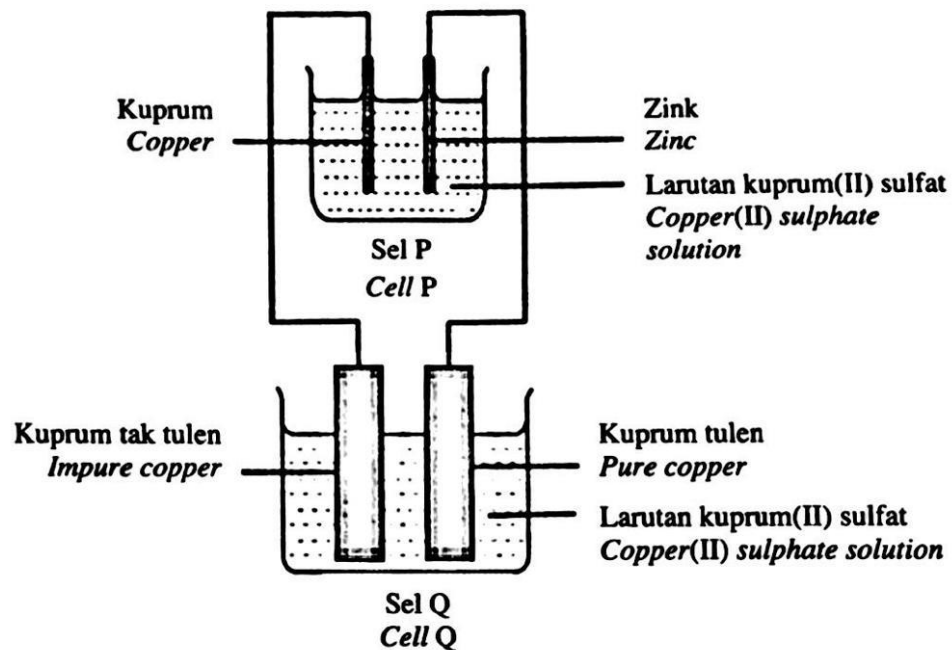
- (b) Berdasarkan Rajah 11.1,  
*Based on Diagram 11.1,*
- (i) Kenal pasti terminal negatif dan terminal positif bagi sel itu.  
*Identify the negative terminal and positive terminal of the cell.*
  - (ii) Tuliskan persamaan ion keseluruhan bagi tindak balas itu.  
*Write the overall ionic equation for the reaction.*
  - (iii) Tuliskan notasi sel bagi sel itu.  
*Write the cell notation of the cell.*

Nilai  $E^\circ$  bagi dua sel setengah itu adalah:  
*The  $E^\circ$  value for the two half-cells are:*

$\text{Mg}^{2+} (\text{ak/aq}) + 2\text{e} \rightleftharpoons \text{Mg}(\text{p/s})$	$E^\circ = -2.38 \text{ V}$
$\text{Ag}^+ (\text{ak/aq}) + \text{e} \rightleftharpoons \text{Ag}(\text{p/s})$	$E^\circ = +0.80 \text{ V}$

[6 markah]

- (c) Rajah 11.2 menunjukkan susunan radas untuk menuliskan logam kuprum.  
*Diagram 11.2 shows the apparatus set-up to purify copper metal.*



Rajah / Diagram 11.2

**PRAKTIS TOPIKAL: KERTAS 2**  
**BPM 2023**

Berdasarkan Rajah 11.2, bandingkan pemerhatian pada warna elektrolit dalam sel P dan sel Q selepas 30 minit. Terangkan jawapan anda.

*Based on Diagram 11.2, compare the observations on the colour of electrolytes in cell P and cell Q after 30 minutes. Explain your answer.*

Nilai  $E^\circ$  bagi beberapa sel setengah adalah:

*The  $E^\circ$  value for a few half-cells are:*

$\text{Zn}^{2+} (\text{ak/aq}) + 2\text{e} \rightleftharpoons \text{Zn}(\text{p/s})$	$E^\circ = -0.76 \text{ V}$
$2\text{H}^+ (\text{ak/aq}) + 2\text{e} \rightleftharpoons \text{H}_2(\text{p/s})$	$E^\circ = 0.00 \text{ V}$
$\text{O}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{ce/l}) + 4\text{e} \rightleftharpoons 4\text{OH}^- (\text{ak/aq})$	$E^\circ = +0.40 \text{ V}$
$\text{S}_2\text{O}_8^{2-} (\text{ak/aq}) + 2\text{e} \rightleftharpoons 2\text{SO}_4^{2-} (\text{ak/aq})$	$E^\circ = +2.01 \text{ V}$

[5 markah]  
[5 marks]



- (d) Jadual 11 menunjukkan sebahagian daripada siri keupayaan elektrod piawai. *Table 11 shows part of the standard electrode potential series.*

Persamaan sel setengah <i>Half-cell equation</i>	$E^\circ / \text{V}$ (298 K)
$\text{Mg}^{2+} (\text{ak/aq}) + 2e \rightleftharpoons \text{Mg}(\text{p/s})$	$E^\circ = -2.38$
$\text{Zn}^{2+} (\text{ak/aq}) + 2e \rightleftharpoons \text{Zn}(\text{p/s})$	$E^\circ = -0.76$
$\text{Fe}^{2+} (\text{ak/aq}) + 2e \rightleftharpoons \text{Fe}(\text{p/s})$	$E^\circ = -0.44$
$2\text{H}^+ (\text{ak/aq}) + 2e \rightleftharpoons \text{H}_2(\text{p/s})$	$E^\circ = 0.00$
$\text{Cu}^{2+} (\text{ak/aq}) + 2e \rightleftharpoons \text{Cu}(\text{p/s})$	$E^\circ = +0.34$

Jadual / *Table 11*

Rajah 11.3 menunjukkan senarai bahan dan radas yang dibekalkan untuk membina satu sel kimia.

*Diagram 11.3 shows the list of materials and apparatus provided to construct a voltaic cell.*

Tomato <i>Tomato</i>	Wayar penyambung <i>Connecting wire</i>	Mentol LED <i>LED bulb</i>
Paku besi <i>Iron nail</i>	Kepingan zink <i>Zinc strip</i>	Wayar kuprum <i>Copper wire</i>
Sudu plastik <i>Plastic spoon</i>	Kepingan magnesium <i>Magnesium strip</i>	Rod karbon <i>Carbon rod</i>
	Kertas pasir <i>Sandpaper</i>	

**Rajah / *Diagram 11.3***

Dengan menggunakan pengetahuan kimia anda, lukis susunan radas sel kimia yang dapat menyalakan mentol LED. Susunan radas yang dibina perlulah menggunakan bahan dan radas yang sesuai daripada senarai dalam Rajah 11.3. Huraikan secara ringkas langkah pembinaan sel kimia itu dan terangkan tindak balas redoks yang berlaku. Kemudian, tentukan nilai bacaan voltan yang diperolehi.

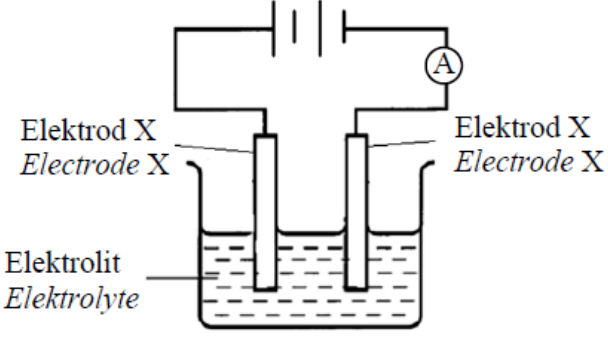
*By using your chemistry knowledge, draw the apparatus set-up of a voltaic cell that can light up an LED bulb. The apparatus set-up constructed should use suitable materials and apparatus given in Diagram 11.3. Describe briefly the steps of constructing the voltaic cell and explain the redox reaction that takes place. Then, determine the value of the voltage reading obtained.*

[8 markah]

7 (Q7, SBP 2022)

Jadual 7.1 menunjukkan susunan radas dan pemerhatian bagi satu proses elektrolisis.

Table 7.1 shows the apparatus set-up and observation for the electrolysis process.

Susunan radas <i>Apparatus set-up</i>		Pemerhatian <i>Observations</i>	
		Anod <i>Anode</i>	Elektrod menipis <i>Electrode becomes thinner</i>
		Katod <i>Cathode</i>	Pepejal kelabu berkilat terenap <i>Shiny grey solid is deposited</i>

Jadual 7.2 menunjukkan nilai  $E^0$  bagi beberapa sel setengah.

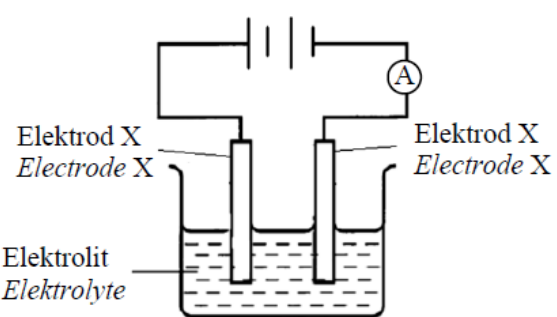
Table 7.2 shows the  $E^0$  value for a few half-cells.

Tindak balas sel setengah <i>Half-cell equation</i>	Nilai $E^0$ (V) <i><math>E^0</math> value (V)</i>
$\text{Na}^+_{(ak/aq)} + e \rightleftharpoons \text{Na}_{(p/s)}$	- 2.71
$2\text{H}^+_{(ak/aq)} + 2e \rightleftharpoons \text{H}_{2(g)}$	0.00
$\text{O}_{2(g)} + 2\text{H}_2\text{O}_{(ce/l)} + 4e \rightleftharpoons 4\text{OH}^-_{(ak/aq)}$	+0.40
$\text{Ag}^+_{(ak/aq)} + e \rightleftharpoons \text{Ag}_{(p/s)}$	+0.80
$\text{NO}_3^-_{(ak/aq)} + 4\text{H}^+_{(ak/aq)} + 3e \rightleftharpoons \text{NO}_{(g)} + 2\text{H}_2\text{O}_{(ce/l)}$	+0.96
$\text{Cl}_{2(g)} + 2e \rightleftharpoons 2\text{Cl}^-_{(ak/aq)}$	+1.36

Jadual/ Table 7.2

- (a) Jadual 7.1 menunjukkan susunan radas dan pemerhatian bagi satu proses elektrolisis.

*Table 7.1 shows the apparatus set-up and observation for the electrolysis process.*

Susunan radas <i>Apparatus set-up</i>	Pemerhatian <i>Observations</i>	
	Anod <i>Anode</i>	Elektrod menipis <i>Electrode becomes thinner</i>
	Katod <i>Cathode</i>	Pepejal kelabu berkilat terenalap <i>Shiny grey solid is deposited</i>

Jadual 7.2 menunjukkan nilai E<sup>0</sup> bagi beberapa sel setengah.

*Table 7.2 shows the E<sup>0</sup> value for a few half-cells.*

Tindak balas sel setengah <i>Half-cell equation</i>	Nilai E <sup>0</sup> (V) <i>E<sup>0</sup> value (V)</i>
$\text{Na}^+_{(ak/aq)} + e \rightleftharpoons \text{Na}_{(p/s)}$	- 2.71
$2\text{H}^+_{(ak/aq)} + 2e \rightleftharpoons \text{H}_{2(g)}$	0.00
$\text{O}_{2(g)} + 2\text{H}_2\text{O}_{(ce/l)} + 4e \rightleftharpoons 4\text{OH}^-_{(ak/aq)}$	+0.40
$\text{Ag}^+_{(ak/aq)} + e \rightleftharpoons \text{Ag}_{(p/s)}$	+0.80
$\text{NO}_3^-_{(ak/aq)} + 4\text{H}^+_{(ak/aq)} + 3e \rightleftharpoons \text{NO}_{(g)} + 2\text{H}_2\text{O}_{(ce/l)}$	+0.96
$\text{Cl}_{2(g)} + 2e \rightleftharpoons 2\text{Cl}^-_{(ak/aq)}$	+1.36

Jadual/ Table 7.2

- (i) Nilai keupayaan elektrod piawai, E<sup>o</sup> bagi sesuatu elektrod dapat diukur dengan menggandingkan elektrod tersebut dengan elektrod hidrogen piawai di bawah keadaan piawai.

Nyatakan salah satu keadaan tersebut.

