Chem Quest

2024

K1 TINGKATAN 5

Jom A+ Kimia

SPM 2023

PERCUMA - TIDAK DIJUAL

[Johor – JB – Tangkak – Skudai]
[Kedah – Kelantan – Negeri Sembilan]
[Pahang – Perlis – Putrajaya – SBP]
[Selangor-Set 1&2 – Terengganu MPP3]
[JUJ-Set 1&2 – Melaka – MRSM = 17Set]

Nama : ..... Kelas : .....

Bab 1 Keseimbangan Redoks

1.1 Pengoksidaan dan penurunan

[Selangaor2023 Set 01-05] Pernyataan yang manakah mendefinisikan pengoksidaan?
Which statement defines oxidation?

A Penerimaan oksigen
Gain of oxygen

B Pengurangan nombor pengoksidaan
Decrease in oxidation number

C Penerimaan elektron
Gain of electron

D Penerimaan hidrogen
Gain of hydrogen

[Selangor2023 Set 1-05] Antara berikut, yang manakah satu contoh agen pengoksidaan?
Which of the following is an example of oxidising agent?

A Air klorin
Chlorine water

B Logam magnesium
Magnesium metal

C Larutan natrium iodida
Sodium iodide solution

D Larutan ferum(II) sulfat
Iron(II) sulphate solution

[Negeri Sembilan 2023-29] Antara yang berikut, bahan tindak balas manakah akan menghasilkan tindak balas redoks?
Which of the following reactants will produce a redox reaction?

A Ferum(III) oksida dan karbon
Iron(III) oxide and carbon

B Natrium klorida dan argentum
Sodium chloride and silver

C Natrium hidroksida dan asid nitrik
Sodium hydroxide and nitric acid

D Kuprum(II) oksida dan asid sulfurik
Copper(II) oxide and sulphuric acid

[SBP2023-25] F5 Bab 09
25. Persamaan ion berikut mewakili satu tindak balas kimia.
The following ionic equation represents a chemical reaction.

$$X + Y^{2+} \rightarrow X^{2+} + Y$$

Antara yang berikut, yang manakah betul tentang bahan-bahan itu?
much of the following are correct about the substances?

	Bahan yang dioksidakan *Oxidised substance*	Bahan yang diturunkan *Reduced substance*	Agen Pengoksidaan *Oxidising agent*	Agen penurunan *Reducing agent*
A	Y^{2+}	X	X	Y^{2+}
B	X	Y^{2+}	X	Y^{2+}
C	X^{2+}	Y	Y	X^{2+}
D	X	Y^{2+}	Y^{2+}	X

[Putrajaya2023-11] Antara yang berikut, yang manakah proses pengoksidaan?
Which of the following is an oxidation process?

A Karbon dioksida kehilangan oksigen
Carbon dioxide loses oxygen

B Ion Mg^{2+} menerima dua elektron
Mg^{2+} ion receives two electrons

C Satu molekul klorin menerima hidrogen
A chlorine molecule gains hydrogen

D Nombor pengoksidaan bagi ferum berubah +2 ke +3
Oxidation number of iron changes +2 to +3

[Perlis 2023-21] Antara persamaan kimia berikut, yang manakah melibatkan tindak balas redoks?
Which of the following chemical equations involves a redox reaction?

A $C(p/s) + O_2(g) \rightarrow CO_2(g)$
B $CaCO_3(p/s) \rightarrow CaO(p/s) + CO_2(g)$
C $2NaOH(ak/aq) + H_2SO_4(ak/aq) \rightarrow Na_2SO_4(ak/aq) + 2H_2O(ce/l)$
D $AgNO_3(ak/aq) + NaCl(ak/aq) \rightarrow AgCl(p/s) + NaNO_3(ak/aq)$

[Pahang 2023-09] Antara berikut yang manakah merupakan agen pengoksidaan?
Which of the following are oxidising agents?

I Kalium iodida
Potassium iodide

II Ferum(II) sulfat
Iron(II) sulphate

III Ferum(III) klorida
Iron(III) chloride

IV Hidrogen peroksida berasid
Acidified hydrogen peroxide

A I dan II
I and II

B I dan IVD
I and IV

C II dan III
II and III

D III dan IV
III and IV

[Negeri Sembilan 2023-12] Antara yang berikut, proses manakah yang berlaku dalam tindak balas penurunan?
Which of the following processes occur in a reduction process?

I Penerimaan oksigen
Accepting of oxygen

II Kehilangan elektron
Loss of electron

III Penerimaan hidrogen
Accepting of hydrogen

IV Pengurangan nombor pengoksidaan
Decreasing of oxidation number

A I dan II
I and II

B II dan III
II and III

C III dan IV
III and IV

D I dan IV
I and IV

[Kedah2023-06] Set manakah bagi definisi penurunan dari segi oksigen, hidrogen dan elektron adalah betul?
Which set of definition of reduction in terms of oxygen, hydrogen and electron is correct?

	Oksigen *Oxygen*	Hidrogen *Hydrogen*	Elektron *Electrons*
A	Penerimaan *Gain*	Kehilangan *Loss*	Kehilangan *Loss*
B	Penerimaan *Gain*	Kehilangan *Loss*	Penerimaan *Gain*
C	Kehilangan *Loss*	Penerimaan *Gain*	Penerimaan *Gain*
D	Kehilangan *Loss*	Penerimaan *Gain*	Kehilangan *Loss*

[Kelantan 2023-14] Antara berikut yang manakah merupakan agen penurunan?
Which of the following is a reducing agent?

A. Hidrogen peroksida berasid, H_2O_2
Acidified hydrogen peroxide, H_2O_2

B. Ferum (III) klorida, $FeCl_3$
Iron (III) chloride, $FeCl_3$

C. Kalium bromida, KBr
Potassium bromide, KBr

D. Air klorin, Cl_2
Chlorine water, Cl_2

[MRSM2023-08] Antara berikut, yang manakah menunjukkan tindak balas penurunan?
Which of the following shows a reduction reaction?

A Atom magnesium menderma elektron membentuk ion magnesium
Magnesium atom donates electron to form magnesium ion

B Plumbum(II) oksida kehilangan oksigen apabila bertindak balas dengan gas hidrogen
Lead(II) oxide loses oxygen when react with hydrogen gas

C Ammonia kehilangan hidrogen membentuk nitrogen apabila bertindak balas dengan kuprum(II) oksida
Ammonia loses hydrogen to form nitrogen when react with copper(II) oxide

D Nombor pengoksidaan zink meningkat daripada 0 kepada +2
Oxidation number of zinc increases from 0 to +2

[Kelantan 2023-16] Kenyataan yang manakah benar mengenai agen pengoksidaan?
Which statement is true about oxidizing agents?

A. Lebih cenderung melepaskan elektron
Has a great tendency to release electron

B. Nombor pengoksidaan bahan berkurang
Oxidation number of substance decrease

C. Mempunyai nilai keupayaan elektrod piawai, E° yang lebih positif.
Has a more positive value of standard electrode potential, E°

[MRSM2023-256] Pernyataan berikut menunjukkan pemerhatian untuk dua tindak balas berbeza bagi gas X dan gas Y.
The following statements show the observations of two different reactions for gas X and gas Y.

• Gas X menukarkan warna ungu larutan kalium manganat(VII) berasid kepada tanpa warna.
Gas X turns purple acidified potassium manganate(VII) solution to colourless.

• Gas Y menukarkan larutan tanpa warna kalium iodida kepada perang.
Gas Y turns colourless potassium iodide solution to brown.

Apakah kesimpulan yang boleh dibuat daripada pemerhatian tersebut?
What conclusion can be made from the observations?

	Gas X	Gas Y
A	Agen pengoksidaan *Oxidising agent*	Agen pengoksidaan *Oxidising agent*
B	Agen penurunan *Reducing agent*	Agen pengoksidaan *Oxidising agent*
C	Agen pengoksidaan *Oxidising agent*	Agen penurunan *Reducing agent*
D	Agen penurunan *Reducing agent*	Agen penurunan *Reducing agent*

[Melaka 2023-13] Antara berikut, tindak balas manakah yang merupakan tindak balas pengoksidaan?
Which of the following reactions is an oxidation reaction?

A Menerima hidrogen
Accept hydrogen

B Menerima elektron
Accept electron

C Menerima oksigen
Accept oxygen

D Nombor pengoksidaan berkurang
Oxidation number decreases

[Johor Bahru 2023-09] Antara yang berikut, yang manakah adalah tindak balas pengoksidaan?
Which of the following is an oxidation reaction?

A Pengurangan nombor pengoksidaan
Decreasing of oxidation number

B Kehilangan hidrogen
Loss of hydrogen

C Penerimaan elektron
Accepting of electron

D Kehilangan oksigen
Loss of oxygen

[Johor Skudai2023-39] Persamaan setengah manakah yang menunjukkan bahan tindak balas bertindak sebagai agen penurunan?
Which half equations show that the reactant acts as a reducing agent?

I $Mg \rightarrow Mg^{2+} + 2e$
II $Cu^{2+} + 2e \rightarrow Cu$
III $2Cl^- \rightarrow Cl_2 + 2e$
IV $2H^+ + 2e \rightarrow H_2$

A I and II
II dan II

B I and III
I dan III

C II and IV
II dan IV

D III and IV
III dan IV

Nombor Pengoksidaan

[Pahang JUJ Set 2 2023-07] 7 Apakah nombor pengoksidaan bagi sulfur dalam ion tiosulfat, $S_2O_3^{2-}$?
What is the oxidation number of sulphur in thiosulphate ion, $S_2O_3^{2-}$?

A -2 B +2 C -3 D +3

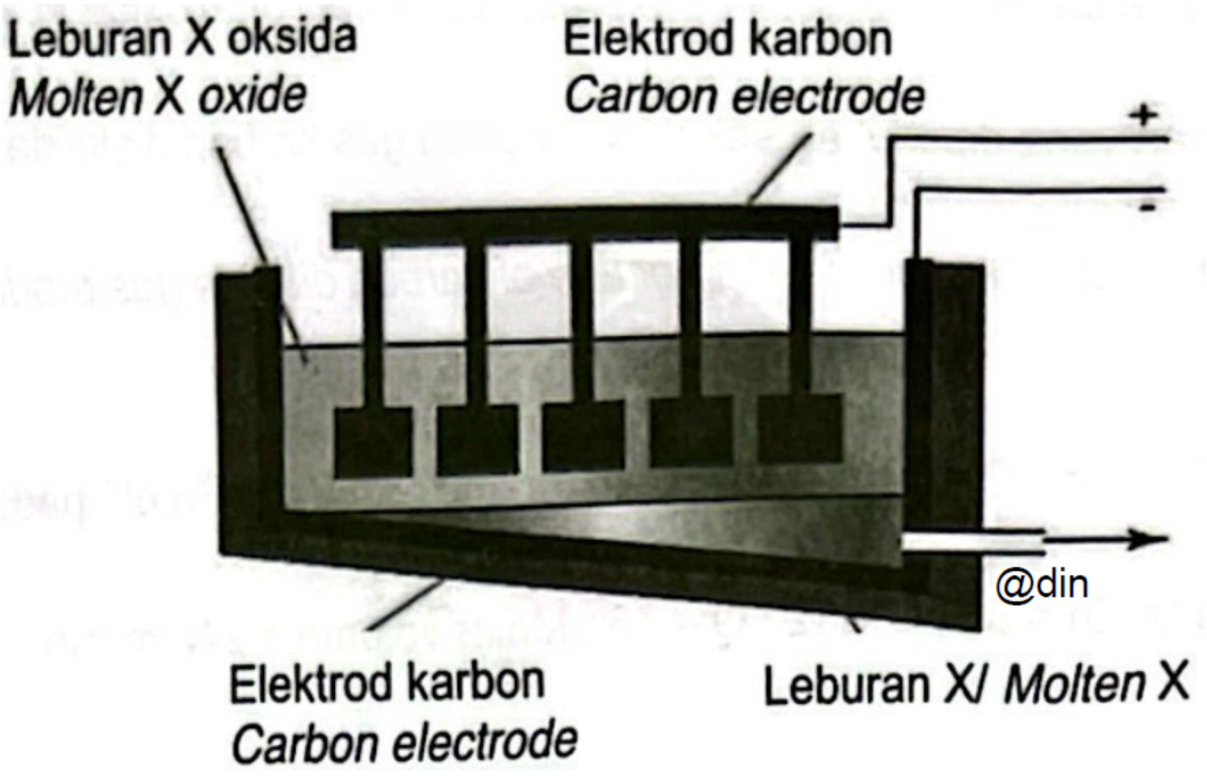
[Johor Skudai2023-37] Persamaan berikut mewakili tindak balas pengoksidaan antara etanol dan kalium dikromat(VI) berasid.
The following equation represents the oxidation reaction between ethanol and acidified potassium dichromate(VI).

$$3C_2H_5OH + 2K_2Cr_2O7 + 8H_2SO_4 \rightarrow 3CH_3COOH + 2Cr_2(SO_4)_3 + 2K_2SO_4 + 11H_2O$$

Apakah perubahan nombor pengoksidaan bagi kromium?
What is the change in the oxidation number of chromium?