*The value of standard electrode potential, E<sup>o</sup> of an electrode can be measured by pairing up the electrode to the standard hydrogen electrode under standard conditions.*

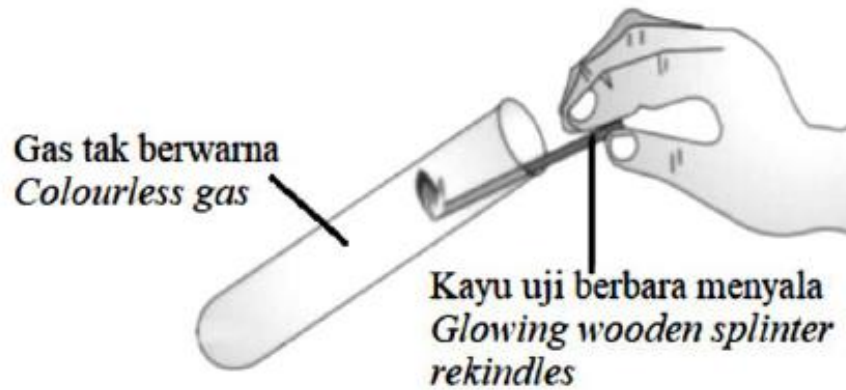
*State one of the conditions.*

.....

[1 mark]

- (ii) Eksperimen dalam Jadual 7.1 diulang dengan melakukan pengubahsuaian pada susunan radas dan gas yang terhasil di anod diuji seperti yang ditunjukkan dalam Rajah 7.1.

*Experiment in Table 7.1 is repeated by modifying the apparatus set-up and the gas collected at anode is tested as shown in Diagram 7.1.*



Rajah/ Diagram 7.1

Sebagai seorang pelajar kimia, apakah pengubahsuaian yang telah dilakukan terhadap susunan radas dalam Jadual 7.1? Terangkan bagaimana gas tersebut terhasil.

*As a chemistry student, what modification that has been done to the apparatus set-up in Table 7.1? Explain how the gas is produced.*

.....

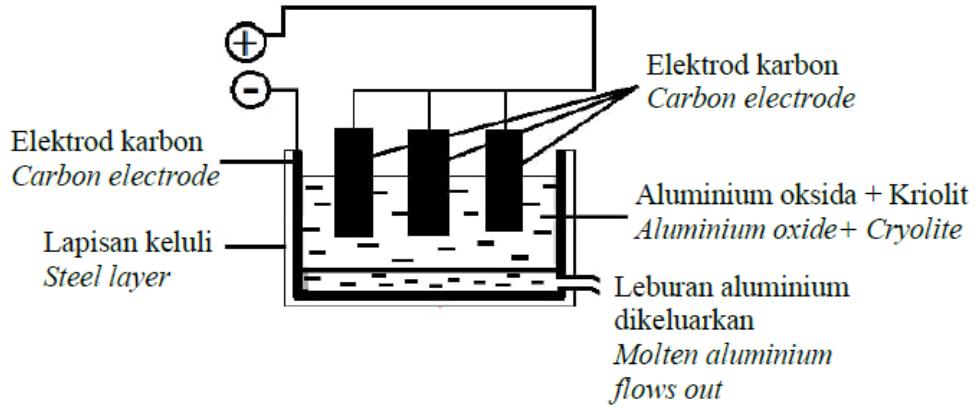
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[3 markah]

- (b) Rajah 7.2 menunjukkan proses pengekstrakan aluminium daripada aluminium oksida.  
*Diagram 7.2 shows the extraction process of aluminium from aluminium oxide.*



Rajah/ Diagram 7.2

Adakah proses pengekstrakan tersebut sesuai dijalankan dalam industri?  
Wajarkan.

*Is the extraction process suitable to be run in industry? Justify.*

.....

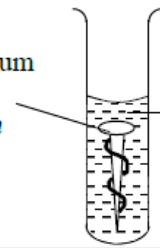
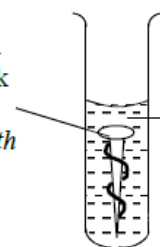
.....

.....

[2 markah]

(c) Jadual 7.3 menunjukkan susunan radas dalam satu eksperimen yang digunakan untuk mengkaji kesan logam yang berbeza ke atas pengamatan paku besi.

*Table 7.3 shows the apparatus set-up in an experiment to investigate the effect of different metals on the rusting of iron nail.*

Set	Susunan radas <i>Apparatus set-up</i>	Pemerhatian <i>Observation</i>
<b>I</b>	<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <p>Paku besi dililit kuprum <i>Iron nail coiled with copper</i></p> </div> <div style="flex: 1; text-align: center;">  </div> <div style="flex: 2;"> <p>Larutan agar-agar panas + larutan kalium heksasianoferat(III) <i>Hot agar solution + potassium hexacyanoferrate(III) solution</i></p> </div> </div>	<p>Tompok biru hadir <i>Blue spots present</i></p>
<b>II</b>	<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <p>Paku besi dililit zink <i>Iron nail coiled with zinc</i></p> </div> <div style="flex: 1; text-align: center;">  </div> <div style="flex: 2;"> <p>Larutan agar-agar panas + larutan kalium heksasianoferat(III) <i>Hot agar solution + potassium hexacyanoferrate(III) solution</i></p> </div> </div>	<p>Tiada perubahan <i>No change</i></p>

Jadual/ *Table 7.3*

Terangkan perbezaan pemerhatian dalam tabung uji bagi kedua-dua set eksperimen dalam Jadual 7.3

*Explain the differences of observation in the test tubes for both sets of experiment in Table 7.3.*

.....

.....

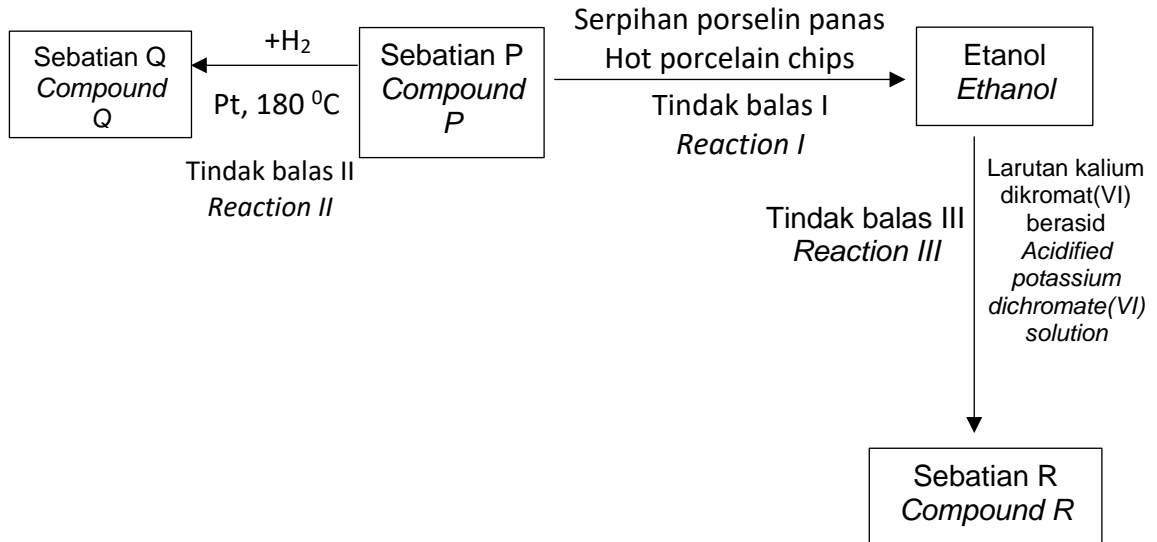
.....

[3 markah]

**BAB 2 : SEBATIAN KARBON**

1 (Q9, SPM 2021)

Rajah 6 menunjukkan carta alir pertukaran etanol kepada beberapa sebatian.  
*Diagram 6 shows a flow chart for the conversion of ethanol to a few compounds.*



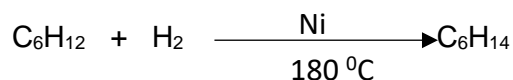
Rajah / Diagram 6

- (a) Apakah yang dimaksudkan dengan hidrakarbon?  
*What is meant by hydrocarbon?* [1]
- (b) Kenal pasti sebatian P, Q dan R. Nyatakan siri homolog dan lukiskan formula struktur bagi sebatian P, Q dan R.  
*Identify compounds P, Q and R. State the homologous series and draw the structural formula of compounds P, Q and R.* [9]
- (c) Tulis persamaan kimia bagi Tindak balas II. Jika 480 cm<sup>3</sup> sebatian P digunakan, hitung isi padu sebatian Q yang terhasil.  
[1 mol gas menempati 24 dm<sup>3</sup> pada keadaan bilik]  
*Write the chemical equation for Reaction II. If 480 cm<sup>3</sup> of compound P is used, calculate the volume of compound produced.*  
[1 mol of gas occupies 24 dm<sup>3</sup> at room temperature] [5]
- (d) Etanol boleh ditukarkan kepada sebatian R melalui Tindak balas III. Nyatakan jenis tindak balas dan kaedah yang digunakan dalam pertukaran itu serta nyatakan perubahan warna bagi larutan kalium dikromat(VI) berasid. Lukis gambarajah susunan radas bagi pertukaran etanol kepada sebatian P melalui Tindak balas I.  
*Ethanol can be converted into compound R through Reaction III. State the type of reaction and state the method that is used in the conversion and state the colour changes of acidified potassium dichromate(VI) solution. Draw an apparatus set-up for the conversion of ethanol to compound P through Reaction I.*

2 (Q9, SPM 2022)

- (c) Formula molekul bagi heksena ialah  $C_6H_{12}$ , manakala formula molekul bagi heksana ialah  $C_6H_{14}$ . Persamaan kimia berikut mewakili tindak balas penghidrogenan heksena,  $C_6H_{12}$ , untuk menghasilkan heksana,  $C_6H_{14}$ .

*Molecular formula for hexene is  $C_6H_{12}$  while molecular formula for hexane is  $C_6H_{14}$ . The following chemical equation represents the hydrogenation reaction of hexene  $C_6H_{12}$  to produce hexane,  $C_6H_{14}$ .*



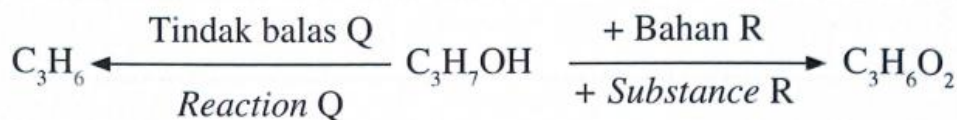
Apakah maksud formula molekul? Nyatakan satu maklumat kualitatif dan satu maklumat kuantitatif yang boleh diperolehi daripada persamaan kimia tersebut. Bandingkan dan bezakan heksena dan heksana dari segi formula kimia.

*What is the meaning of molecular formula? State one qualitative and one quantitative information that can be obtained from the chemical equation. Compare and contrast the hexene and hexane in terms of chemical formula. [8]*

3 (Q11, SPM 2022)

- (a) Rajah 9.1 menunjukkan dua jenis tindak balas bagi penukaran sebatian  $C_3H_7OH$  kepada dua sebatian organik yang berlainan.

*Diagram 9.1 shows two types of reactions for the changes of compound  $C_3H_7OH$  to two different organic compounds.*



Rajah / Diagram 9.1

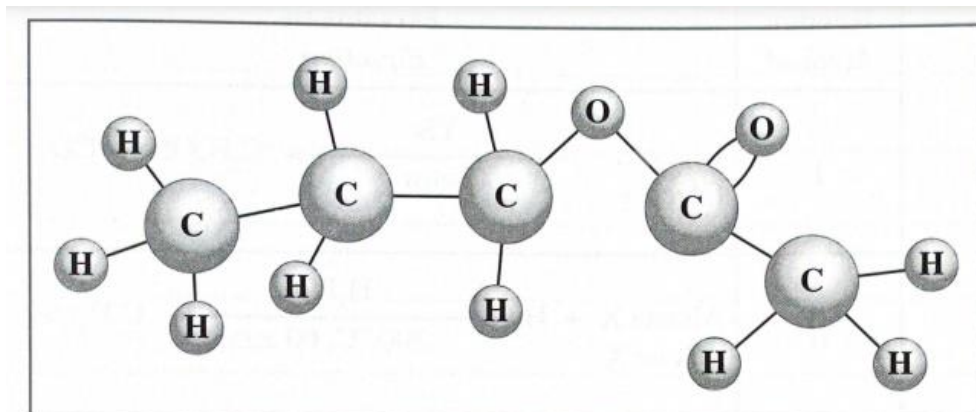
Berdasarkan Rajah 9.1, nyatakan siri homolog bagi  $C_3H_7OH$  dan nyatakan nama bagi tindak balas Q dan Bahan R. Tulis persamaan kimia bagi pembentukan sebatian  $C_3H_6O_2$

*Based on Diagram 9.1, state the homologous series of  $C_3H_7OH$  and state the name of reaction Q and substance R. Write a chemical equation for the formation of compound  $C_3H_6O_2$*

[5 markah]



- (b) Rajah 9.2 menunjukkan lukisan model molekul bagi sebatian organik I dan sebatian organik II daripada siri homolog yang sama.  
*Diagram 9.2 shows the drawing of molecular models for organic compounds I and II from the same homologous series.*



**Sebatian organik I**  
**Organic compound I**

Rajah / Diagram 9.2

Berdasarkan Rajah 9.2, kenal pasti kumpulan berfungsi bagi sebatian organik I dan sebatian organik II. Nyatakan nama bagi bahan tindak balas yang digunakan untuk menghasilkan sebatian organik I dan sebatian organik II.