A +2 kepada/to +6
B +3 kepada/to +6
C +6 kepada/to +2
D +6 kepada/to +3

[Terengganu2023-39] Rajah 39 menunjukkan susunan radas bagi mengekstrak logam daripada bijihnya.
Diagram 39 shows the apparatus set-up for extracting metal from the ore.



2 cm^3 leburan X dimasukkan ke dalam dua tabung uji yang berasingan dan ditambahkan dengan dua reagen iaitu larutan natrium hidroksida, NaOH dan larutan ammonia, NH_3 secara berasingan.
2 cm^3 of molten X is put into two separate test tubes and added with two reagents which is sodium hydroxide solution, NaOH and ammonia solution, NH_3 separately.

Jadual 39 menunjukkan keputusan pemerhatian bagi tindak balas di atas.
Table 39 shows the observation results for the above reaction.

Reaqen/ *Reaqent*	Pemerhatian/ *Observation*
Larutan Natrium hidroksida,NaOH *Sodium hydroxide solution, NaOH*	Mendakan putih yang tidak larut di dalam larutan natrium hidroksida, NaOH berlebihan. *A white precipitate insoluble in sodium hydroxide solution, excess NaOH*
Larutan Ammonia, NH_3 *Ammonia solution, NH_3*	Tiada perubahan *No change*

Leburan X bertindak balas dengan asid hidroklorik menghasilkan garam terlarutkan. Apakah perubahan nombor pengoksidaan X.
Molten X reacts with hydrochloric acid to form a soluble salt.
What is the change in oxidation number of X.

A +3 kepada/to 0
B +2 kepada/to 0
C 0 kepada/to +2
D 0 kepada/to +3

[Melaka 2023-22] Apakah nombor pengoksidaan bagi sulfur dalam asid sulfurik, H_2SO_4?
What is the oxidation number of sulphur in sulphuric acid, H_2SO_4?

A -2 B -4 C +4 D +6

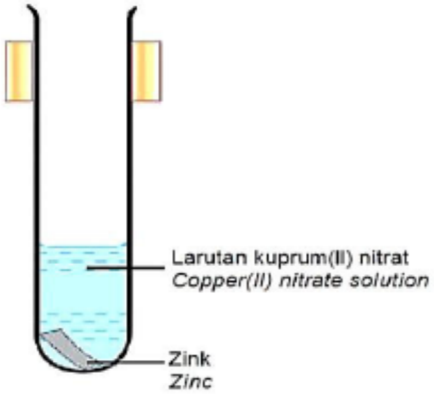
[MRSM2023-35] Persamaan ion berikut mewakili satu tindak balas redoks.
The following ionic equation represents a redox reaction.

$3C_2H_5OH + 2X_2O_7^{2-} + 16H^+ \rightarrow 3CH_3COOH + 4X^{3+} + 11H_2O$

Apakah perubahan nombor pengoksidaan X?
What is the change in the oxidation number of X?

A +6 ke/to +12
B +6 ke/to +3
C +7 ke/to +3
D +7 ke/to +12

[Johor PPD Tangkak 2023 19] Rajah 9 menunjukkan satu kepingan zink dimasukkan ke dalam tabung uji yang mengandungi larutan kuprum(II) nitrat. Antara perubahan nombor pengoksidaan berikut, yang manakah betul bagi kuprum.
Diagram 9 shows a piece of zinc plate is added into a test tube containing copper(II) nitrate solution. Which of the following changes in oxidation number is correct for copper?



$Cu(NO_3)_2$ (ak) + Zn (p) → $Zn(NO_3)_2$ (ak) + Cu (p)
$Cu(NO_3)_2$ (aq) + Zn (s) → $Zn(NO_3)_2$ (aq) + Cu (s)

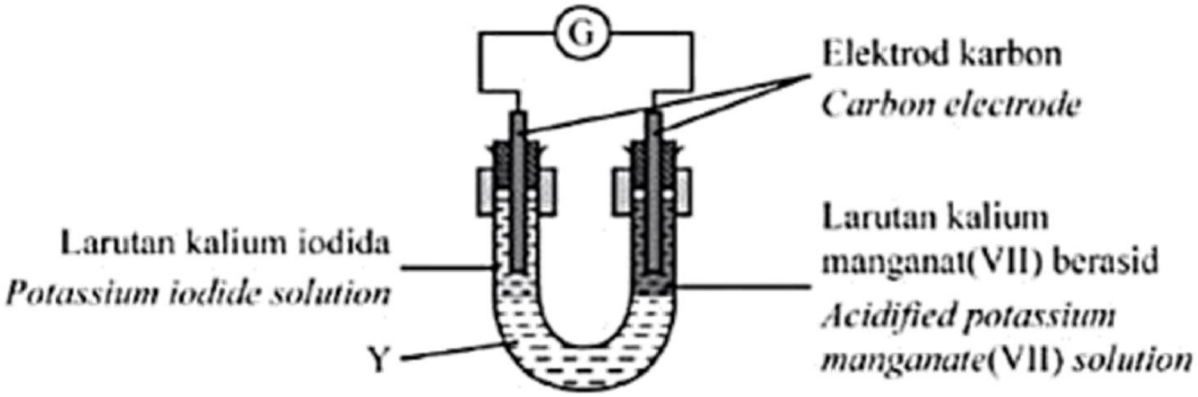
A 0 kepada/to +1
B +1 kepada/to 0
C 0 kepada/to +2
D +2 kepada/to 0

[SBP2023-33] Apakah nombor pengoksidaan klorin dalam natrium klorat, $NaClO_3$?
What is the oxidation number of chlorine in sodium chlorate, $NaClO_3$?

A 0 B -1 C +5 D +7

Tiub U

[Johor PPD Tangkak 2023 18] Rajah 8 menunjukkan susunan radas bagi pemindahan elektron pada suatu jarak dalam tiub-U.
Diagram 8 shows the apparatus set-up for the transfer of electrons at a distance in Utube.



Apakah fungsi Y?/ *What is the function of Y?*

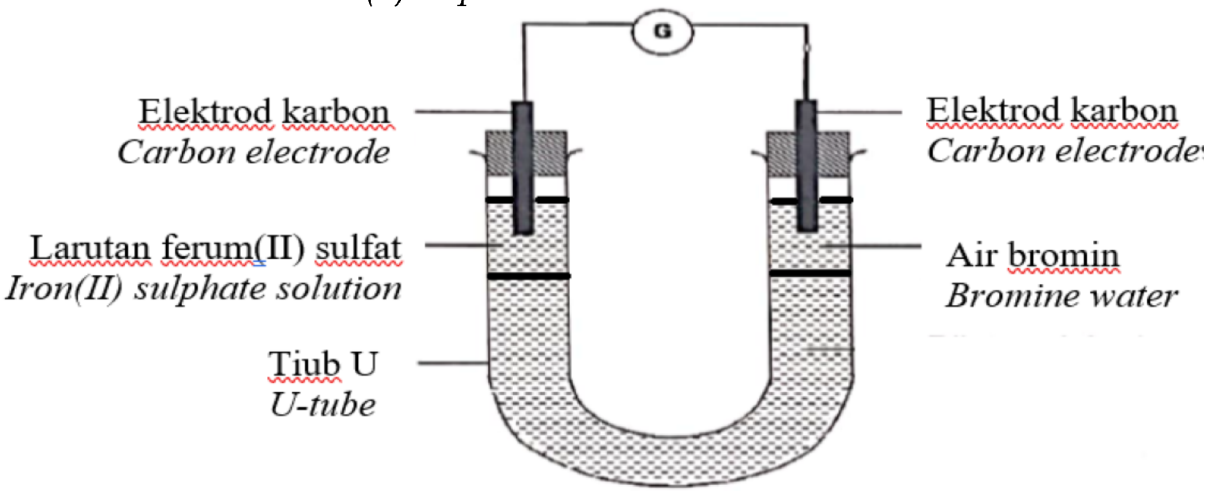
A Membenarkan pengaliran ion dari kedua-dua larutan
Allow the flow of ions from both solutions

B Menerima elektron dari larutan kalium iodida
Accept electrons from potassium iodide solution

C Membenarkan pemindahan elektron dari terminal negatif ke terminal positif.
Allow the transfer of electrons from negative terminal to positive terminal.

D Bertindak sebagai agen pengoksidaan
Act as an oxidizing agent

[Pahang JUJ Set 2 2023-21] Rajah 3 menunjukkan susunan radas untuk mengkaji tindak balas antara air bromin dengan larutan ferum(II) sulfat.
Diagram 3 shows the apparatus set- up to investigate the reaction of bromine water solution with iron(II) sulphate solution.



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

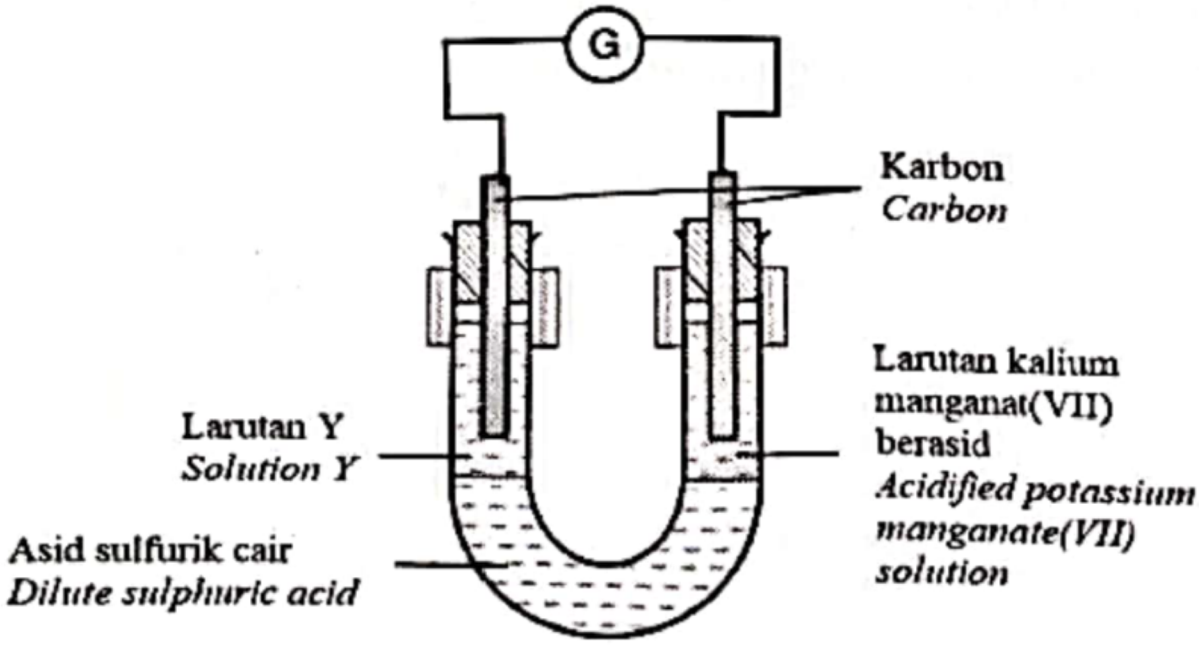
A Ferum(II) diturunkan kepada ferum(III)
Iron(II) is reduced to iron(III)

B Air bromin dioksidakan kepada ion bromida
Bromine water is oxidised to bromide ion

C Larutan ferum(II) sulfat adalah agen pengoksidaan
Iron(II) sulphate is an oxidising agent

D Warna air bromin berubah dari perang kepada tidak berwarna
The colour of bromin water changes from brown to colourless

[Johor Bahru 2023-27] Rajah 7 menunjukkan susunan radas untuk mengkaji pemindahan elektron pada satu jarak.
Diagram 7 shows the apparatus set-up to investigate the transfer of electrons at a distance.



Apakah Y?/ *What is Y?*

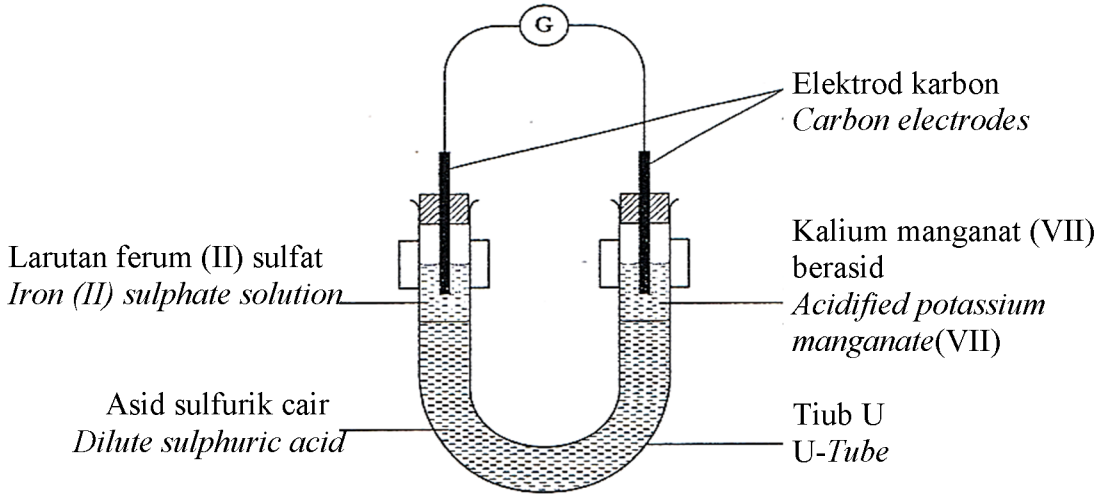
A Air bromin
Bromine water

B Air klorin
Chlorine water

C Larutan kalium iodida
Potassium iodide solution

D Larutan ferum(III) sulfat
Iron(III) sulphate solution

[Putrajaya2023-24] Rajah 9 menunjukkan susunan radas untuk mengkaji tindak balas antara kalium manganat (VII) dengan larutan ferum (II) sulfat.
Diagram 9 shows the apparatus set-up used to investigate the reaction of acidified potassium manganate(VII) with iron(II) sulphate solution.

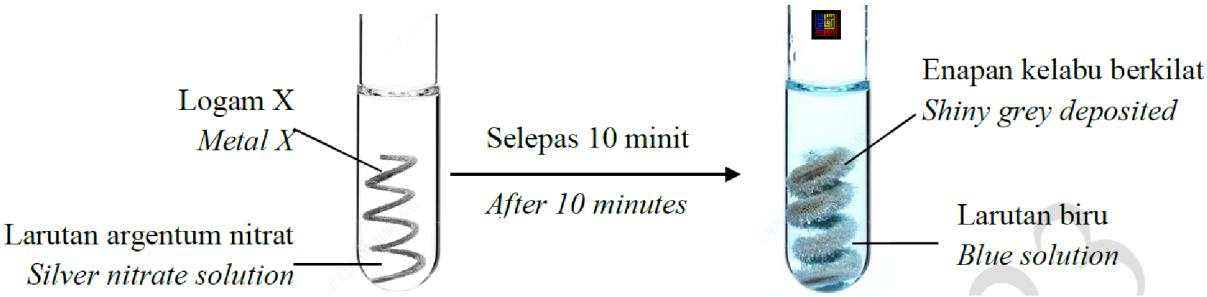


Antara yang berikut, yang manakah perubahan warna bagi kedua-dua larutan itu?
Which of the following is the colour change of the two solutions?

	Larutan ferun(II) sulfat ***Iron(II) sulphate solution***	**Kalium manganat(VII) berasid** ***Acidified potassium manganat(VII)***
A	Hijau kepada perang *Green to brown*	Ungu kepada tidak berwarna *Purple to colourless*
B	Perang kepada hijau *Brown to green*	Ungu kepada tidak berwarna *Purple to colourless*
C	Perang kepada hijau *Brown to green*	Jingga kepada hijau *Orange to green*
D	Hijau kepada perang *Green to brown*	Jingga kepada hijau *Orange to green*

Penyesaran logam

[Pahang JUJ Set 1 2023-27] Rajah 12 menunjukkan pemerhatian bagi satu tindak balas kimia.
Diagram 12 show the observation of a chemical reaction.



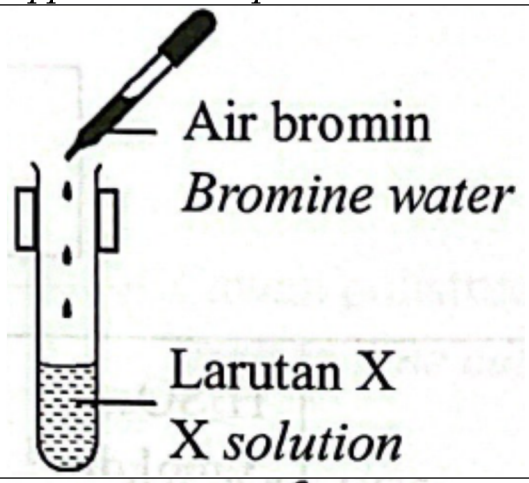
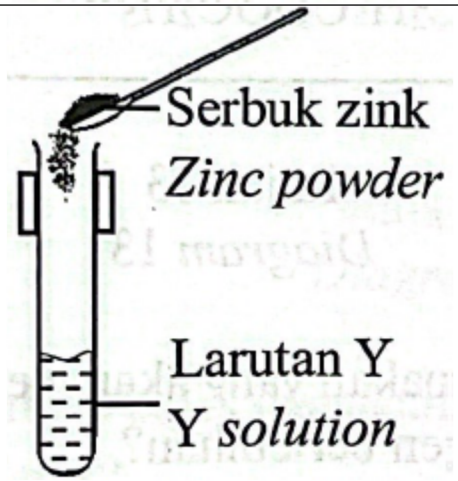
Rajah 12/ *Diagram 12*

Apakah logam X? / *What is metal X?*

A Ferum/*Iron*
B Kuprum/ *Copper*
C Plumbum/*Lead*
D Magnesium/ *Magnesium*

Penyesaran halida

[Negeri Sembilan 2023-38] Jadual 3 menunjukkan pemerhatian bagi dua eksperimen yang telah dijalankan oleh seorang murid.
Table 3 shows the observations for two experiments that has been carried out by a student.

Eksperimen *Experiment*	Susunan radas *Apparatus set-up*	Pemerhatian *Observation*
I		Larutan hijau berubah menjadi perang *The green solution turns brown*
II		Larutan perang berubah menjadi hijau *The brown solution turns green*

Antara yang berikut, pemerhatian manakah yang betul jika X dan Y diuji dengan larutan kalium heksasianoferat(III)?
Which of the following is the correct observation if X and Y are tested with potassium hexacyanoferrate(UI) solution?

	X	**Y**
A	Mendakan biru muda *Light blue precipitate*	Mendakan biru tua *Dark blue precipitate*
B	Perang kehijauan *Greenish brown*	Mendakan biru tua *Dark blue precipitate*
C	Mendakan biru tua *Dark blue precipitate*	Perang kehijauan *Greenish brown*
D	Mendakan biru tua *Dark blue precipitate*	Mendakan biru muda *Light blue precipitate*

Pertukaran Fe^{2+} ke Fe^{3+}

[Putrajaya2023-22] Antara yang berikut, bahan yang manakah digunakan untuk menukarkan ion ferum (III) kepada ion ferum (II) ?
Which the following substance is used to change iron (III) ion to iron (II) ion?

A Air bromin
Bromine water

B Larutan kalium iodida
Potassium iodide solution

C Larutan kalium dikromat(VI)
Potassium dichromate(VI) solution

D Larutan kalium manganat(VII) berasid
Acidified potassium manganate(VII) solution

[Pahang 2023-22] Larutan ion Fe^{3+} boleh ditukarkan kepada ion Fe^{2+} dengan menambah serbuk zink. Bahan yang manakah boleh digunakan untuk menggantikan serbuk zink dalam tindak balas ini?
Fe^{3+} ion solution can be converted to Fe^{2+} ion by adding zinc powder. Which substance can be used to replace zinc powder in this reaction?

A Air klorin
Chlorine water

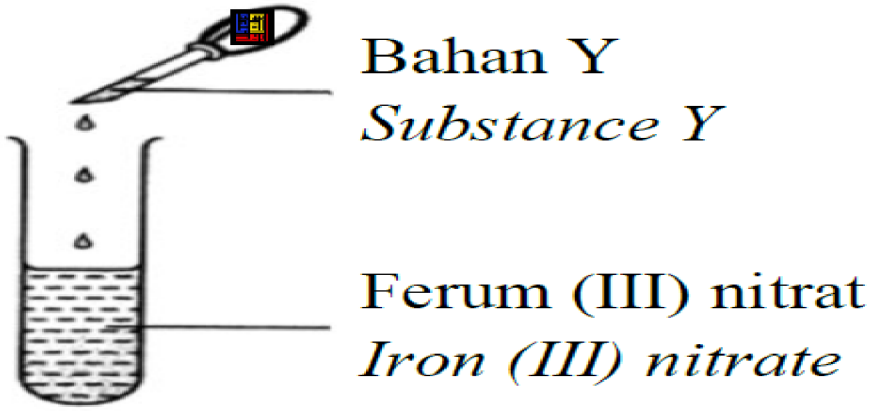
B Larutan kalium iodida
Potassium iodide solution

C Larutan kalium heksasianoferrat(II)
Potassium hexacyanoferrate(II) solution

D Larutan kalium manganat(VII) berasid
Acidified potassium manganate(VII) solution

[Pahang JUJ Set 1 2023-22] Rajah 7 menunjukkan susunan radas suatu eksperimen bagi pertukaran ion ferum (III), Fe^{3+} kepada ion ferum (II), Fe^{2+} .

Diagram 7 shows a set up of apparatus an experiment conversation of iron (III) ion, Fe^{3+} to iron (II) ion, Fe^{2+}.



Apakah bahan Y? / *What is substance Y?*

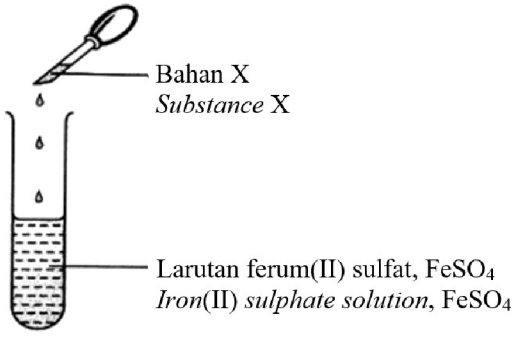
A Air klorin
Chlorine water

B Hidrogen peroksida
Hydrogen peroxide

C Larutan kalium bromida
Potassium bromide solution

D Larutan kalium manganate (VII) berasid
Acidified potassium manganate (VII) solution

[Johor Skudai2023-20] Rajah 20 menunjukkan susunan radas suatu eksperimen untuk mengkaji pertukaran ion ferum(II), Fe^{2+} kepada ion ferum(III), Fe^{3+}.
Diagram 20 shows an apparatus set-up of an experiment to study the conversion of iron(II) ion, Fe^{2+} to iron(III) ion, Fe^{3+}.



Bahan manakah yang boleh digunakan sebagai bahan X?
Which substance can be used as substance X?

A Air klorin, Cl_2
Chlorine water, Cl_2

B Larutan kalium iodida, KI

Potassium chloride, KI solution

D Larutan natrium klorida, NaCl
Sodium chloride, NaCl solution

C Larutan kalium nitrat, KNO_3
Potassium nitrate, KNO_3 solution

1.2 Keupayaan elektrod piawai

[Kedah2023-12] Jadual di bawah menunjukkan nilai E° bagi tindak balas sel setengah.
The table below shows the E° value for half-cell equations.

Tindak balas sel setengah *Half-cell equations*	Nilai E° (V) *E° value (V)*
Na^+ (ak/aq) + e ⇌ Na (p/s)	-2.71
Fe^{3+} (ak/aq) + e ⇌ Fe^{2+} (ak/aq)	+0.77
Cl_2 (g) + 2e ⇌ $2Cl^-$ (ak/aq)	+1.36

Antara yang berikut, yang manakah agen penurunan yang paling kuat?
Which of the following is the strongest reducing agent?

A Cl^- B Na C Cl_2 D Fe^{2+}

[Melaka 2023-35] Antara pernyataan berikut, yang manakah benar?
Which of the following statements are true?

I Setengah sel yang mempunyai E° bernilai positif lebih mudah mengalami pengoksidaan
Half of the cells that have a positive E° value are more easily undergo oxidation
II Setengah sel yang mempunyai E° yang bernilai negatif lebih mudah mengalami penurunan
Half of the cells with a negative E° value more easily undergo reduction

III Setengah sel yang mempunyai nilai E° yang bernilai positif lebih mudah mengalami penurunan
Half of the cells with a positive E° value are more easily undergo reduction

IV Setengah sel yang mempunyai E° yang bernilai negatif lebih mudah mengalami pengoksidaan
Half of the cells that have a negative E° value are more easily undergo oxidation

A I dan II
I and II

C II dan IV
II and IV

B I dan III
I and III

D III dan IV

III and IV

[Melaka 2023-27] Jadual 2 menunjukkan sebahagian siri keupayaan elektrod piawai bagi sel setengah bagi beberapa bahan kimia.
Table 2 shows a part of the standard electrode potential series of half-cells for severed chemicals.

$Cl_2 + 2e \rightleftharpoons 2Cl^-$	E° = +1.36 V
$Mg^{2+} + 2e \rightleftharpoons Mg^{2+}$	E° = -2.38 V
$Cu^{2+} + 2e \rightleftharpoons Cu$	E° = +0.34 V
$Fe^{2+} + 2e \rightleftharpoons Fe$	E° = -0.44 V

Jadual 2 / *Table 2*

Yang manakah merupakan agen pengoksidaan yang paling kuat?
Which is the strongest oxidising agent?

A Atom kuprum
Copper atom

B Atom magnesium
Magnesium atom

C Ion ferum (II)
Iron (II) ion

D Molekul klorin
Chlorine molecule

[Johor Skudai2023-18] Nilai keupayaan elektrod piawai, E° bagi tindak balas sel setengah diberikan seperti di bawah.
The standard electrode potential, E° for half-cell equations are given below.