*Based on Diagram 9.2, identify the functional group of the organic compounds I and II. State the names of the reactants that are used to produce organic compounds I and II.*

[5 markah]

- (c) Jadual 6 menunjukkan dua kaedah dan persamaan berlainan untuk menghasilkan etanol.

*Table 6 shows two different methods and equations to prepare ethanol.*

Kaedah Method	Persamaan Equation
I	$\begin{array}{l} \text{Glukosa} \\ \text{Glucose} \end{array} \xrightarrow[\text{Yeast}]{\text{Yis}} \text{C}_2\text{H}_5\text{OH} + \text{CO}_2$
II	$\begin{array}{l} \text{Alkena X} + \text{H}_2\text{O} \\ \text{Alkene X} \end{array} \xrightarrow[300^\circ\text{C}, 60\text{atm}]{\text{H}_3\text{PO}_4} \text{C}_2\text{H}_5\text{OH}$

Jadual / Table 6

- (i) Cadangkan alkena X dan lukis formula struktur bagi etanol. Pada pandangan anda, kaedah manakah yang lebih sesuai untuk menyediakan etanol dan berikan sebab bagi jawapan anda itu.  
*Suggest alkene X and draw the structural formula of ethanol. In your opinion, which method is more suitable to prepare ethanol and give reasons for your answer.*

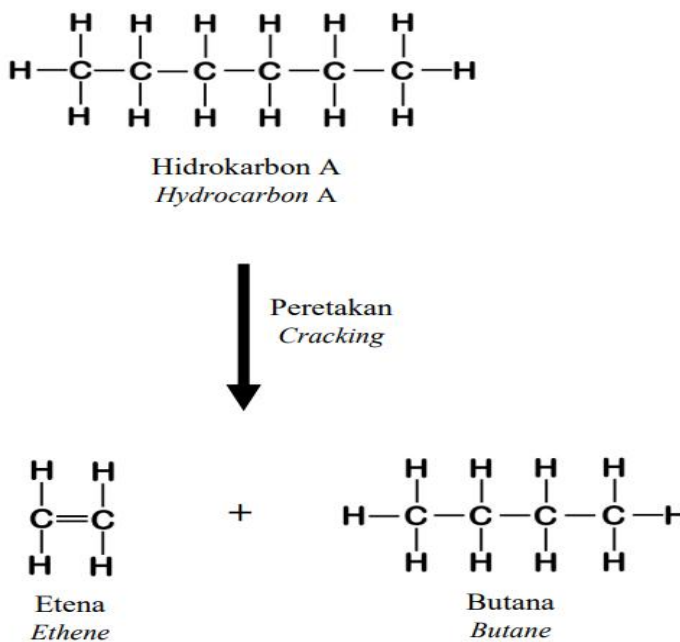
[4 markah]

- (ii) Cadangkan satu bahan semula jadi selain daripada larutan glukosa yang dapat diproses sehingga menghasilkan etanol di dalam makmal. Huraikan secara ringkas langkah penyediaan etanol tersebut.  
*Suggest one natural substance other than glucose solution that can be processed to produce ethanol in the laboratory. Describe briefly the steps of preparation of the ethanol.*

[6 markah]

4 (Q11, SPMRSM 2021)

- (a) (v) Rajah 11.1 menunjukkan proses peretakan hidrokarbon A yang menghasilkan etena dan butana.  
*Diagram 11.1 shows a cracking process of hydrocarbon A that produce ethene and butane.*



Rajah / Diagram 11.1

- (i) Nyatakan siri homolog hidrokarbon A. Lukis dua isomer bagi butana dan namakan setiap isomer tersebut.  
*State the homologous series of hydrocarbon A. Draw two isomers of butane and name each of the isomers.*

[5 marks]

- (ii) Apabila stim panas dialirkan melalui etena pada suhu 300 °C, tekanan 60 atm dan asid fosforik,  $H_3PO_4$  sebagai mangkin, sebatian B akan dihasilkan. Sebatian B boleh dioksidakan untuk menghasilkan sebatian C. Bandingkan dan bezakan sebatian B dan sebatian C.  
*When hot steam is passed through ethene at 300 °C, 60 atm and phosphoric acid,  $H_3PO_4$  as the catalyst, compound B will be produced. Compound B can be oxidised to form compound C. Compare and contrast compound B and compound C.*

[5 marks]

- (b) Rajah 11.3 menunjukkan susu berperisa pisang.  
*Diagram 11.3 shows banana flavoured milk.*



Rajah / Diagram 11.3

Ester digunakan sebagai bahan tambah makanan untuk meningkatkan rasa dan bau makanan yang diproses. Pentil etanoat adalah perisa tiruan yang digunakan dalam minuman ini. Dengan menggunakan bahan yang sesuai, terangkan secara ringkas bagaimana anda boleh menyediakan perisa pisang tersebut di dalam makmal. Jawapan anda haruslah mengandungi persamaan kimia yang terlibat.

*Esters are used as food additives to enhance the taste and smell of processed foods. Pentyl ethanoate is an artificial flavour used in this drink. By using suitable substances, explain briefly how you can prepare the banana flavour in laboratory. Your answer should include the chemical equation involved.*

[7 marks]

- (c) Rajah 11.2 menunjukkan dua jenis pensanitasi tangan yang mengandungi peratusan alkohol yang berbeza.  
*Diagram 11.2 shows two types of hand sanitisers that contains different percentage of alcohol.*



Pensanitasi tangan M  
75% kandungan alkohol  
*Hand sanitiser M  
75% alcohol*



Pensanitasi tangan N  
55% kandungan alkohol  
*Hand sanitiser N  
55% alcohol*

Rajah / Diagram 11.2

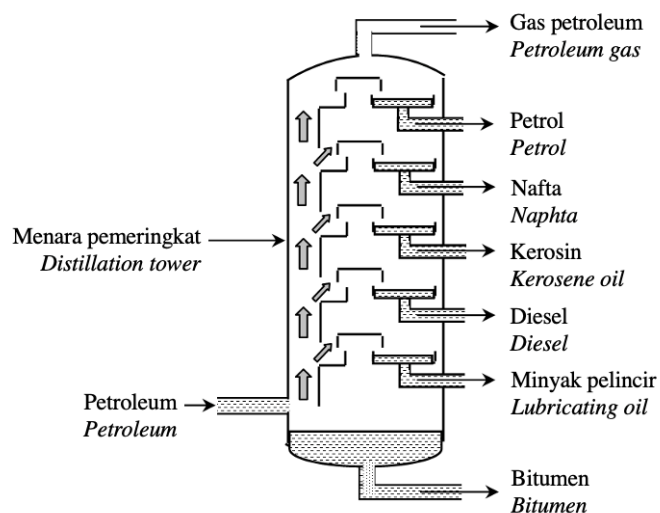
Berdasarkan Rajah 11.2, pilih pensanitasi tangan yang akan anda gunakan. Wajarkan pilihan anda.  
*Based on Diagram 11.2, choose which hand sanitiser will you use. Justify your choice.*

[3 marks]

5 (Q10, SPMRSM 2022)

Rajah 10.1 menunjukkan proses yang digunakan untuk mengasingkan petroleum dalam penghasilan pelbagai produk dalam industri.

*Diagram 10.1 shows a process used to separate petroleum into various products in industry.*



Rajah / Diagram 10.1

- (a) (i) Nyatakan kaedah dan sifat fizik yang terlibat dalam proses pengasingan petroleum seperti yang ditunjukkan dalam Rajah 10.1.  
*State the method and physical properties involved in the separation process of petroleum as shown in Diagram 10.1.*

[2]

- (ii) 2,2,4-trimetilpentana dan butana adalah hasil sulingan petroleum. Lukiskan formula struktur untuk kedua-dua hasil sulingan.

*2,2,4-trimethylpentane and butane are products of petroleum distillate. Draw the structural formulae for both distillates.*

[2]

- (b) Nafta adalah campuran hidrokarbon yang terdiri daripada 5 hingga 10 atom karbon. Salah satu hasil sulingan adalah heksana,  $C_6H_{14}$ .  
*Naphtha is the mixture of hydrocarbon that consists of 5 to 10 carbon atoms. One of the distilled product is hexane,  $C_6H_{14}$ .*  
Tulis persamaan kimia bagi pembakaran heksana.  
Hitung isipadu gas karbon dioksida,  $CO_2$  yang dibebaskan pada keadaan bilik apabila 258 g heksana digunakan dalam pembakaran lengkap di atas.  
[Jisim atom relatif : H=1, C=12; 1 mol gas menempati  $24 \text{ dm}^3 \text{ mol}^{-1}$  pada keadaan bilik]

*Write the chemical equation for the combustion of hexane.*

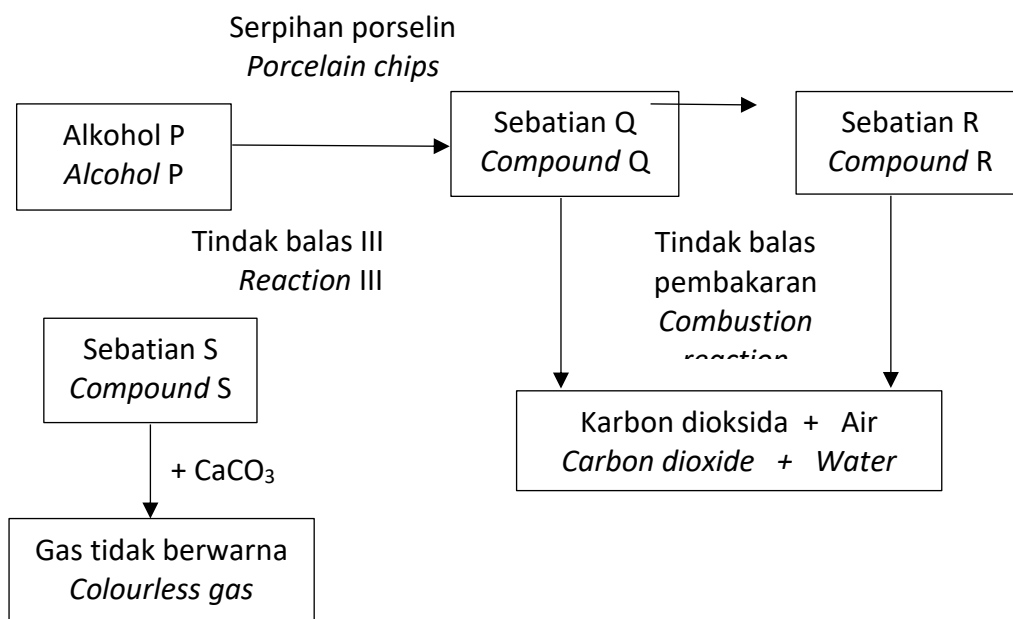
*Calculate the volume of carbon dioxide,  $CO_2$  gas released at room condition when 258 g of hexane used in the complete combustion above.*

*[Relative atomic mass : H=1, C=12; 1 mol of gas occupies  $24 \text{ dm}^3 \text{ mol}^{-1}$  at room conditions]*

[5]

- (c) Rajah 10.2 menunjukkan pertukaran sebatian organik daripada satu siri homolog kepada yang lain. Alkohol P mempunyai kurang daripada empat karbon atom dalam molekulnya. Sebatian Q boleh ditukarkan kepada R melalui tindak balas penghidrogenan.