Zn^{2+}(ak/aq) + 2e ⇌ Zn(p/s) E° = – 0.76 V
Fe^{3+}(ak/aq) + e ⇌ Fe^{2+}(ak/aq) E°= + 0.77 V

Apakah yang dapat disimpulkan daripada maklumat yang diberikan?
What can be deduced from the given information?

A Nombor pengoksidaan bagi ferum, Fe meningkat dari +2 kepada +3
The oxidation for ferum, Fe increases from +2 to +3

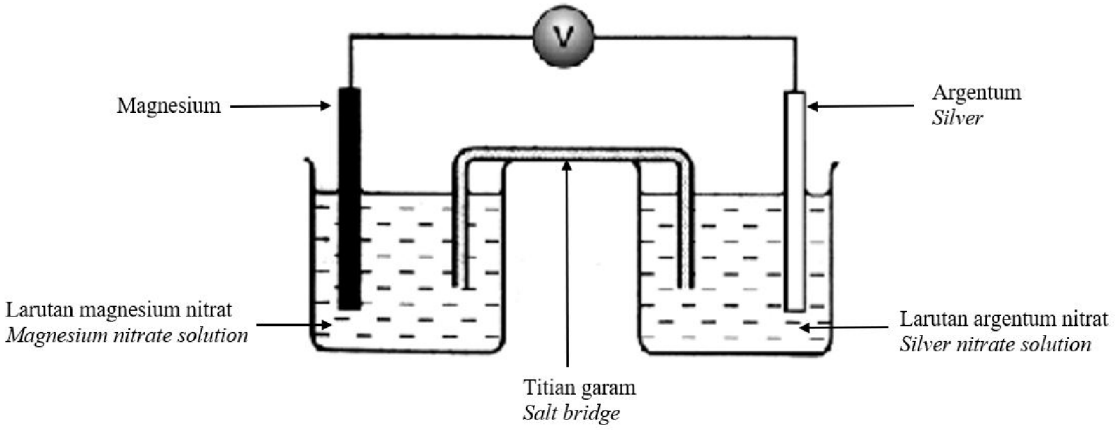
B Ion ferum(III), Fe^{3+} bertindak sebagai agen penurunan
Iron(III) ion, Fe^{3+} act as reducing agent

C Ion zink, Zn^{2+} lebih mudah menerima elektron
Zinc ion, Zn^{2+} is easier to receive electron

D Atom zink, Zn mengalami pengoksidaan
Zinc atom, Zn undergoes oxidation

1.3 Sel kimia

[Perlis 2023-35]



Rajah 11 menunjukkan satu susunan radas sel kimia satu tindak balas redoks.
Diagram 11 shows the apparatus arrangement of a chemical cell in a redox reaction.

Apakah bacaan voltmeter dalam Rajah 11?
What is the voltmeter reading in Diagram 11?

A 0.96 V B 3.18 V C -1.58 V D -2.38 V

[MRSM2023-34] Notasi sel bagi satu sel kimia ditunjukkan di bawah
Cell notation for a voltaic cell is shown below.

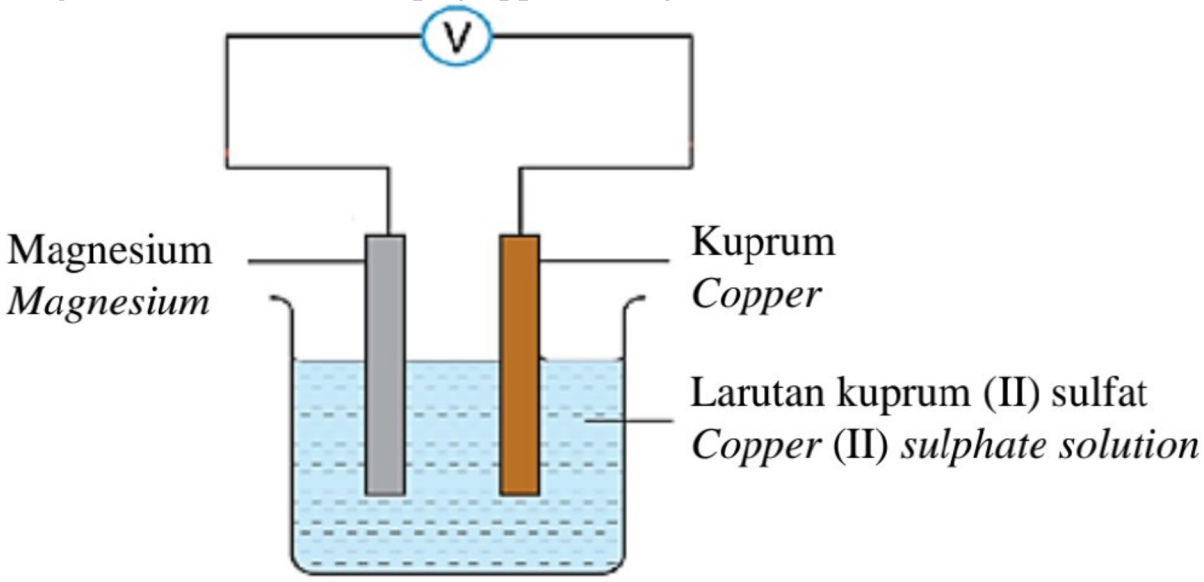
$Zn(p) \mid Zn^{2+}(ak) \mid\mid Cu^{2+}(ak) \mid Cu(p)$ $E° = + 1.10$ V
$Zn(s) \mid Zn^{2+}(aq) \mid\mid Cu^{2+}(aq) \mid Cu(s)$ $E° = + 1.10$ V

Antara setengah persamaan berikut, yang manakah mewakili tindak balas di terminal negatif?
Which of the following half equation represents the reaction at the negative terminal?

A Zn^{2+} (ak/aq) + 2e- → Zn(p/s)
B Zn (p/s) → Zn^{2+} (ak/aq) + 2e-
C Cu^{2+} (ak/aq) + 2e- → Cu(p/s)
D Cu (p/s) → Cu^{2+} (ak/aq) + 2e-

[Melaka 2023-23] Rajah 5 menunjukkan susunan radas bagi satu sel kimia.

Diagram 5 shows the set-up of apparatus of a chemical cell.



Rajah 5/ *Diagram 5*

$Mg^{2+} + 2e \rightleftharpoons Mg$	$E° = -2.38$ V
$Cu^{2+} + 2e \rightleftharpoons Cu$	$E° = +0.34$ V

Antara yang berikut, penyataan manakah yang benar tentang sel itu? *Which of the following statements are correct about the cell?*

I Elektrod magnesium sebagai terminal negatif Magnesium
electrode acts as negative terminal

II Elektrod kuprum sebagai terminal negatif
Copper electrode acts as negative terminal

III Ion kuprum(II) mengalami tindak balas pengoksidaan
Copper(II) ion undergoes oxidation reaction

IV Ion kuprum(II) mengalami tindak balas penurunan
Copper(II) ion undergoes reduction reaction

A I dan II
I and II

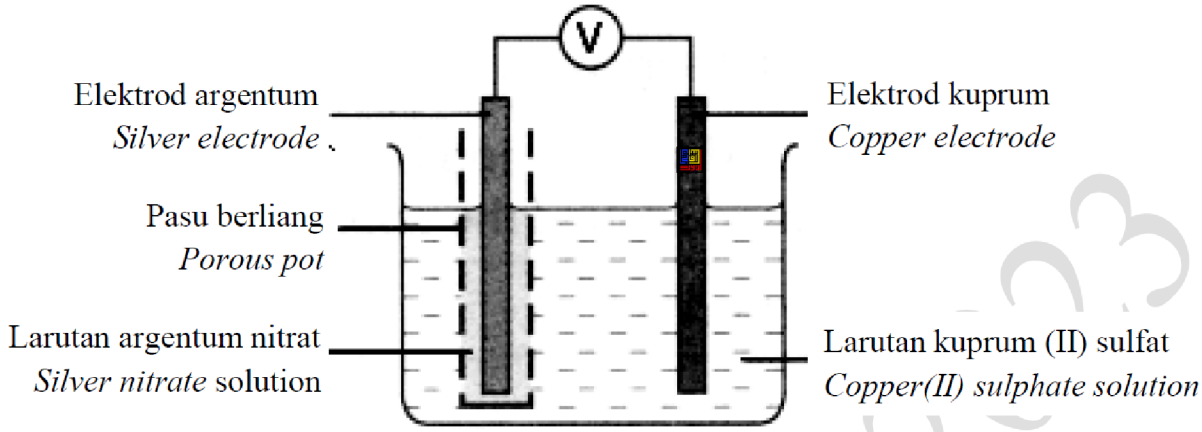
B I dan IV
I and IV

C II dan III
II and III

D II dan IV
II andIV

[Pahang JUJ Set 1 2023-37] Rajah 19 menunjukkan susunan radas bagi sel kimia yang menggunakan kuprum dan argentum sebagai elektrod.

Diagram 19 shows the apparatus set-up of a chemical cell using copper and silver as the electrode.



Jadual 4 menunjukkan sebahagian daripada Siri Keupayaan Elektrod Piawai:
Table 4 shows a part of Standard Electrode Potential Series:

Tindak balas sel setengah *Half – cell reaction*	E° / V (297K)
$Cu^{2+} + 2e^- \rightleftharpoons Cu$	E° = +0.34V
$Ag^+ + e^- \rightleftharpoons Ag$	E° = + 0.80V

Antara berikut, yang manakah mewakili setengah persamaan di terminal positif dan nilai voltan sel ini?
Which of the following represent half equation and voltage value of the cell?

	Setengah persamaan di terminal positif *Half equation at positive terminal*	Nilai voltan / V Voltage value /V
A	$Ag^+ + e \rightarrow Ag$	+ 0.46
B	$Ag \rightarrow Ag^+ + e$	- 0.46
C	$Cu^{2+} + 2e \rightarrow Cu$	+ 0.46
D	$Cu \rightarrow Cu^{2+} + 2e$	- 0.46

[Johor Bahru 2023-15] Apakah perubahan tenaga yang berlaku dalam satu sel kimia?
What is the energy change that happens in a chemical cell?

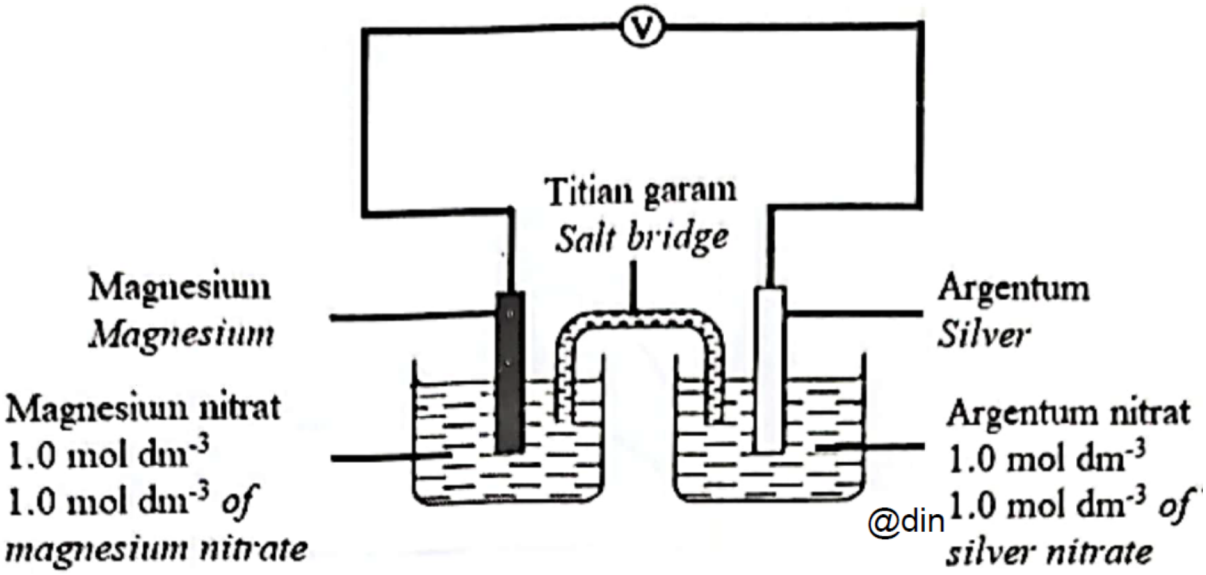
A Tenaga elektrik kepada tenaga kimia
Electrical energy to chemical energy

B Tenaga haba kepada tenaga elektrik
Heat energy to electrical energy

C Tenaga kimia kepada tenaga elektrik
Chemical energy to electrical energy

D Tenaga elektrik kepada tenaga haba
Electrical energy to heat energy

[Johor Bahru 2023-32] Rajah 10 menunjukkan satu sel kimia
Diagram 10 shows a chemical cell.