*Diagram 10.2 shows the conversion of organic compound from one homologous series to another. Alcohol P has less than four carbon atoms in its molecules. Compound Q can be converted to R through hydrogenation reaction.*



Rajah / Diagram 10.2

**PRAKTIS TOPIKAL: KERTAS 2  
BPM 2023**

- (i) Cadangkan nama alkohol P, tuliskan formula molekul sebatian Q, nyatakan siri homolog bagi sebatian R dan namakan tindak balas III.  
*Suggest the name of alcohol P, write the molecular formula of compound Q, state the homologous series of compound R and name Reaction III.*

[4]

- (ii) Bandingkan kejelagaan nyalaan bagi pembakaran sebatian Q dan sebatian R.

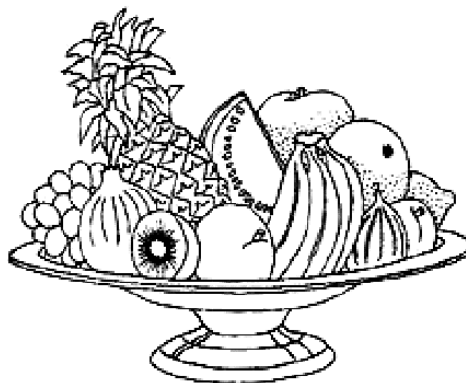
[Jisim atom relatif : H=1, C=12]

*Compare the sootiness of flames for the combustion of compound Q and compound R.*

[Relative atomic mass : H=1, C=12]

[4]

- (d) Rajah 10.3 menunjukkan buah-buahan tempatan yang baru dipetik.  
*Diagram 10.3 shows the freshly plucked local fruits.*



Rajah / Diagram 10.3

Buah-buahan yang masak secara semulajadi akan mengeluarkan gas etena,  $C_2H_4$ . Sesetengah buah-buahan disuntik dengan etena,  $C_2H_4$  tiruan semasa proses pemeraman.

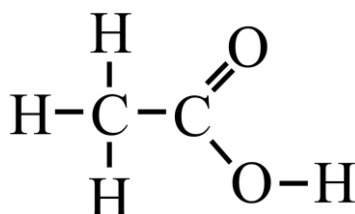
Wajarkan penggunaan etena tiruan semasa proses pemeraman buah.

*Ethene,  $C_2H_4$  gas is naturally released from the ripe fruits. Some fruits are injected with artificial ethene,  $C_2H_4$  during the ripening process.*

*Justify the use of artificial ethene during the fruit ripening process.* [3]

6 (Q11, SPMRSM 2022)

- (a) Rajah 11.1 menunjukkan formula struktur bagi asid etanoik.  
*Diagram 11.1 shows the structural formula of ethanoic acid*





Rajah / Diagram 11.1

- (i) Nyatakan kebesan asid etanoik dan terangkan.  
*State the basicity of ethanoic acid and explain.*

[2 marks]

(ii)

<b>Eksperimen I</b> <i>Experiment I</i>	<b>Eksperimen II</b> <i>Experiment II</i>
 <p style="text-align: center; margin-top: 10px;">Asid etanoik glasial, <math>\text{CH}_3\text{COOH}</math> + Kalsium karbonat, <math>\text{CaCO}_3</math> <i>Glacial ethanoic acid,</i> <math>\text{CH}_3\text{COOH}</math> + <i>Calcium carbonate,</i> <math>\text{CaCO}_3</math></p>	 <p style="text-align: center; margin-top: 10px;">Larutan asid etanoik, <math>\text{CH}_3\text{COOH}</math> + Kalsium karbonat, <math>\text{CaCO}_3</math> <i>Ethanoic acid solution,</i> <math>\text{CH}_3\text{COOH}</math> + <i>Calcium carbonate,</i> <math>\text{CaCO}_3</math></p>

Rajah 11.2  
*Diagram 11.2*

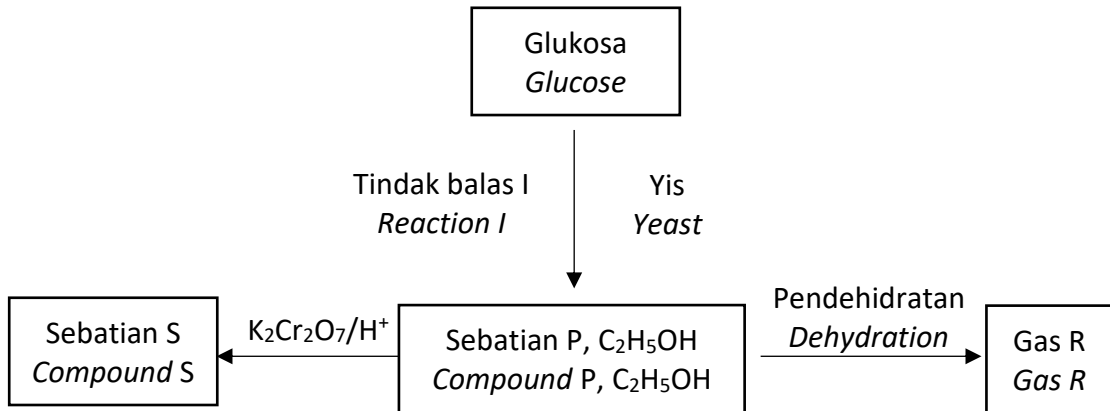
Berdasarkan Rajah 11.2, terangkan perbezaan pemerhatian antara eksperimen I dan II.

*Based on Diagram 11.2, explain the differences in the observation between experiment I and II.*

[3 marks]

7 (Q6, SBP 2021)

Rajah 6 menunjukkan siri tindak balas melibatkan sebatian P, C<sub>2</sub>H<sub>5</sub>OH.  
Diagram 6 shows series of reactions involving compound P, C<sub>2</sub>H<sub>5</sub>OH.



Rajah / Diagram 6

Berdasarkan Rajah 6,  
Based on Diagram 6,

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

.....[1]

- (ii) Nyatakan nama sebatian P, C<sub>2</sub>H<sub>5</sub>OH  
State the name of compound P, C<sub>2</sub>H<sub>5</sub>OH

.....[1]

- (b) Tulis persamaan kimia bagi pembakaran lengkap sebatian P.  
Write a chemical equation for complete combustion of compound P.

.....[2]

- (c) (i) Berdasarkan Rajah 6, pilih dua bahan yang bertindak balas untuk menghasilkan satu sebatian yang berbau wangi.  
Based on Diagram 6, choose two substances that can react to produce a compound with sweet smell.

.....  
.....[1]

- (ii) Lukis formula struktur bagi sebatian yang terbentuk itu.  
Draw the structural formula for the compound formed.

[1]



- (d) Jadual 6 menunjukkan pemerhatian apabila gas R dan gas etana dialirkan ke dalam dua tabung uji berisi air bromin secara berasingan.  
*Table 6 shows the observations when gas R and ethane gas are delivered into two test tubes filled with bromine water separately.*

Gas	Pemerhatian <i>Observation</i>
R	Warna perang air bromin menjadi tidak berwarna <i>Brown colour of bromine water</i>
Etana <i>Ethane</i>	Warna perang air bromin tidak berubah <i>Brown colour of bromine water unchanged</i>

Jadual / *Table 6*

Terangkan perbezaan pemerhatian dalam Jadual 6.  
*Explain the differences in the observation in Table 6.*

.....

.....

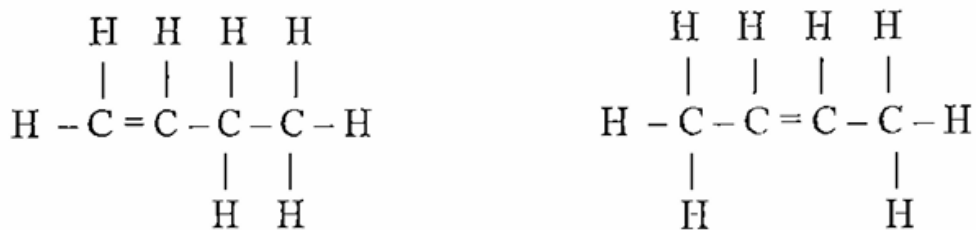
.....

.....

[3]

**8** (Q11, SBP 2022)

Rajah 11 menunjukkan dua isomer bagi sebatian V. Diagram 11 shows two isomers for compound V.



Rajah / *Diagram 11*

- (a) Berdasarkan Rajah 11,  
*Based on the Diagram 11,*
- (i) *Apakah yang dimaksudkan dengan keisomeran struktur?*  
*What is meant by structural isomerism?*

[1 markah]

- (ii) Sebatian V mempunyai tiga isomer. Lukis formula struktur yang lain bagi isomer sebatian V dan nyatakan nama isomer itu dengan menggunakan sistem penamaan IUPAC.

*Compound V has three isomers. Draw another structural formula for isomer compound V and state the name of the isomer by using IUPAC nomenclature system.*

[2 markah]

- (iii) Sebatian W dihasilkan melalui tindak balas penghidratan daripada sebatian V. Tulis persamaan kimia bagi tindak balas yang berlaku dan tentukan jisim sebatian W yang terhasil apabila 0.125 mol sebatian V digunakan dalam tindak balas tersebut.

*Compound W is produced through hydration reaction from compound V. Write the chemical equation for the reaction that occurs and determine the mass of compound W produced when 0.125 mol of compound V is used in the reaction. [Jisim atom relatif : H = 1, C = 12, O = 16] [Relative atomic mass : H = 1, C = 12, O = 16]*

[2 markah]

- (b) Jadual 11 menunjukkan maklumat bagi sebatian R, sebatian S dan sebatian T. Table 11 shows the information of compounds R, S and T.

Sebatian Compound	Maklumat Information
R	<ul style="list-style-type: none"> <li>• Terdiri daripada unsur karbon, hidrogen dan oksigen <i>Consists of carbon, hydrogen and oxygen elements</i></li> <li>• Mempunyai 2 atom karbon <i>Has 2 carbon atoms</i></li> <li>• Larut dalam air <i>Soluble in water</i></li> <li>• Bertindak balas dengan asid etanoik menghasilkan ester U <i>Reacts with ethanoic acid to produce ester U</i></li> </ul>
S	<ul style="list-style-type: none"> <li>• Terdiri daripada unsur karbon dan hidrogen sahaja <i>Consists of carbon and hydrogen elements only</i></li> <li>• Mempunyai 3 atom karbon <i>Has 3 carbon atoms</i></li> <li>• Tidak menyahwarnakan warna ungu larutan kalium manganate(VIII) berasid <i>Does not decolourise the purple colour of acidified potassium manganate(VII)</i></li> </ul>
T	<ul style="list-style-type: none"> <li>• Terdiri daripada unsur karbon dan hidrogen sahaja <i>Consists of carbon and hydrogen elements only</i></li> <li>• Mempunyai 3 atom karbon <i>Has 3 atom karbon</i></li> <li>• Menyahwarnakan warna ungu larutan kalium manganate(VII) berasid <i>Decolourises the purple colour of acidified potassium manganate(VII)</i></li> </ul>

Berdasarkan maklumat dalam Jadual 11:  
*Based on the information in Table II:*

- (i) Berdasarkan maklumat dalam Jadual 11: Based on the information in Table II: Kenai pasti sebatian R, S dan T dan seterusnya terangkan perbezaan pemerhatian bagi sebatian S dan sebatian T apabila bertindak balas dengan larutan kalium manganat(VII) berasid.  
*Identify compounds R, S and T and then explain the difference in the observations for compounds S and T when react with acidified potassium manganate(VII) solution.*

[4 markah]

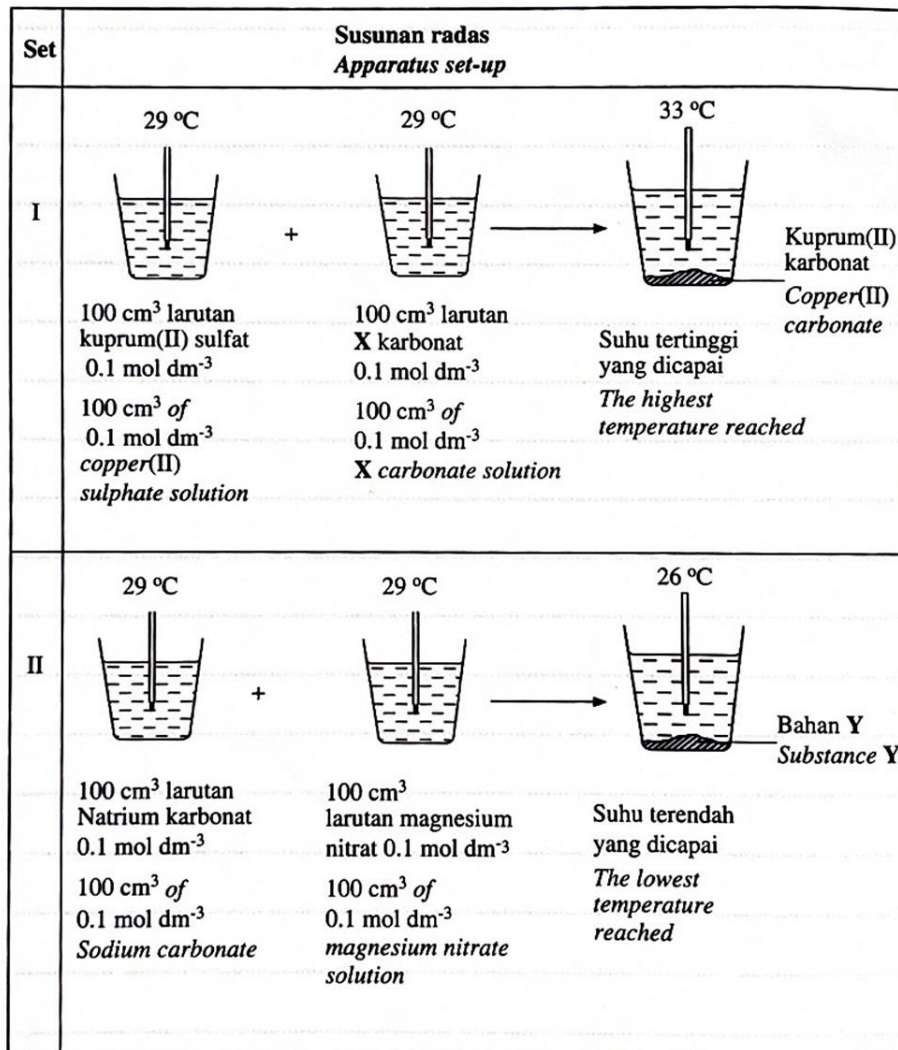
- (ii) Sebatian R dapat disediakan secara tindak balas kimia melalui proses penapaian glukosa. Dengan menggunakan bahan yang sesuai yang terdapat di rumah anda, terangkan bagaimana anda dapat menyediakan sebatian R di makmal sekolah. Dalam penerangan anda, terangkan bagaimana sebatian R tulen dapat dikumpulkan.  
*Compound R can be prepared by a chemical reaction through a fermentation process of glucose. By using suitable materials found in your home, explain how you can prepare compound R at the school laboratory. In your description, explain how pure compound R can be collected.*

[8 markah/ marks]

BAB 3 : TERMOKIMIA

1 (Q10, SPM 2021)

- (a) Rajah 7 menunjukkan dua set eksperimen yang dijalankan oleh seorang pelajar untuk mengkaji haba pemendakan bagi kuprum (II) karbonat dan bahan Y.  
Diagram 7 shows two sets of experiments carried out by a student to investigate the heat of precipitation of copper (II) carbonate and substance Y.



Rajah / Diagram 7

- (i) Berdasarkan Rajah 7,  
Based on Diagram 7,

Nyatakan definisi bagi haba pemendakan dan warna bagi kuprum (II) karbonat yang terhansil.  
State the definition of heat of precipitation and the colour of copper (II) carbonate formed.

[2 markah]

- (ii) Cadangkan larutan **X** karbonat dan bahan **Y**  
*Suggest X carbonate solution and substance Y*
- [2 markah]
- (iii) Hitung haba pemendakan bagi tindak balas dalam Set I dan Set II  
[Diberi muatan haba tentu bagi larutan ialah  $C = 4.2 \text{ Jg}^{-1} \text{ }^{\circ}\text{C}^{-1}$ ;  
ketumpatan larutan =  $1 \text{ gcm}^{-3}$ ]  
*Calculate the heat of precipitation of the reaction in Set I and Set II*  
*[Given the specific heat capacity is  $C = 4.2 \text{ Jg}^{-1} \text{ }^{\circ}\text{C}^{-1}$  ;*  
*Density of solution =  $1 \text{ g cm}^{-3}$ ]*
- [6 markah]
- (iv) Nyatakan jenis tindak balas yang berlaku dalam Set I and Set II. Bandingkan perbezaan jenis tindak balas bagi Set I and Set II dari segi perubahan suhu, perbezaan kandungan tenaga bahan tindak balas dan hasil tindak balas serta perubahan tenaga sewaktu pemecahan ikatan dan pembentukan ikatan. Lukis gambar rajah aras tenaga bagi Set I dan Set II.
- State the type of reactions that occurs in Set I and Set II. Compare the difference in the type of reaction for Set I and Set II in terms of the change in temperature, difference in energy content of reactants and products and energy changes during bond breaking and bond formation. Draw the energy level diagram for Set I or Set II*
- [7 markah]

2 (Q5, SPM 2022)

- (a) Nyatakan jenis tindak balas bagi pembakaran gas butana.  
*State the type of reaction for the combustion of butane gas.*

.....  
[1 markah]

- (b) Berdasarkan persamaan termokimia diberi,  
*Based on the thermochemical equation given,*

- (i) Lukis gambar rajah aras tenaga bagi tindak balas itu pada paksi yang disediakan.  
*Draw the energy level diagram for the reaction on the provided axis.*



[2 markah]

- (ii) Nyatakan satu maklumat yang boleh didekduksikan daripada gambar rajah di 5 (b)(i).  
*State one information that can be deducted from the diagram in 5 (b)(i).*

.....  
[1 markah]

- (c) Nilai bahan api ialah jumlah tenaga haba yang terbebas apabila 1 g bahan api terbakar lengkap dalam oksigen. Jadual 2 menunjukkan tiga jenis bahan api dengan nilai bahan api masing-masing.  
*The fuel value is the amount of heat energy released when 1 g of fuel is burned completely in oxygen. Table 2 shows three types of fuel with their fuel value respectively.*

Jenis bahan api <i>Type of fuel</i>	Nilai bahan api (kJ g <sup>-1</sup> ) <i>Fuel value (kJ g<sup>-1</sup>)</i>
Hidrogen <i>Hydrogen</i>	143
Etanol <i>Ethanol</i>	30
Petrol <i>Petrol</i>	34

Jadual / Table 2

Berdasarkan Jadual 2, bahan api manakah yang lebih baik daripada petrol?  
Berikan satu sebab.  
*Based on Table 2, which fuel is better than petrol ? Give one reason.*

.....  
.....

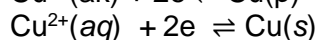
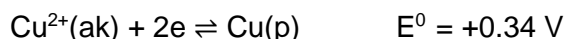
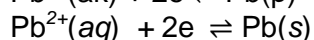
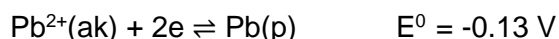
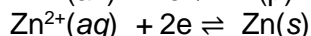
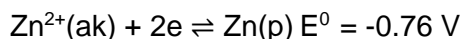
[2 markah]

**3** (Q8, SPMRSM 2021)

- (a) Persamaan kimia berikut mewakili tindak balas penyesaran antara logam Q dengan larutan plumbum(II) nitrat.  
*The following chemical equation represents a displacement reaction between metal Q and lead(II) nitrate solution.*



Diberi nilai keupayaan elektrod berikut.  
*Given the following electrode potential values.*



- (i) Cadangkan logam Q.  
*Suggest metal Q.*

.....  
[1markah]

- (ii) Haba penyesaran bagi tindak balas tersebut ialah  $-112 \text{ kJ mol}^{-1}$ .  
Hitungkan perubahan suhu apabila serbuk Q berlebihan ditambahkan kepada  $100 \text{ cm}^3$  larutan plumbum(II) nitrat  $0.5 \text{ mol dm}^{-3}$ .  
[Muatan haba tentu larutan =  $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ ;  
Ketumpatan larutan =  $1.0 \text{ g cm}^{-3}$ ]

*The heat of displacement for the reaction is  $-112 \text{ kJ mol}^{-1}$ .  
Calculate the change in temperature when excess Q powder is added to  
 $100 \text{ cm}^3$  of  $0.5 \text{ mol dm}^{-3}$  lead(II) nitrate solution.  
[Specific heat capacity of a solution =  $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ ;  
Density of solution =  $1.0 \text{ g cm}^{-3}$ ]*

[ 3 markah]

- (b) Jadual 8 menunjukkan haba peneutralan bagi tindak balas antara larutan kalium hidroksida dengan dua jenis asid yang berlainan.  
*Table 8 shows the heat of neutralisation of the reaction between potassium hydroxide solution with two different types of acids.*

<b>Bahan tindak balas Reactants</b>	<b>Haba peneutralan (<math>\text{kJ mol}^{-1}</math>) Heat of neutralisation (<math>\text{kJ mol}^{-1}</math>)</b>
Asid R + larutan kalium hidroksida <i>Acid R + potassium hydroxide solution</i>	-55
Asid S + larutan kalium hidroksida <i>Acid S + potassium hydroxide solution</i>	-57

Jadual / Table 8

- (i) Cadangkan asid R dan asid S.  
*Suggest acid R and acid S.*

*Asid R: .....*  
*Acid R*  
*Asid S: .....*  
*Acid S*

[2 markah]



- (ii) Berdasarkan jawapan di 8(b)(i), tuliskan persamaan termokimia bagi tindak balas antara asid R dengan larutan kalium hidroksida.  
*Based on your answer in 8(b)(i), write the thermochemical equation of the reaction between acid R and potassium hydroxide solution.*

.....  
[2 markah]

- (iii) Nilai haba peneutralan bagi kedua-dua tindak balas adalah berbeza. Terangkan mengapa.  
*The value of heat of neutralisation for both reactions are different. Explain why.*

.....  
[2 markah]

**4 (Q7, SPMRSM 2022)**

- (a) (i) Apakah maksud haba pemendakan?  
*What is the meaning of heat of precipitation?*

.....  
[1 markah]

- (ii) Nyatakan satu maklumat yang boleh diperolehi daripada gambar rajah aras tenaga yang ditunjukkan dalam Rajah 7.1.  
*State one information that can be obtained from the energy level diagram shown in Diagram 7.1.*

.....  
....[1 markah]

- (iii) Namakan larutan X.  
*Name solution X.*

.....  
[1 markah]

- (iv) Berdasarkan jawapan anda di 7(a)(iii), tulis persamaan ion bagi tindak balas ini.  
*Based on your answer in 7(a)(iii), write the ionic equation for this reaction.*

.....  
[1 markah]

- (b) (i) Persamaan termokimia di bawah mewakili tindak balas antara larutan plumbum(II) nitrat dengan larutan natrium sulfat.  
*The thermochemical equation below represents the reaction between lead(II) nitrate solution and sodium sulphate solution.*



Hitungkan kenaikan suhu apabila 25 cm<sup>3</sup> larutan plumbum(II) nitrat 1 mol dm<sup>-3</sup> ditambah kepada 25 cm<sup>3</sup> larutan natrium sulfat 1 mol dm<sup>-3</sup>.  
[Muatan haba tentu larutan = 4.2 J g<sup>-1</sup> °C<sup>-1</sup>, ketumpatan larutan = 1 g cm<sup>-3</sup>]  
*Calculate the increase in temperature when 25 cm<sup>3</sup> of 1 mol dm<sup>-3</sup> lead(II) nitrate solution is added to 25 cm<sup>3</sup> of 1 mol dm<sup>-3</sup> sodium sulphate solution.*  
*[Specific heat capacity of solution = 4.2 J g<sup>-1</sup> °C<sup>-1</sup>, density of solution = 1 g cm<sup>-3</sup>]*

[3 markah]

- (ii) Eksperimen diulang dengan menggunakan isipadu larutan yang sama seperti dalam 7(b)(i) dan perubahan suhu,  $\theta$  yang didapati berkurang kepada separuh. Cadangkan bagaimana anda boleh mendapatkan perubahan suhu baharu,  $\theta$  tersebut.  
*Experiment is repeated by using the same volume of solution as in 7(b)(i) and the temperature change,  $\theta$  obtained is reduced by half. Suggest how you can obtain the new temperature change,  $\theta$ .*

[1 markah]

- (c) Jadual 7 menunjukkan nilai bahan api metana dan oktana.  
*Table 7 shows fuel value of methane and octane.*

<b>Jenis bahan api</b> <i>Type of fuel</i>	<b>Metana</b> <i>Methane</i>	<b>Oktana</b> <i>Octane</i>
Nilai bahan api (kJ g <sup>-1</sup> ) <i>Fuel value (kJ g<sup>-1</sup>)</i>	27.0	89.0
Takat didih (°C) <i>Boiling point (°C)</i>	-161.6	125.6
Keadaan fizik pada suhu bilik <i>Physical state at room temperature</i>	Gas Gas	Cecair <i>Liquid</i>
Harga per liter (RM) <i>Price per litre (RM)</i>	2.05	4.84

Jadual / Table 7

Bahan api manakah yang anda pilih untuk memasak dan wajarkan pilihan anda.  
*Which fuel would you choose for cooking and justify your choice.*

.....  
.....