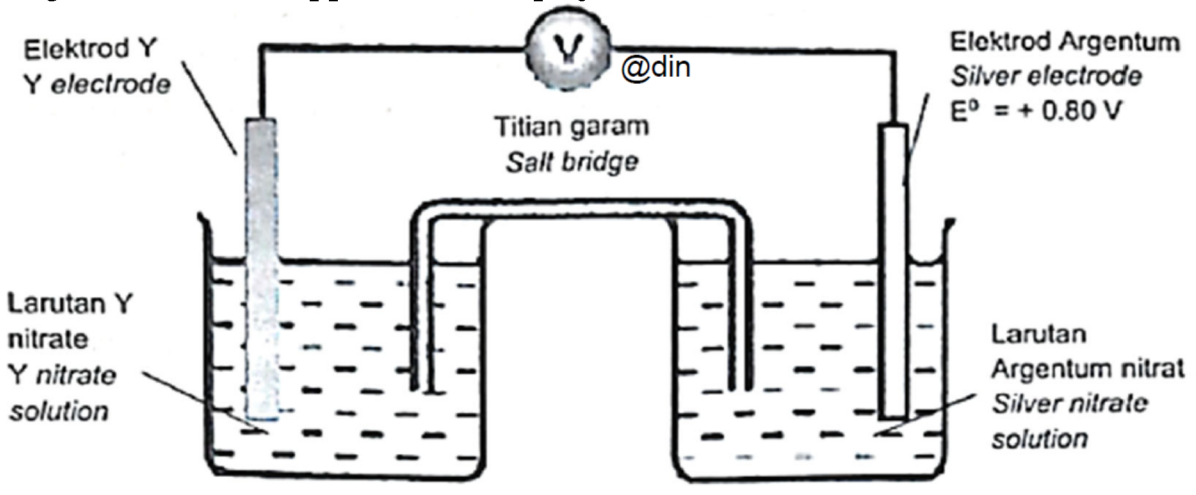
Diberi sebahagian daripada Siri Keupayaan Elektrod Piawai:
Given part of the Standard Electrode Potential Series.

Tindak balas sel setengah/ *Half-cell equations*	E° / V (298 K)
$Mg^{2+} + 2e \rightleftharpoons Mg$	-2.38
$2H^{+} + 2e \rightleftharpoons H_2$	0.00
$Ag^{+} + e \rightleftharpoons Ag$	+0.80

Apakah nilai voltan sel itu?
What is the value of the cell's voltage?

A 0.80 V
B 1.58 V
C 2.38 V
D 3.18 V

[Johor PPD Tangkak 2023 35] Rajah 18 menunjukkan susunan radas bagi satu sel kimia.
Diagram 18 shows apparatus set-up of a voltaic cell.



Elektron mengalir dari elektrod Y ke elektrod argentum melalui wayar penyambung. Jika bacaan voltan E° bagi sel kimia tersebut ialah + 0.93V, apakah nilai E° bagi elektrod Y?
Electron flow from Y electrode to silver electrode through connecting wire. If voltage reading E° for voltaic cell is + 0.93V, what is the E° value for Y electrode?

A + 2.73V B -2.73V C +0.13V D -0.13V

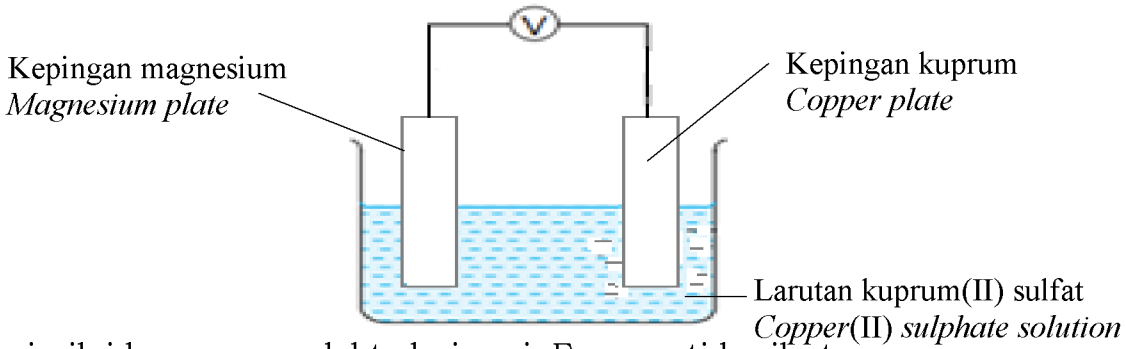
[Kedah2023-36] Keupayaan elektrod piawai, E° bagi tindak balas sel setengah diberi dibawah.
The standard electrode potential E° for the hall-cell equations are given below.

Al^{3+} (ak/aq) + 3e ⇌ Al (p/s) E° = -1.66 V
Cu^{2+} (ak/aq) +2e ⇌ Cu (p/s) E° = +0.34 V

Berapakah perbezaan voltan sel, $E°_{Sel}$ bagi kedua-dua tindak balas sel setengah?
What is the difference cell voltage, $E°_{Cell}$ for both of hall-cell equation?

A -1.32 V B -2.00 V C +1.32 V D +2.00 V

[Putrajaya2023-35] Rajah 14 menunjukkan satu sel kimia ringkas.
Diagram 14 shows a simple chemical cell.



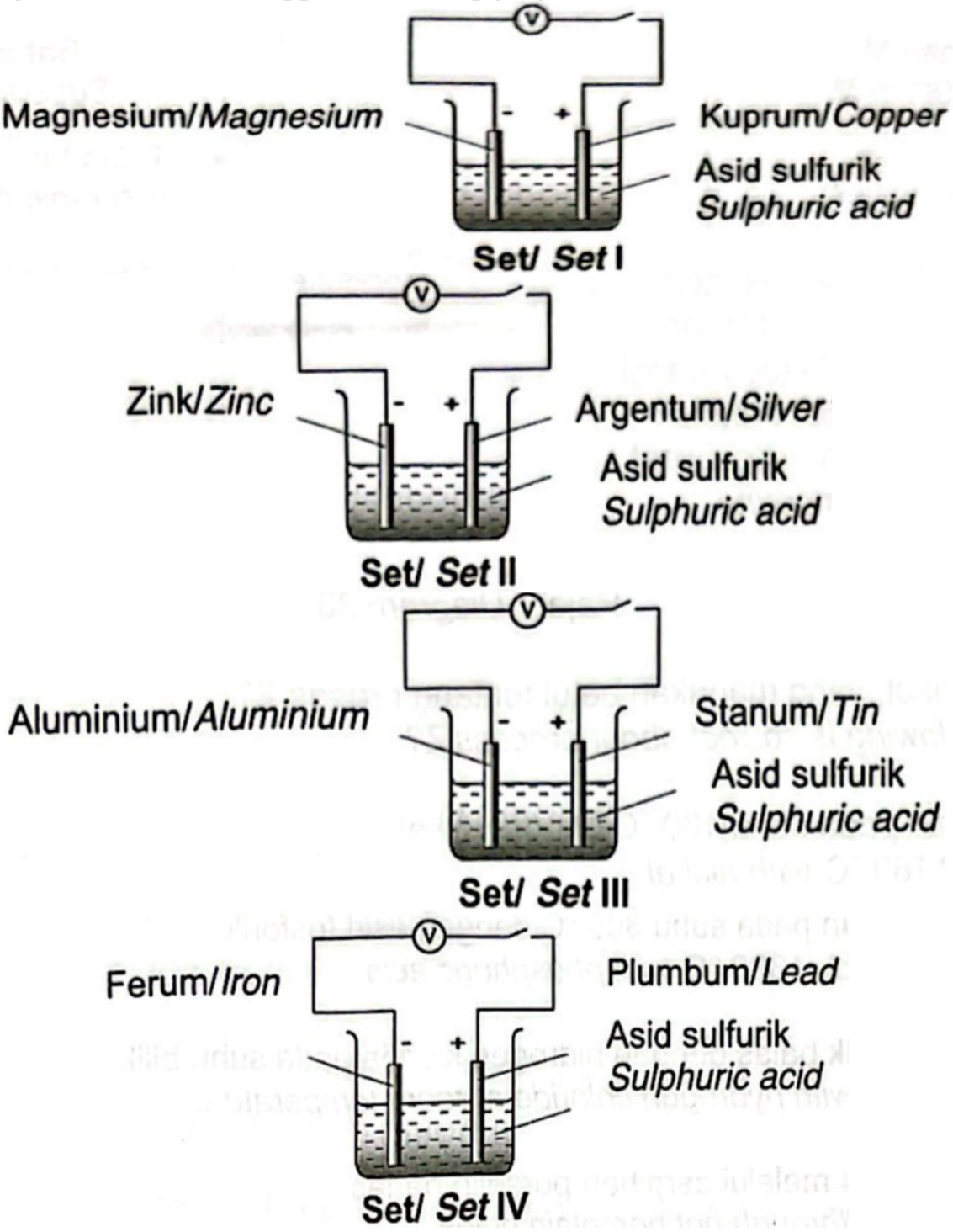
Diberi nilai keupayaan elektod piawai, Eo seperti berikut:
Given the standard electrode potential, Eo values as below:

Persamaan sel setengah ***Half-cell equation***	**E^0 (V) (298 K)**
Mg^{2+} + 2e ⇌ Mg	-2.38
Cu^{2+} + 2e ⇌ Cu	+0.34
$2H^+$ + 2e− ⇌ H_2	0.00
$S_2O_8^{2-}$ + 2e− ⇌ $2SO_4^{2-}$	+2.01

Berapakah nilai voltan bagi sel itu?/ *What is the voltage value for the cell?*

A +2.72 V B -2.38 V C +2.35 V D -2.04 V

[Terengganu2023-32] Rajah 32 menunjukkan susunan radas bagi empat sel kimia.
Diagram 32 shows the apparatus set-up for four chemical cells.



Rajah 32/ Diagram 32

$Mg^{2+}(ak) + 2e \rightleftharpoons Mg(P)$	E°= -2.38V	$Sn^{2+}(ak) + 2e \rightleftharpoons Sn(p)$	E°= -0.14V
$Al^{3+}(ak) + 3e \rightleftharpoons Al(p)$	E°= -1.66V	$Pb^{2+}(ak> + 2e \rightleftharpoons Pb(P)$	E°= -0.13V
$Zn^{2+}(ak) + 2e \rightleftharpoons Zn(p)$	E°= -0.76V	$Cu^{2+}(ak) + 2e \rightleftharpoons Cu(P)$	E°= +0.34V
$Fe^{2+}(ak) + 2e \rightleftharpoons Fe(P)$	E°= -0.44V	$Ag^{+}(ak) + e \rightleftharpoons Mg(P)$	E°= +0.80V

Antara berikut yang manakah memberikan nilai bacaan voltan sel yang paling tinggi?
Which of the following gives the highest cell voltage reading?

A Set I
B Set II
C Set III
D Set IV

1.4 Sel elektrolisis

[Pahang JUJ Set 1 2023-09] Ion yang manakah terdapat dalam leburan plumbum(II) bromida?
Which ions are present in molten lead(II) bromide?

I H^+ II Br^- III Pb^{2+} IV OH^-

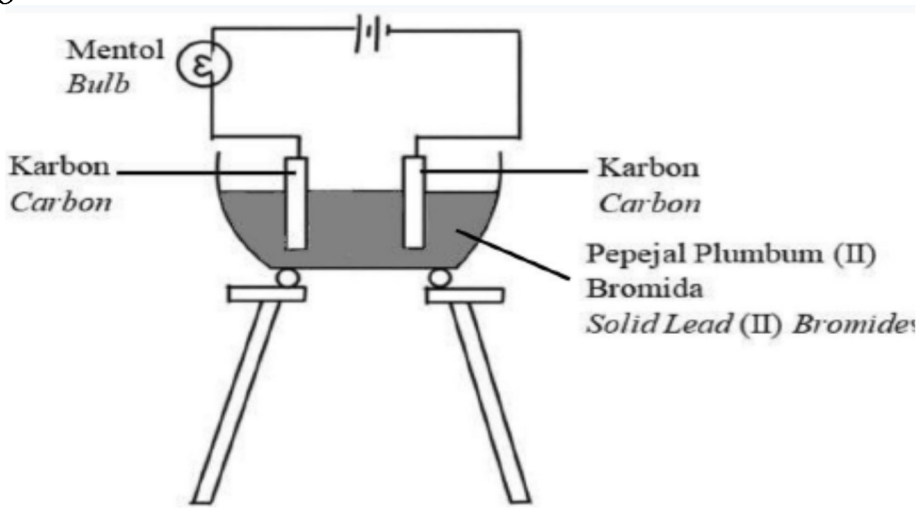
A I dan II
I and II

C II dan III
II and III

B I dan IV
I and IV

D III dan IV
III and IV

[Melaka 2023-40] Rajah 12 menunjukkan susunan radas satu eksperimen yang dijalankan oleh sekumpulan pelajar di dalam makmal.
Diagram 12 shows an apparatus set-up carried out by a group of students in laboratory.