[2 markah]

**5** (Q7, SBP 2021)

- (a) Nyatakan maksud haba pemendakan.  
*State the meaning of heat of precipitation.*

.....  
.....

[1 markah]

- (b) Nyatakan warna mendakan yang terbentuk.  
*State the colour of the precipitate formed.*

.....

[1 markah]

- (c) Hitungkan perubahan suhu apabila 25cm<sup>3</sup> larutan argentum nitrat 0.5 mol dm<sup>-3</sup> bertindak balas dengan 25 cm<sup>3</sup> larutan natrium klorida 0.5 mol dm<sup>-3</sup>.  
[Muatan haba tentu larutan = 4.2 Jg<sup>-1</sup> °C<sup>-1</sup>, Ketumpatan larutan = 1 g cm<sup>-3</sup>]

*Calculate the temperature change when 25cm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> silver nitrate solution reacts with 25 cm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> sodium chloride solution.*  
[Specific heat capacity of solution = 4.2 Jg<sup>-1</sup> °C<sup>-1</sup>, Density of solution = 1 g cm<sup>-3</sup>]

[3 markah]

- (d) Tindak balas diulangi dengan menggunakan 25 cm<sup>3</sup> larutan kalium klorida, 0.5 mol dm<sup>-3</sup> bagi menggantikan larutan natrium klorida. Ramalkan nilai haba pemendakan bagi tindak balas itu. Terangkan jawapan anda.

*The reaction is repeated by using 25 cm<sup>3</sup> of 0.5 mol dm<sup>-3</sup> potassium chloride solution to replace sodium chloride solution.*

*Predict the value of heat precipitation for the reaction. Explain your answer.*

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

[3 markah]

- (e) Jadual 7 menunjukkan nilai bahan api bagi beberapa jenis bahan api. *Table 7 shows the fuel values of a few types of fuels.*

<b>Bahan api Fuel</b>	<b>Nilai bahan api (kJ g<sup>-1</sup>) Fuel value (kJ g<sup>-1</sup>)</b>
Etanol <i>Ethanol</i>	30
Petrol <i>Petrol</i>	34
Gas asli <i>Natural gas</i>	50
Gas hidrogen <i>Hydrogen gas</i>	143

Jadual / Table 7

Berdasarkan jadual 7, bahan api yang manakah yang sesuai untuk menggantikan petrol dalam kenderaan? Berikan alasan bagi jawapan anda.

*Based on Table 7, which fuel is the most suitable to replace petrol in vehicles? Give reason for your answer.*

.....  
.....

[2 markah]

6 (Q8, SBP 2022)

- (a) (i) Mengapakah bekas kuprum digunakan dalam eksperimen ini?  
*Why copper can used in this experiment?*

.....

[1 markah]

- (ii) Berikan sebab mengapa bahagian bawah bekas kuprum menjadi hitam setelah dipanaskan.  
*Give a reason why does the bottom of the copper can turn black after being heated.*

.....

[1 markah]

- (iii) Hitungkan haba pembakaran bagi propanol,  $C_3H_7OH$ .  
[Jisim atom relative: H = 1, C = 12, O = 16;  
muatan haba tentu air,  $c = 4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ , ketumpatan air =  $1.0 \text{ g cm}^{-3}$ ]  
[Relative atomic mass: H = 1, C = 12, O = 16;

*Calculate the heat of combustion of propanol,  $C_3H_7OH$ .  
Specific heat capacity of water,  $c = 4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ ,  
Density of water =  $1.0 \text{ g cm}^{-3}$ ]*

[3 markah]

- (b) Jadual 8 menunjukkan formula molekul dan haba pembakaran bagi mentanol dan etanol.

*Table 8 shows the molecular formula and the heat of combustion for methanol and ethanol.*

Alcohol <i>Alcohol</i>	Formula molekul <i>Molecular formula</i>	Haba pembakaran ( $\text{kJ mol}^{-1}$ ) <i>Heat of combustion (<math>\text{kJ mol}^{-1}</math>)</i>
Metanol <i>Methanol</i>	$CH_3OH$	-723
Etanol <i>Ethanol</i>	$C_2H_5OH$	-1360

Berdasarkan maklumat dalam jadual 8, bandingkan haba pembakaran antara methanol dan etanol. Terangkan mengapa terdapat perbezaan antara nilai haba pembakaran bagi alcohol itu.

*Based on the information in Table 8, compare the heat of combustion between methanol and ethanol. Explain why there is a difference in the values of the heat of combustion between alcohols.*

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

[2 markah]

- (c) Alex mengikuti perkhemahan di hutan. Selain dari makanan dan minuman dalam tin, berikut adalah bahan dan peralatanyang dibawa Bersama:

*Alex went for a camping in the jungle. Besides food and conned beverage, the following materials and equipment are brought together:*

- Air  
*Water*
- Besen kecil  
*Small basin*
- Serbuk ammonium nitrat  
*Ammonium nitrate powder*
- Serbuk kalsium oksida  
*Calcium oxide powder*

Alex ingin menyejukkan minuman dalam tin. Dengan memilih bahan-bahan yang sesuai, huraikan bagaimana Alex dapat menyejukkan minuman itu?

*Alex wants to cool baverage in the can. By choosing suitable materials, describe how Alex can cool the beverage?*

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

*[3 markah]*

**BAB 4: POLIMER**

**1 (Q7, SPM 2022)**

Jadual 3 menunjukkan tiga jenis polimer dan kegunaannya dalam kehidupan seharian.  
*Table 3 shows three types of polymers and their uses in daily life.*

<b>Polimer Polymer</b>	<b>Kegunaan Use</b>
Y	Beg plastik, plastik pembungkus <i>Plastic bag, plastic wrap</i>
Polipropena <i>Polypropene</i>	Karpet, alat permainan <i>Carpet, toy</i>
Poliisoprena <i>Polyisoprene</i>	Sarung tangan pembedahan, gelang getah <i>Surgical gloves, rubber band</i>

Jadual / Table 3

Berdasarkan Jadual 3,  
*Based on Table 3,*

- (a) (i) Nyatakan maksud polimer.  
*State the meaning of polymer.*

.....  
[1 markah/ 1 mark]

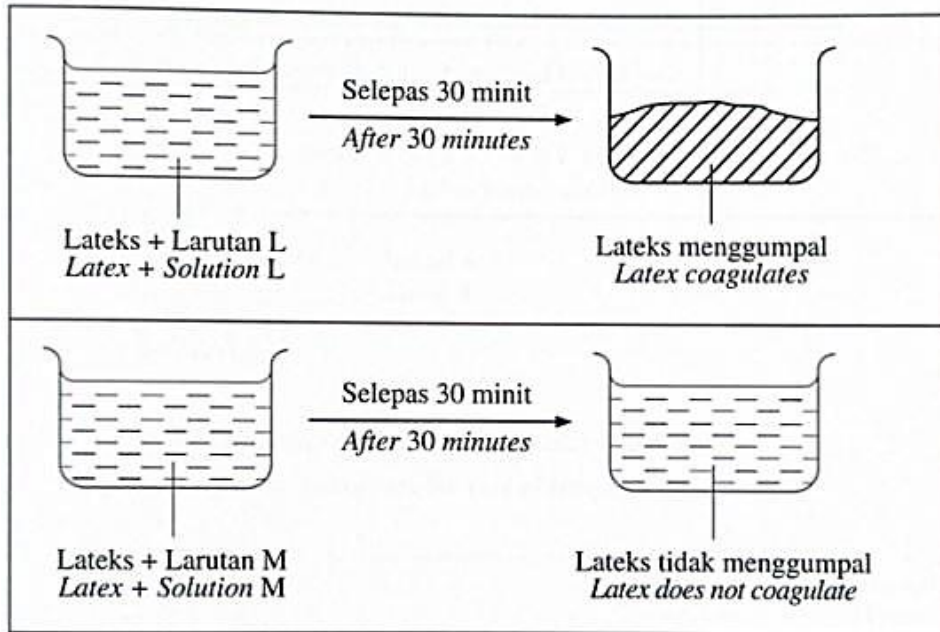
- (ii) Kenal pasti polimer Y.  
*Identify polymer Y.*

.....  
[1 markah/ 1 mark]

- (iii) Tunjukkan bagaimana polipropena dihasilkan daripada monomernya dalam tindak balas pempolimeran.  
*Show how polypropene is produced from its monomer in polymerisation reaction.*

[2 markah/ 2 marks]

- (b) Rajah 5 menunjukkan pemerhatian apabila larutan L dan larutan M ditambah kepada lateks.  
*Diagram 5 shows the observations when solution L and solution M are added to the latex.*



Rajah / Diagram 5

Cadangkan larutan L dan larutan M. Terangkan mengapa terdapat perbezaan dalam pemerhatian bagi setiap bikar selepas 30 minit.

*Suggest solution L and solution M. Explain why there is a difference in the observation for each beaker after 30 minutes.*

.....

.....

.....

[3 markah / 3 marks]

- (c) Kepelbagaian ciri yang terdapat pada polimer menyebabkan permintaan dan penggunaannya semakin meningkat. Sebagai contoh, penggunaan penyedut minuman plastik. Namun terdapat negeri tertentu yang tidak menggalakkan penggunaan penyedut minuman plastik. Wajarkan penggunaan penyedut minuman plastik dan berikan **satu** sebab.

*The various properties found in polymer causes its demand and usage to increase. For example, the usage of plastic straws. However, there is certain state that does not encourage the usage of plastic straws. Justify the usage of plastic straws and give **one** reason.*

.....

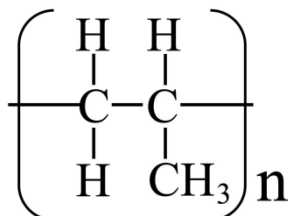
.....

[2 markah / 2 marks]



2 (Q5, SPMRSM 2022)

Rajah 5.1 menunjukkan formula struktur bagi satu polimer.  
*Diagram 5.1 shows structural formula of a polymer.*



Rajah / Diagram 5.1

- (a) Apakah yang dimaksudkan dengan polimer?  
*What is meant by polymer?*

.....  
.....

[1 markah/ 1 mark]

- (b) (i) Lukiskan formula dstruktur monomernya.  
*Draw the structural formula of the monomer.*

[1 markah/ 1 mark]

- (ii) Namakan jenis tindak balas pempolimeran dalam penghasilan polimer tersebut.  
*Name the type of polymerisation reaction in the production of the polymer.*

.....  
[1 markah/ 1 mark]

- (iii) Nyatakan satu kegunaan polimer tersebut.  
*State one of the uses of the polymer.*

.....  
[1 markah/ 1 mark]

- (c) (i) Rajah 5.2 menunjukkan kasut sukan yang digunakan oleh seorang pemain badminton.  
*Diagram 5.2 shows sport shoes used by a badminton player.*



Rajah / Diagram 5.2

Getah asli dan getah sintetik boleh digunakan sebagai bahan pembuatan tapak kasut sukan. Pilih jenis getah yang boleh digunakan sebagai bahan pembuatan tapak kasut sukan dan wajarkan pilihan anda.

*Natural rubber and synthetic rubber can be used as the materials for the sport shoe sole. Choose the type of rubber that can be used as the material and justify your choice.*

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

[3 marks]

- (ii) Pembuangan getah sintetik yang tidak terkawal boleh menyebabkan masalah pencemaran alam sekitar. Cadangkan satu cara untuk mengatasi isu ini.  
*Uncontrolled disposal of synthetic rubber leads to an environmental pollution. Suggest one way to overcome this issue.*

.....

[1 mark]

3 (Q10, SBP 2021)

- (a) Seorang penoreh getah ingin mengumpul lateks dalam bentuk cecair. Namun begitu, dia mendapati cecair lateks menjadi pepejal putih selepas ditinggalkan untuk beberapa jam. Apakah yang perlu dilakukan oleh penoreh getah itu bagi mengatasi masalah ini? Terangkan jawapan anda.