Selepas 5 minit, didapati mentol masih tidak menyala. Apakah langkah yang perlu diambil oleh kumpulan pelajar itu untuk mengatasi masalah tersebut?
After 5 minutes, it was found that the bulb still did not light up. What step should be taken by the students to overcome the

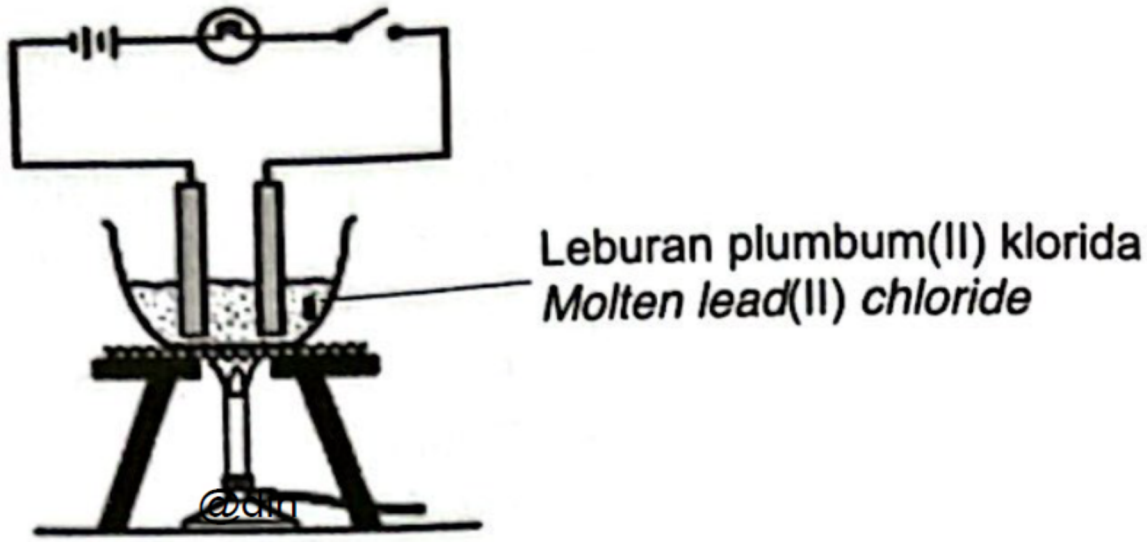
A Gantikan pepej al plumbum(II) bromida dengan pepejal natrium klorida
Replace solid lead(II) bromide with solid sodium chloride

B Larutkan pepejal plumbum(II) bromida dalam air
Dissolve solid lead(II) bromide in water

C Larutkan pepejal plumbum(II) bromida dalam etanol
Dissolve solid lead (II) bromide in ethanol

D Panaskan pepejal plumbum(II) bromida sehingga lebur
Heat solid lead (II) bromide until it melts

[Terengganu2023-14] Rajah 14 menunjukkan suatu sel ringkas.
Diagram 14 shows a simple cell.



Apakah anion yang hadir di dalam elektrolit?
What anion are present in the electrolyte?

A H^+ B Pb^{2+} C OH^- D Cl^-

[Selangaor2023 Set 01-23] F5 Bab 09 Elektrolisis leburan
23. Apabila elektrolisis dilakukan pada leburan bahan X dengan menggunakan elektrod karbon, gas tidak berwarna yang menyalakan semula kayu uji berbara dihasilkan di anod. Apakah bahan X?
When electrolysis is carried out on molten substance X using carbon electrodes, a colourless gas that relights a glowing wooden splinter is produced at the anode. What is substance X?

A Kalium klorida
Potassium chloride

B Ferum(II) sulfida
Iron(II) sulphide

C Plumbum(II) bromida
Lead(II) bromide

D Natrium oksida
Sodium oxide

[Terengganu2023-13] Apakah yang dimaksudkan dengan konduktor?
What is meant by conductor?

A Bahan yang mengalirkan arus elektrik dalam semua keadaan
A substance that conducts electricity under all conditions

B Bahan yang mengalirkan arus elektrik dan mengalami penguraian kepada juzuk-juzuknya
A substance that conducts an electric current and breaks down into its constituents

C Bahan yang mengkonduksikan elektrik dalam keadaan pepejal atau leburan tetapi tidak mengalami perubahan kimia
A substance that conducts electricity in a solid or molten state but does not undergo a chemical change

D Bahan yang dapat mengalirkan arus elektrik dalam keadaan lebur atau larutan akueus dan mengalami perubahan kimia
A substance that can conduct an electric current in a molten state or an aqueous solution and undergoes a chemical change

[Kedah2023-23] Jadual di bawah menunjukkan pemerhatian suatu eksperimen bagi elektrolisis menggunakan elektrod karbon.
The table below shows the observation of an experiment on electrolysis using carbon electrodes.

Elektrod *Electrode*	Pemerhatian *Observation*
Anod *Anode*	Gas kuning kehijauan dibebaskan. *Greenish yellow gas released*
Katod *Cathode*	Gelembung gas tidak berwarna dibebaskan dan terbakar dengan bunyi 'pop' apabila diuji dengan kayu uji bernyala. *Colourless gas bubbles are released which bum with a 'pop' sound when tested with a lighted wooden splinter.*

Apakah elektrolit yang mungkin digunakan dalam eksperimen tersebut?
What is the possible electrolyte used in the experiment?

A Asid hidroklorik cair/ *Dilute hydrochloric acid*

B Larutan kuprum(II) klorida pekat
Concentrated copper(II) chloride solution

C Larutan kalium klorida pekat
Concentrated potassium chloride solution

D Larutan magnesium bromida pekat
Concentrated magnesium bromide solution

[Pahang 2023-37] Antara berikut, larutan yang manakah menghasilkan gas klorin pada anod dan gas hidrogen pada katod apabila elektrik mengalir melaluinya?
Which of the following solutions produce chlorine gas at the anode and hydrogen gas at the cathode when electricity is passed through it?

I Asid sulfurik 0.1 mol dm^{-3}
0.1 mol dm^{-3} sulphuric acid
II Asid hidroklorik 0.1 mol dm^{-3}
0.1 mol dm^{-3} hydrochloric acid
III Larutan natrium klorida 0.5 mol dm^{-3}
0.5 mol dm^{-3} sodium chloride solution
IV Larutan kalium nitrat 0.5 mol dm^{-3}
0.5 mol dm^{-3} potassium nitrate solution

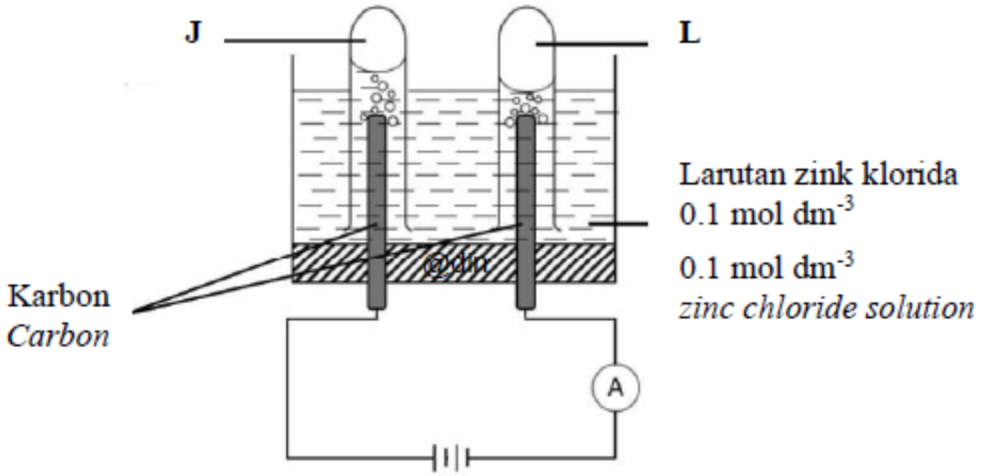
A I dan II
I and II

B I dan IV
I and IV

C II dan III
II and III

D III dan IV
III and IV

[MRSM2023-38] Rajah 15 menunjukkan susunan radas bagi elektrolisis larutan zink klorida 0.1 mol dm^{-3}.
Diagram 15 shows the apparatus set-up for the electrolysis of 0.1 mol dm^{-3} zinc chloride solution.



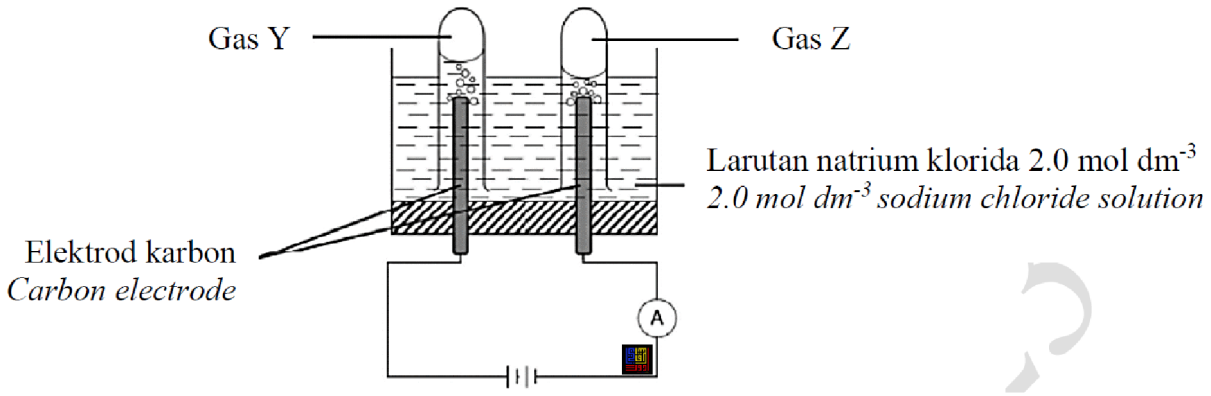
Diberi,/ *Given,*

Persamaan sel setengah Half-cell equation	E° / V (298K)
$Zn^{2+} + 2e^- \rightleftharpoons Zn$	- 0.76
$2H^+ + 2e^- \rightleftharpoons H_2$	0.00
$O_2 + 2H_2O + 4e^- \rightleftharpoons 4OH^-$	+ 0.40
$Cl_2 + 2e^- \rightleftharpoons 2Cl^-$	+ 1.36

Apakah gas J dan L?/ *What is gas J and L?*

	J	L
A	Hidrogen *Hydrogen*	Klorin *Chlorine*
B	Oksigen *Oxygen*	Hidrogen *Hydrogen*
C	Klorin *Chlorine*	Hidrogen *Hydrogen*
D	Hidrogen *Hydrogen*	Oksigen *Oxygen*

[Pahang JUJ Set 2 2023-32] Rajah 10 menunjukkan susunan radas bagi elektrolisis ke atas larutan natrium klorida.
Diagram 10 shows the apparatus set-up for the electrolysis on sodium chloride solution.



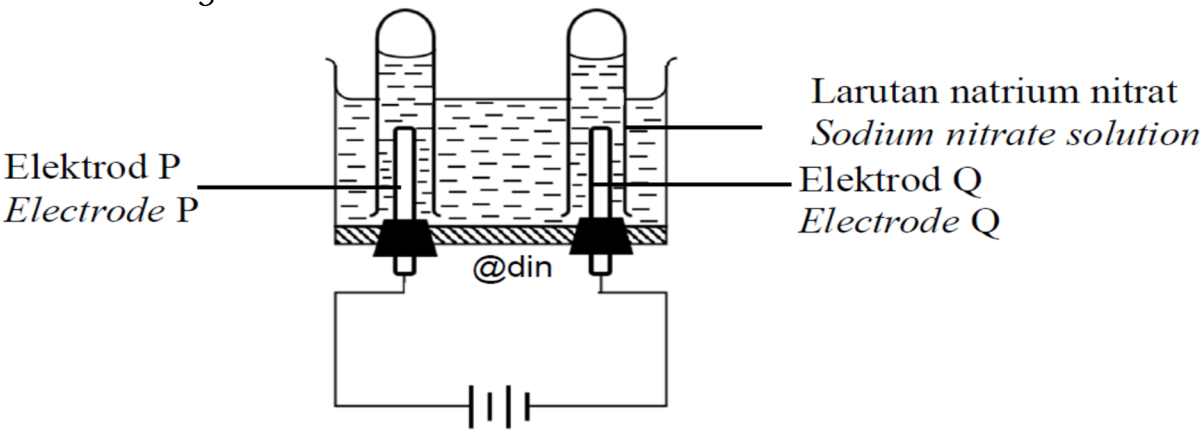
Jadual 2 menunjukkan sebahagian daripada Siri Keupayaan Elektrod Piawai.
Table 2 shows part of Standard Electrode Potential Series.

Persamaan setengah sel/ *Half-cell equation*	E° / V (298K)
$Na^+ + e^- \rightleftharpoons Na$	-2.71
$2H^+ + 2e^- \rightleftharpoons H_2$	0.00
$O_2 + 2H_2O + 4e^- \rightleftharpoons 4OH^-$	+0.40
$Cl_2 + 2e^- \rightleftharpoons 2Cl^-$	+1.36

Namakan gas Y dan gas Z./ *Name the gas Y and gas Z.*

	Gas Y	Gas Z
A	Gas klorin/ *Chlorine gas*	Gas hydrogen/ *Hydrogen gas*
B	Gas oksigen/ *Oxygen gas*	Gas hydrogen/ *Hydrogen gas*
C	Gas hydrogen/ *Hydrogen gas*	Gas klorin/ *Chlorine gas*
D	Gas hydrogen/ *Hydrogen gas*	Gas oksigen/ *Oxygen gas*

[Johor PPD Tangkak 2023 34] Rajah 17 menunjukkan susunan radas untuk elektrolisis larutan natrium nitrat dengan menggunakan elektrod karbon.
Diagram 17 shows the apparatus set up for the electrolysis of sodium nitrate solution using carbon electrodes.



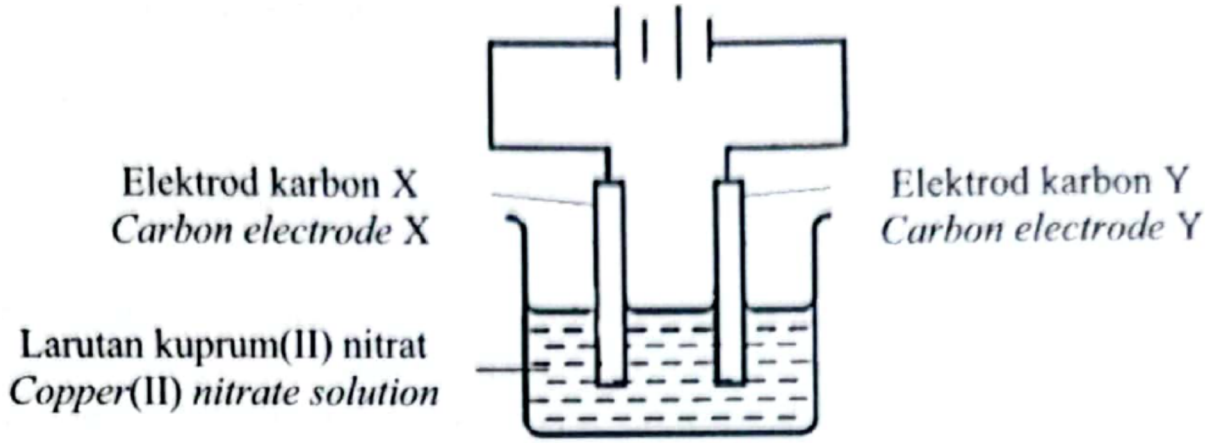
Jadual 5 menunjukkan nilai keupayaan elektrod piawai sel setengah bagi beberapa bahan.
Table 5 shows the standard electrode potential values of half-cells for some substance.

Tindak balas sel setengah/ *Reaction of half-cells*	E° / V (298K)
$Na^+ + e \rightleftharpoons Na$	– 2.71
$2H^+ + 2e \rightleftharpoons H_2$	+ 0.00
$O_2 + 2H_2O + 4e \rightleftharpoons 4OH^-$	+ 0.40
$NO_3^- + 2H^+ + e \rightleftharpoons NO_2 + H_2O$	+ 0.81

Berdasarkan Rajah 17 dan Jadual 5, apakah hasil terbentuk pada kedua-dua elektrod?
Based on Diagram 17 and Table 5, what are the products forms at both electrodes?

	Elektrod P *Electrode P*	Elektrod Q *Electrode Q*
A	Gas oksigen *Oxygen gas*	Gas hidrogen *Hydrogen gas*
B	Gas hidrogen *Hydrogen gas*	Gas oksigen *Oxygen gas*
C	Gas oksigen *Oxygen gas*	Gas nitrogen dioksida *Nitrogen dioxide gas*
D	Gas nitrogen dioksida *Nitrogen dioxide gas*	Gas hidrogen *Hydrogen gas*

[SBP2023-22] Rajah 5 menunjukkan susunan radas bagi satu sel elektrolisis.
Diagram 5 shows the apparatus set-up of an eletrolytic cell.



Rajah/ Diagram 5

Jadual 1 menunjukkan nilai keupayaan elektrod piawai bagi beberapa sel setengah.
Table 1 shows the standard electrode potential values for some half-cells.

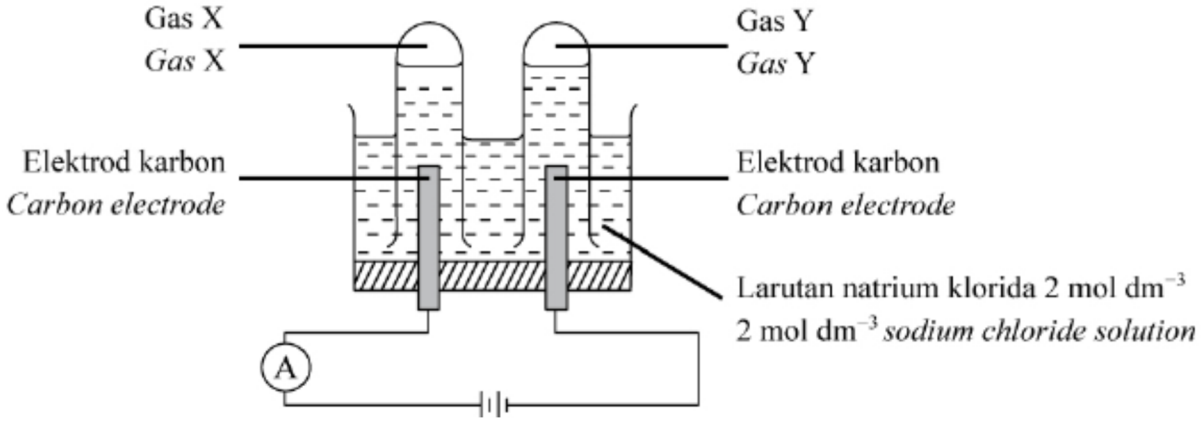
Tindak balas sel setengah *Half-cell equation*	Nilai E°(V) *E° value (V)*
$2H^+$ (ag/aq) + 2e ⇌H_2 (g)	0.00
Cu^{2+} (ag/aq) + 2e ⇌ Cu (p)	+0.34
O_2 (g) + $2H_2O$(ce/l) +4e ⇌ $4OH^-$(ag/aq)	+0.40
NO_3^- (ag/aq) + $4H^+$ (ag/aq) + 3e⇌NO_2 (g) + $2H_2O$ (ce/l)	+0.96

JaduaL/ Table 1

Apakah pemerhatian di X dan hasil di Y?
What are the observations at X and product at Y?

	X	Y
A	Elektrod menipis *Electrode becomes thinner*	Kuprum *Copper*
B	Enapan perang terenap *Brown solid deposited*	Gas hidrogen *Hydrogen gas*
C	Gelembung gas terbebas *Bubbles of gas released*	Gas oksigen *Oxygen gas*
D	Gelembung gas terbebas *Bubbles of gas released*	Kuprum *Copper*

[Selangaor2023 Set 01-38] Rajah 12 menunjukkan susunan radas untuk mengkaji elektrolisis larutan natrium klorida menggunakan elektrod-elektrod karbon.
Diagram 12 shows the set-up of the apparatus to investigate the electrolysis of sodium chloride solution using carbon electrodes.



Namakan gas X dan gas Y./ *Name the gas X and gas Y.*

	Gas X	Gas Y
A	Gas klorin/ *Chlorine gas*	Gas hydrogen/ *Hydrogen gas*
B	Gas oksigen/ *Oxygen gas*	Gas hidrogen/*Hydrogen gas*
C	Gas hydrogen/ *Hydrogen gas*	Gas klorin/ *Chlorine gas*
D	Gas hydrogen/ *Hydrogen gas*	Gas oksigen/ *Oxygen gas*

1.5 Pengekstrakan logam daripada bijihnya

[SBP2023-11] Dalam tindak balas termit, besi diekstrak daripada bijihnya menggunakan aluminium. Antara yang berikut, logam manakah yang boleh diekstrak daripada bijihnya menggunakan tindak balas yang sama?
In thermite reaction, iron is extracted from its ore using aluminium.
Which of the following metals can be extracted from its ore using the same reaction?

A Aurum
Gold

C Argentum
Silver

B Kromium
Chromium

D Magnesium
Magnesium

[Negeri Sembilan 2023-13] Logam X mempunyai sifat-sifat berikut.
Metal X has the following properties.

• Kurang reaktif daripada ferum
Less reactive than iron

• Tidak bertindak balas dengan ferum(III) oksida
Does not react with iron(III) oxide

Oksida logam manakah boleh bertindak balas dengan logam X?
Which metal oxide can react with metal X?

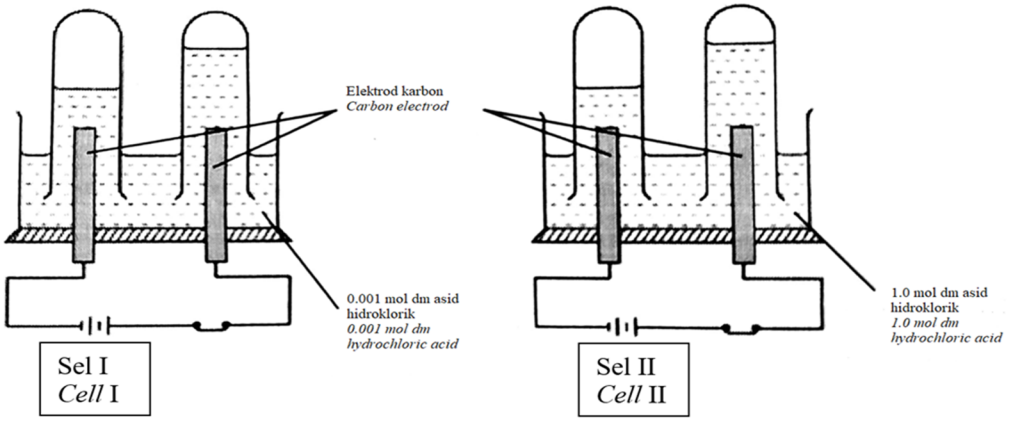
A Zink oksida
Zinc oxide

C Aluminium oksida
Aluminium oxide

B Magnesium oksida
Magnesium oxide

D Kuprum(II) oksida
Copper(II) oxide

[Perlis 2023-40] Rajah 13 menunjukkan elektrolisis bagi asid hidroklorik yang berbeza kepekatan.
Diagram 13 shows the electrolysis of hydrochloric acid with different concentrations.

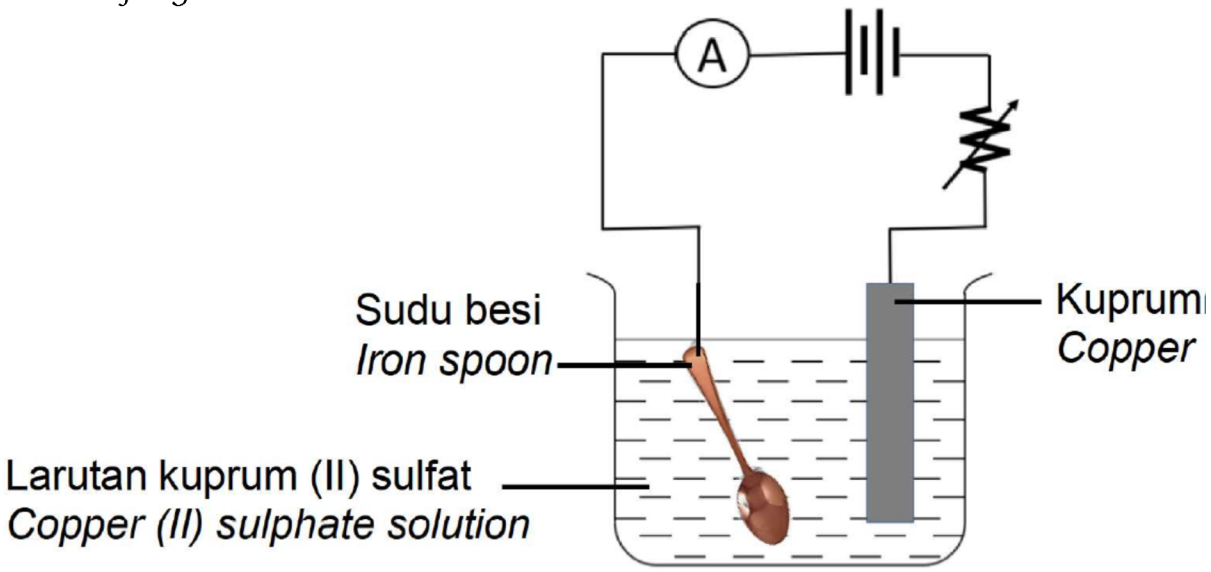


Antara yang berikut, pernyataan manakah benar tentang Sel I dan Sel II?
Which of the following statements is true about Cell I and Cell II?

	Sel I/ *Cell* I	Sel II/ *Cell* II
A	Kayu uji berbara menyala semula apabila dimasukkan ke dalam tabung uji di katod. *A glowing wooden splinter relights when it is put in the test tube at cathode*	Bunyi `pop` terhasil apabila kayu uji menyala didekatkan ke mulut tabung uji di katod. *A `pop` sound is produced when a lighted wooden splinter is put near the mouth of the test tube at cathode.*
B	Ion-ion Cl^- dan OH^- bergerak ke katod.	Ion-ion Cl^- dan OH^- bergerak ke anod.