*A rubber tapper intends to collect latex in liquid form. However, he found the liquid latex turns into white solid after being left for a few hours. What should the rubber tapper do to overcome this problem? Explain your answer.*

Jenis getah Type of rubber	Set	Panjang asal kepingan getah (cm) <i>Initial length of rubber strip (cm)</i>	Panjang kepingan getah dengan pemberat 100 g (cm) <i>Length of rubber strip with 100 g weight (cm)</i>	Panjang kepingan getah apabila pemberat 100 g dialihkan (cm) <i>Length of rubber strip when 100 g weight is removed (cm)</i>
Getah X <i>Rubber X</i>	I	12.00	12.35	12.10
	II	12.00	12.25	12.10
	III	12.00	12.30	12.15
Getah Y <i>Rubber Y</i>	I	12.00	12.05	12.00
	II	12.00	12.10	12.05
	III	12.00	12.00	12.00

Jadual / Table 10

Berdasarkan Jadual 10,  
*Based on Table 10,*

- (i) Nyatakan jenis getah X dan getah Y. Bandingkan dan terangkan perbezaan purata peningkatan panjang getah selepas pemberat dialihkan.  
*State the type of rubber X and rubber Y. Compare and explain the differences in average increase in the length of rubber after weight is removed.*

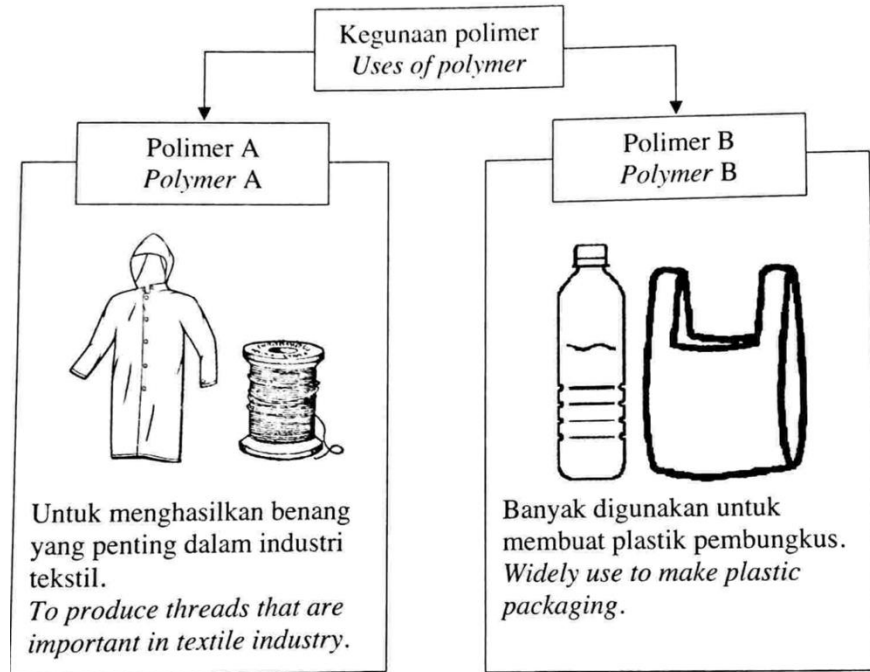
[6 markah/ 6 marks]

- (ii) Tapak kasut boleh diperbuat daripada getah X dan getah Y. Getah manakah yang sesuai untuk membuat tapak kasut yang tahan lebih lama? Berikan dua sebab kepada jawapan anda.  
*Shoe soles can be made of rubber X and rubber Y. Which rubber is suitable to make shoe soles that can last longer? Give two reasons for your answer.*

[3 markah/ 3 marks]

- (c) Polimer digunakan dengan sangat meluas dalam kehidupan seharian kita. Rajah 10 menunjukkan kegunaan dua polimer yang berbeza dalam kehidupan seharian.

*Polymers are widely used in our daily life. Diagram 10 shows the uses of two different polymers in daily life.*



Rajah 10/ *Diagram 10*

- (i) Nyatakan maksud polimer dan berikan satu contoh polimer semula jadi. Lukiskan formula struktur dan namakan polimer B mengikut sistem penamaan IUPAC.

*State the meaning of polymer and give one example of natural polymer. Draw the structural formula and name polymer B according to IUPAC nomenclature.*

[4 markah/ 4 marks]

- (ii) Banding dan bezakan polimer A dan polimer B dari segi jenis tindak balas pempolimeran dan ciri-ciri monomer yang terlibat.

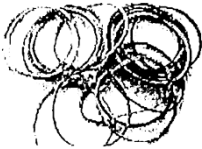

*Compare and contrast polymer A and polymer B in terms of types of polymerisation reaction and characteristics of the monomer involved.*

[4 markah/ 4 marks]

4 (Q2, SBP 2022)

Jadual 2 menunjukkan dua jenis produk yang diperbuat daripada dua jenis getah yang berbeza.

*Table 2 shows two types of products made up from two different types of rubber.*

<b>Jenis getah</b> <i>Type of rubber</i>	<b>Produk</b> <i>Product</i>
Getak tak tervulkan <i>Unvulcanised rubber</i>	 A
Getah tervulkan <i>Vulcanised rubber</i>	 B

Jadual / Table 2

(a) Getah adalah sejenis polimer. Apakah yang dimaksudkan dengan polimer?  
*Rubber is a type of polymer. What is meant by polymer?*

.....  
.....

[1 markah / 1 mark]

(b) Nyatakan nama monomer bagi getah asli.  
*State the name of monomer for natural rubber.*

.....  
.....

[1 markah/ 1 mark]

(c) (i) Produk B lebih kuat berbanding produk A. Terangkan jawapan anda.  
*Product B is stronger than product A. Explain your answer.*

.....  
.....

[2 markah/ 2 marks]

(ii) Produk B lebih kuat berbanding produk A. Terangkan jawapan anda.  
*Product B is stronger than product A. Explain your answer.*

.....  
.....

[1 markah/ 1 mark]

BAB 5: KIMIA KONSUMER DAN INDUSTRI

1 (Q7, SPM 2021)

Jadual 4 menunjukkan persamaan kimia bagi penyediaan agen pencuci A dan agen pencuci B.

Table 4 shows the chemical equation in the preparation of cleaning agent A and cleaning agent B.

Agen pencuci A Cleaning agent A	Agen pencuci B Cleaning agent B
$\text{CH}_3(\text{CH}_2)_n\text{CH}_2\text{OH}$ <p style="text-align: center;">↓ <math>\text{H}_2\text{SO}_4</math></p> $\text{CH}_3(\text{CH}_2)_n\text{CH}_2\text{O}-\overset{\text{O}}{\parallel}{\text{S}}-\text{OH}$ <p style="text-align: center;">↓ Proses peneutralan Neutralisation process</p> $\text{CH}_3(\text{CH}_2)_n\text{CH}_2\text{O}-\overset{\text{O}}{\parallel}{\text{S}}-\text{O}-\text{Na}^+$ <p style="text-align: center;">Bahan Q Substance Q</p>	$\begin{array}{c} \text{O} \\ \parallel \\ \text{CH}_2-\text{O}-\text{C}-(\text{CH}_2)_{14}\text{CH}_3 \\   \\ \text{O} \\ \parallel \\ \text{CH}_2-\text{O}-\text{C}-(\text{CH}_2)_{14}\text{CH}_3 \\   \\ \text{O} \\ \parallel \\ \text{CH}_2-\text{O}-\text{C}-(\text{CH}_2)_{14}\text{CH}_3 \end{array}$ <p style="text-align: center;">↓ Bahan Q Substance Q</p> $\begin{array}{c} \text{CH}_2-\text{OH} \\   \\ \text{CH}_2-\text{OH} \\   \\ \text{CH}_2-\text{OH} \end{array} + 3\text{CH}_3(\text{CH}_2)_{14}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{Na}^+$

Jadual / Table 4

- (a) (i) Apakah maksud sabun?  
What is the meaning of soap?

.....  
[1 markah]

- (ii) Nyatakan nama bagi bahan Q  
State the name of substance Q

.....  
[1 markah]

- iii Ahmad telah menyertai satu perkhemahan di pantai Tanjung Bidara. Bajunya diselaputi lumpur dan dia telah mencuci bajunya dengan sejenis pencuci. Didapati kesan lumpur pada bajunya masih ada. Cadangkan agen pencuci A atau agen pencuci B yang sesuai untuk digunakan bagi menghilangkan kotoran tersebut. Berikan alasan anda.

*Ahmad participated a camping at a beach in Tanjung Bidara. His shirt was stained with mud and he washed his shirt with a type of cleaning agent. It was found that the mud stain on his shirt remained. Suggest cleaning agent A or cleaning agent B which is more suitable to be used to remove the stain. Give your reasons.*

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

[3 markah]

- b (i) En. M merupakan seorang pesakit yang mengalami gangguan pemikiran seperti mendengar suara dan melihat sesuatu yang tidak nyata. Cadangkan satu jenis ubat moden berserta dengan contohnya bagi merawat masalah kesihatan En. M. Bagaimana ubat tersebut dapat meredakan masalah yang dialaminya?

*Mr. M is a patient who suffers from thought disorder such as hearing voices and seeing things that are not real. Suggest one type of modern medicine and its example to treat Mr. M's health problem. How the medicine can reduce the problem that he faced?*

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

[3 markah]

- (ii) Batuk dapat dikurangkan dengan menggunakan ubat tradisional iaitu jus asam jawa atau menggunakan ubat moden iaitu kodeina. Wajarkan penggunaan dua jenis ubat itu. *Cough can be reduced by using traditional remedies such as tamarind juice or modern medicine such as codeine. Justify the uses of these two medicines.*

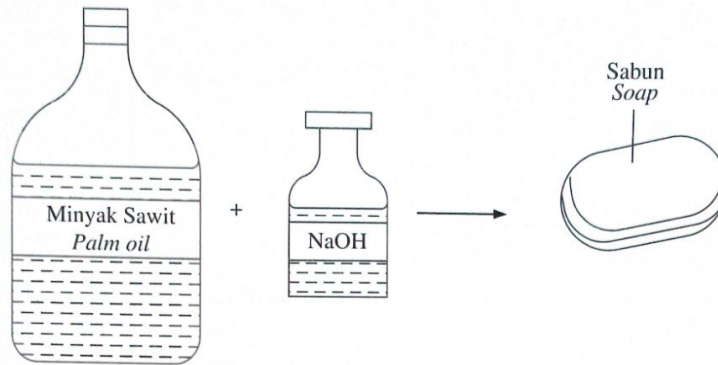
.....  
.....

[2 markah]

2 (Q3, SPM 2022)

Rajah 3 menunjukkan bahan-bahan yang digunakan untuk membuat sabun melalui tindak balas saponifikasi.

Diagram 3 shows the materials used to make soap through saponification reaction.



Rajah / Diagram 3

- (i) Apakah yang dimaksudkan dengan sabun?  
*What is meant by soap?*

.....  
[1 markah]

- (ii) Dalam tindak balas saponifikasi, minyak sawit dihidrolisis kepada asid palmitik,  $\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$  dan gliserol. Kemudian, asid palmitik bertindak balas dengan natrium hidroksida, NaOH melalui tindak balas peneutralan.

Tulis persamaan kimia bagi tindak balas peneutralan tersebut.

*In the saponification reaction, palm oil is hydrolysed into palmitic acid,  $\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$  and glycerol. Then, palmitic acid reacts with sodium hydroxide, NaOH through neutralisation reaction.*

*Write the chemical equation for the neutralisation reaction.*

.....  
[1 markah]

- (iii) Nyatakan nama bagi sabun yang terhasil jika natrium hidroksida di 3(a)(ii) digantikan dengan kalium hidroksida.  
*State the name of the soap formed if sodium hydroxide in 3(a)(ii) is replaced with potassium hydroxide.*

.....  
[1 markah]

- (i) Apakah yang dimaksudkan dengan sabun?  
*What is meant by soap?*

.....  
[1 markah]



- (b) Seorang suri rumah telah menggunakan kuantiti sabun yang sangat banyak untuk menanggalkan kotoran daripada pakaian yang dicuci dalam air liat.  
Dengan menggunakan pengetahuan kimia anda, bagaimanakah anda dapat membantu suri rumah itu untuk mengatasi masalah tersebut? Terangkan jawapan anda.

*A housewife used a very large quantity of soap to remove the stain from clothes that is cleaned in hard water.*

*By using your knowledge of chemistry, how can you help the housewife to overcome the problem? Explain your answer.*

.....

.....

.....

.....

[3 markah]

**3** (Q3, SPMRSM 2021)

Rajah 3.1 menunjukkan pelbagai jenis bahan kosmetik di pasaran.  
*Diagram 3.1 shows various types of cosmetics found in the market.*



Rajah / Diagram 3.1

- (a) Apakah yang dimaksudkan dengan kosmetik?  
*What is meant by cosmetics?*

.....

[1 markah]

- (b) Nyatakan satu contoh bahan kimia terlarang dalam kosmetik yang menyebabkan kemerahan dan kulit mengelupas.  
*State one example of the harmful chemicals in cosmetics that can cause redness and peeling skin.*

.....

[1 markah]

- (c) Masalah kegatalan kulit dapat dirawat dengan mengambil ubat-ubatan tertentu. Rajah 3.2 menunjukkan perbualan antara Emelda dan Maryam tentang rawatan kegatalan kulit.  
*Itchiness of skin can be treated by taking certain medicine. Diagram 3.2 shows a conversation between Emelda and Maryam about skin itchiness treatment.*



Rajah 3.2  
Diagram 3.2

- (d) Berikan satu contoh ubat tradisional yang boleh digunakan oleh Emelda dan huraikan secara ringkas cara penggunaannya.  
*Give one example of traditional medicine that can be used by Emelda and describe briefly how it is used.*

.....  
[1 markah]

- (e) Ubat moden dan ubat tradisional boleh merawat penyakit yang sama walaupun tahap keberkesanan mungkin berbeza. Mengapa?  
*Modern and traditional medicines can both treat the same illnesses although the efficacy level may differ. Why?*

.....  
[1 markah]

4 (Q1, SPMRSM 2022)

Rajah 1 menunjukkan ramuan bagi sebiji kek.  
*Diagram 1 shows the ingredients of a cake.*



Ramuan:

Tepung Gandum, Lemak Tepu, Asid Sitrik, Sirap Jagung,  
Karamel, Lesitin, Telur, Marjerin.

*Ingredients:*

*Wheat Flour, Saturated Fat, Citric Acid, Corn Syrup, Caramel,  
Lecithin, Egg, Margarine.*

Rajah / Diagram 1

- (a) Lemak ialah salah satu bahan yang terdapat dalam kek.  
Nyatakan keadaan fizikal lemak pada suhu bilik.  
*One of the ingredients in the cake is fats.  
State the physical state of fats at room temperature.*

.....  
[1 markah]

- (b) Lemak tak tepu boleh ditukarkan kepada lemak tepu melalui suatu tindak  
balas.  
Namakan tindak balas tersebut.  
*Unsaturated fats can be converted to saturated fats through a reaction.  
Name the reaction.*

.....  
[1 markah]

- (c) Nyatakan satu contoh lain bahan tambah makanan yang terdapat dalam  
kek.  
*State another example of food additives in the cake.*

.....  
[1 markah]

- (d) Nyatakan satu contoh lain bahan tambah makanan yang terdapat dalam kek.

*State another example of food additives in the cake.*

.....  
[1 markah]

- 5 (b) (Q8, SBP 2021)

Rajah 8.1 menunjukkan poster kempen berkaitan dengan pelaksanaan salah satu program Teknologi Hijau dalam komuniti.

*Diagram 8.1 shows a campaign poster related to the implementation of one of the Green Technology programmes in the community.*



Rajah / Diagram 8.1

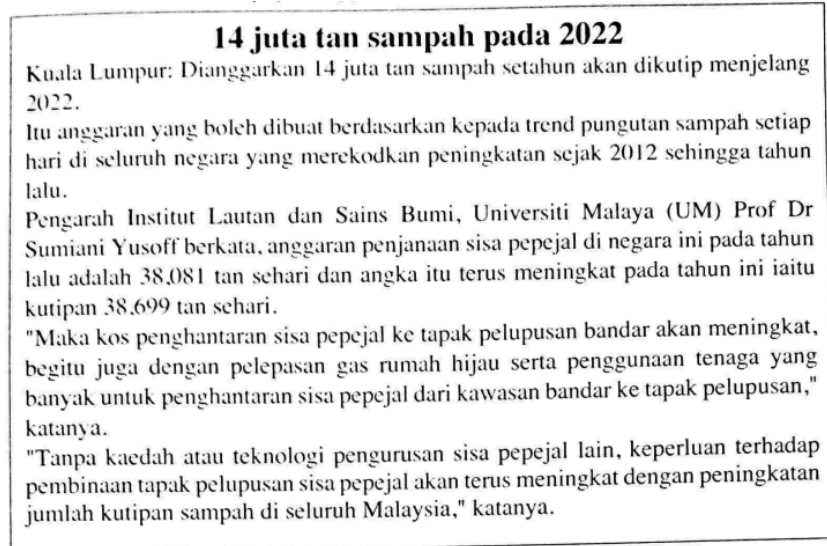
Pada pendapat anda, adakah kita perlu menyokong kempen yang ditunjukkan dalam Rajah 8.1? Terangkan jawapan anda.

*In your opinion, do we need to support the campaign show in Diagram 8.1? Explain your answer.*

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

[3 markah]

- (c) Rajah 8.2 menunjukkan keratan akhbar berkaitan pembuangan sampah di Malaysia  
*Diagram 8.2 shows newspaper clipping minting to rubbish disposal in Malaysia.*



Rajah *Diagram* 8.2

Berdasarkan keratan akhbar dalam Rajah 8.2, cadangkan dua kaedah yang melibatkan aplikasi Teknologi hijau bagi mengatasi masalah yang diutarakan. Berikan kelebihan bagi salah satu kaedah yang dicadangkan.  
*Based on the newspaper clipping in Diagram 8.2, suggest two methods involving the application of Green Technology to solve the problem highlighted. Give one advantage for one of the methods suggested.*

.....

.....

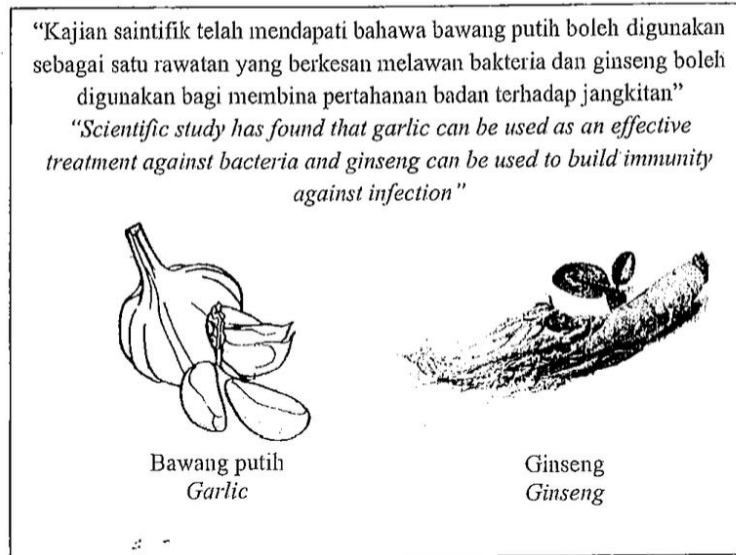
.....

[3 markah]

6 (a) (Q4, SBP 2022)

Rajah 4 menunjukkan satu pernyataan berkaitan bawang putih dan ginseng yang boleh digunakan sebagai ubat tradisional.

*Diagram 4 shows a statement related to garlic and ginseng that can be used as traditional medicine.*



Rajah / Diagram 4

Berdasarkan Rajah 4,  
Based on Diagram 4,

- (i) bagaimanakah cara bawang putih atau ginseng digunakan untuk merawat penyakit?  
*how garlic or ginseng is used to treat illness?*

.....  
[1 markah]

- (ii) berikan dua kelebihan menggunakan ubat-ubat yang dinyatakan dalam Rajah 4.  
*give two advantages of using the medicines stated in Diagram 4.*

.....  
[1 markah]

(b) Ali adalah seorang pesakit gastrik dan dia sedang mengalami sakit kepala. Bagi meredakan sakit kepalanya, Ali telah mengambil aspirin. Malangnya, dia mengalami kesakitan dalam perut.  
*Ali is a gastric patient, and he is having headache. In order to relieve his headache, he took aspirin. Unfortunately, he got pain in his stomach.*

(i) Terangkan mengapa beliau mengalami keadaan sedernikian.  
*Explain why he experiences that situation.*

.....

.....

[2 markah]

(ii) Cadangkan nama ubat yang boleh menggantikan aspirin.  
*Suggest the name of the medicine that can replace aspirin.*

.....

[1 markah]

(iii) Nyatakan kesan sampingan jika ubat yang dicadangkan di 4(b)(ii) diambil secara berlebihan  
*State the side effect if the medicine suggested in 4(b)(ii) is taken excessively.*

.....

[1 markah]

Wafa Binti Mohamad Fauzi  
 Muhammad Hazriq Bin Aris  
 Nur Siti Fatimah Binti Bukhori  
 Nik Nurul Fatimah Binti Mohd Noor  
 Nurul Amira Binti Abu Bakar  
 Nur Syuhadha Binti Mohamad Aseri  
 Siti Raudhah Binti Abdul Manap  
 Amierul Hafreez Bin Noor Hasnan  
 Nuraziella Binti Abdullah  
 Nurul 'Afifah Sya-Irah bt Abd Nasir  
 Shahira Binti Mat Yusof  
 Norhana Humairah Binti Alias  
 Ahmad Tajudin Bin Abdul Rahman  
 Nur Farhana Binti Mohamad Ali  
 Rahayu Binti Abdul Rahman  
 Nur Syamimi Binti Ab Rasid  
 Nur Qusyairi Bin Mohamed Fauzi  
 Muhammad Firdaus Bin Hamzah  
 Muhamad Haizat Bin Ghazali  
 Nik Muhammad Irfan Hakimi Bin Mohd Saufi  
 Azhar Bin Zawawi  
 Abdul Hafiz Bin Sheik Muhamed  
 Nurhayatun Sobariah Binti Abdul Razak  
 Wan Muhammad Najmi Bin Wan Anuar  
 Nur Adila Binti Ramlon  
 Dinah Adelina Binti Razali  
 Amir Farhan Bin Omar  
 Aida Rohayu Binti Abdul Karim  
 Muhammad Norazraa Bin Nordin  
 Kartika Binti Firman  
 Najibulla Bin Romainor  
 Elysa Anak Chundang  
 Shahadad Bin Zainol Abidin  
 Norizan Binti Ramli  
 Danial Fikri Bin Samsudin  
 Saidah Nafisah bt Zulkupli  
 Najihah Binti Haron  
 Nurfarizah Binti Muhammad Faisal  
 Basirah Binti Abu Bakar  
 Amalin Sofea Binti Rozani  
 Nawal Binti Nasarudin  
 Najwa Binti Ahmad Shahrir  
 Nor Azieda Binti Azahari  
 Ghazali Bin Musa

MRSM Alor Gajah  
 MRSM ARAU  
 MRSM ARAU  
 MRSM ATM BERA  
 MRSM ATM BERA  
 MRSM ATM BERA  
 MRSM Bagan Datuk  
 MRSM Bagan Datuk  
 MRSM Baling  
 MRSM Baling  
 MRSM Batu Pahat  
 MRSM Bentong  
 MRSM Beseri  
 MRSM Beseri  
 MRSM Besut  
 MRSM Besut  
 MRSM Betong  
 MRSM Felda Trolak  
 MRSM Gemencheh  
 MRSM Johor Bahru  
 MRSM Johor Bahru  
 MRSM Jeli  
 MRSM Kota Putra  
 MRSM Kuala Klawang  
 MRSM Kuantan  
 MRSM Kuantan  
 MRSM Kuching  
 MRSM Langkawi  
 MRSM Langkawi  
 MRSM Mersing  
 MRSM Pengkalan Chepa  
 MRSM Kota Putra  
 MRSM Pengkalan Chepa  
 MRSM Serting  
 MRSM Tumpat  
 MRSM Tumpat  
 MRSM Tun Abdul Razak  
 MRSM Tun Ghafar Baba  
 MRSM Tun Ghazali Shafie  
 MRSM Tun Mohammad Fuad Stephens  
 MRSM Tun Mohammad Fuad Stephens  
 MRSM Tun Mustapha  
 BPM  
 BPM