	Cl^- *and* OH^- *ions move to the cathode.*	Cl^- *and* OH^- *ions move to anode.*
C	Gas yang tak berwarna dihasilkan di anod dan di katod. *Colourless gas bubbles release at the anode and cathode.*	Gas tak berwarna dihasilkan di katod. Gas berwarna kuning kehijauan dihasilkan di anod. *Colourless gas bubbles release at the cathode.* *Greenish yellow gas released at anode.*
D	Setengah persamaan di katod : *Half equation at cathode :* $2H^+ + 2e \rightarrow H_2$	Setengah persamaan di anod : *Half equation at anode :* $4OH^- \rightarrow 2H_2O + O_2 + 4e$

[Kelantan 2023-40] Rajah 20 menunjukkan susunan radas yang digunakan oleh seorang pelajar untuk menyadur sudu besi menggunakan kuprum. Pelajar tersebut mendapati penyaduran tidak berjaya dilakukan.
Diagram 20 shows the arrangement of the apparatus used by a student to plate an iron spoon using copper. The student found that plating was not done successfully.



Rajah 20/ *Diagram 20*

Apakah yang perlu dilakukan agar penyaduran dapat dilakukan dan penyaduran berlaku sekata?
What needs to be done so that the plating can be done and the plating happens evenly?

I. Rendahkan voltan
Lower the voltage

II. Tambahkan bilangan sel kering
Add the number of dry cells

III. Tukar kedudukan antara sudu besi dengan kuprum
Change the position between the iron spoon and copper

IV. Tingkatkan kepekatan larutan kuprum (II) sulfat
Increase the concentration of copper (II) sulfate solution

A I dan II
I and II

B I dan III
I and III

C II dan IV
II and IV

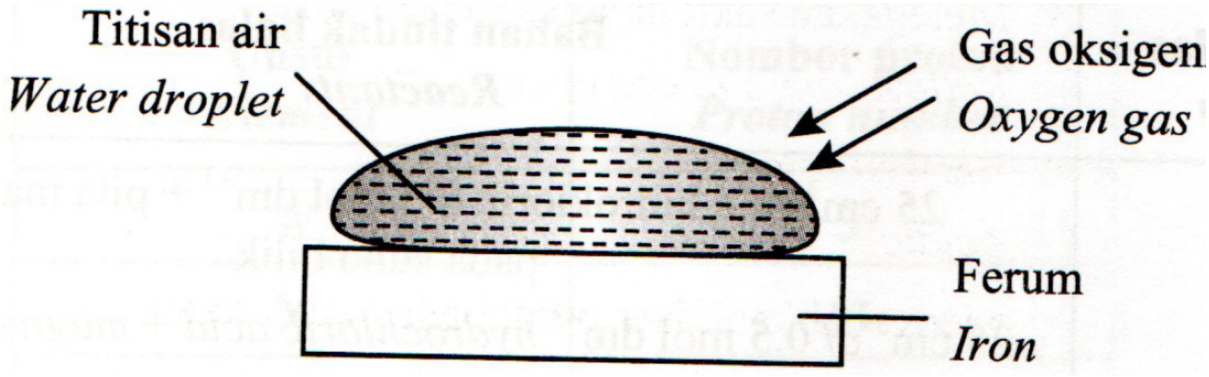
D III dan IV
III and IV

[Pahang JUJ Set 2 2023-25] Amalia menjalankan eksperimen untuk menyadurkan sudu besi dengan argentum secara elektrolisis. Pasangan anod dan elektrolit yang manakah sesuai digunakan?
Amalia carried out an experiment to electroplate iron spoon with silver using electrolysis. Which of the following pairs of anode and electrolyte are suitable to be used?

	Anod *Anode*	Elektrolit *Electrolyte*
A	Argentum *Silver*	Argentum karbonat *Silver carbonate*
B	Argentum *Silver*	Argentum nitrat *Silver nitrate*
C	Sudu besi *Iron spoon*	Argentum karbonat *Silver carbonate*
D	Sudu besi *Iron spoon*	Argentum nitrat *Silver nitrate*

1.6 Pengaratan

[Selangor2023 Set 1-23] Rajah 7 menunjukkan mekanisme pengaratan besi.
Diagram 1 shows the mechanism of rusting of iron.



Tindak balas yang manakah berlaku di anod?
Which reaction occurred at the anode?

A $Fe \rightarrow Fe^{2+} + 2e$
B $Fe \rightarrow Fe^{3+} + 3e$
C $H_2 \rightarrow 2H^+ + 2e$
D $4OH^- \rightarrow 2H_2O + O_2 + 4e$

[Johor Bahru 2023-38] Persamaan berikut mewakili suatu tindak balas kimia yang berlaku pada pagar besi.
The following equation represents a chemical reaction that occurred on an iron fence.

$$4Fe + 3O_2 + 6H_2O \rightarrow 4Fe(OH)_3$$

Antara yang berikut, cara manakah yang boleh dilakukan untuk mengelakkan tindak balas ini berlaku?
Which of the following ways can be used to prevent this reaction from occurring?

I Sadurkan pagar dengan zink
Plate the fence with zinc

II Sadurkan pagar dengan kuprum
Plate the fence with copper

III Sapu minyak pada pagar
Apply oil on the fence

IV Sapu gris pada pagar
Apply grease on the fence

A I dan II
I andII

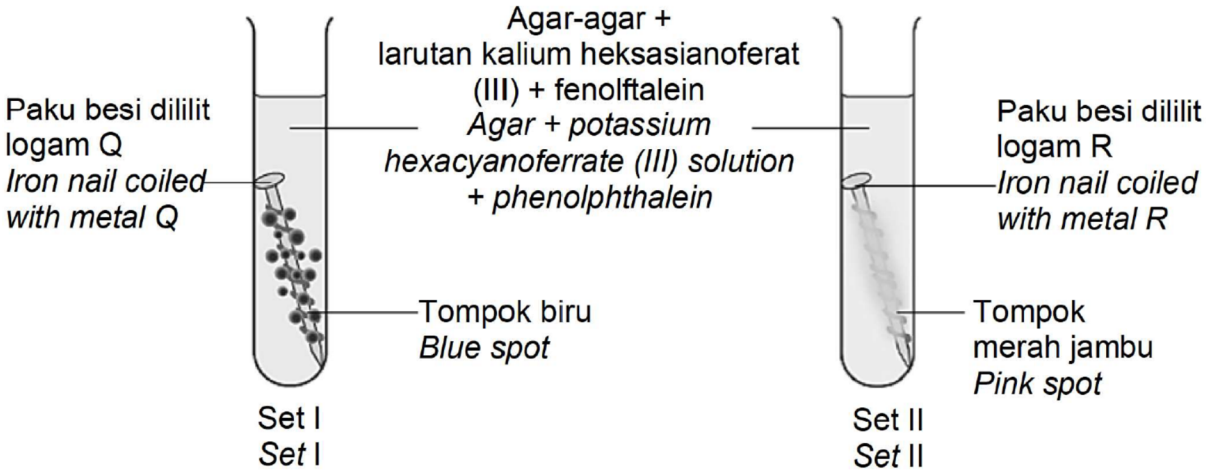
B I dan IV
I and IV

C II dan III
II and III

D II dan IV
II and IV

[Kelantan 2023-30] Rajah 14 menunjukkan pemerhatian kepada eksperimen untuk mengkaji kesan logam Q dan logam R ke atas pengaratan besi

Diagram 14 shows the observation of an experiment to study the effect of metal Q and metal R on the corrosion of iron



Rajah 14/ Diagram 14

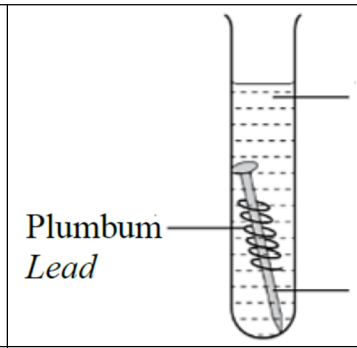
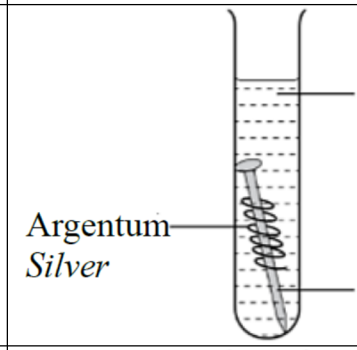
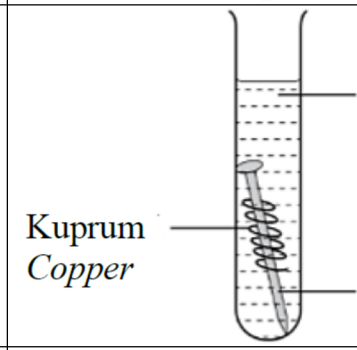
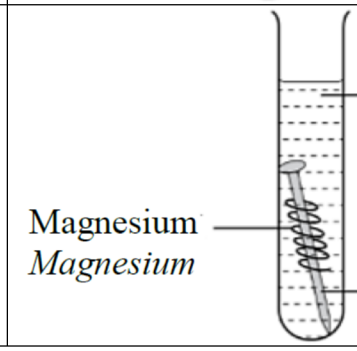
Antara berikut yang manakah benar?
Which of the following is true?

A. Tompokan biru menunjukkan kehadiran ion OH^-
The blue spot shows the presence of OH^- ions.
B. Logam Q ialah argentum manakala logam R ialah zink
The Q metal is argentum while the R metal is zinc

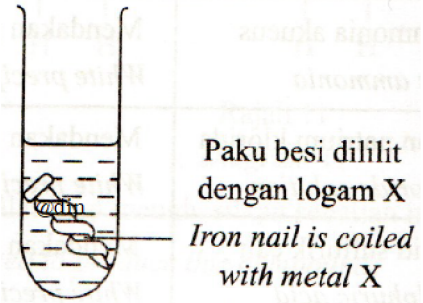
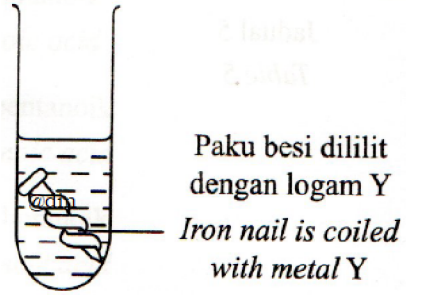
C. Ion Fe^{2+} hadir dalam Set II tetapi tiada dalam Set I
Fe^{2+} ions were present in Set II but not in Set I

D. Paku besi tidak berkarat dalam Set I tetapi berkarat dalam Set II
The iron nail did not rust in Set I but did rust in Set II

[Pahang 2023-27] Paku besi manakah yang tidak terkakis?
Which iron nail does not corrode?

A	
B	
C	
D	

[Selangor2023 Set 1-38] Rajah 12 menunjukkan pemerhatian eksperimen untuk mengkaji kesan logam ke atas pengaratan besi.
Diagram 12 shows the observation for an experiment to investigate the effect of metals on the rusting of iron.

Tabung uji *Test tube*	Susunan radas *Set-up of apparatus*	Pemerhatian *Observation*
P		Tompok merah jambu terbentuk *Pink spot is formed*
Q		Tompok biru terbentuk *Blue spot is formed*

Rajah 12/ Diagram 12

Berdasarkan pemerhatian, susun besi, logam X dan logam Y mengikut tertib menaik keelektropositifan.
Based on the observation, arrange iron, metal X and metal Y in ascending order of electropositivity.

A X, besi, Y
X, iron, Y

B Y, besi, X
Y, iron, X

C Besi, X, Y
Iron, X, Y

D Besi, Y, X
Iron, Y, X

Bab 2 Sebatian Karbon

2.1 Jenis-jenis sebatian karbon

[Melaka 2023-15] Antara berikut, yang manakah bukan hidrokarbon?
Which of the following is non hydrocarbon?

A Alkana
Alkane

B Alkena
Alkene

C Alkohol
Alcohol

D Alkuna
Alkyne

[Negeri Sembilan 2023-14] Antara yang berikut, penyataan manakah betul tentang hidrokarbon tak tepu?
Which of the following statements is correct about unsaturated hydrocarbon?

A Sebatian yang mengandungi unsur hidrogen, karbon dan oksigen
Compounds that contain hydrogen, carbon and oxygen elements

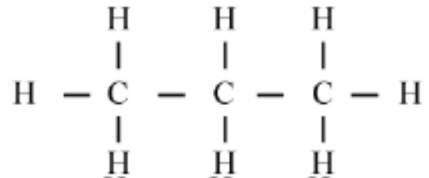
B Mengalami tindak balas penukargantian dan pembakaran Sahaja
Undergoes substitution reaction and combustion only

C Menyahwamakan waraa perang air bromin
Decolourise brown colour of bromine water

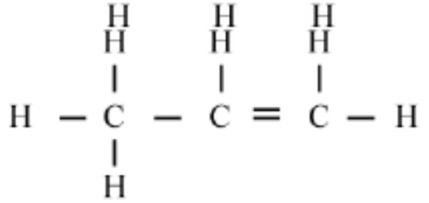
D Sebatian yang hanya mengandungi ikatan ganda dua antara atom-atom karbon
Compounds that only contain double bond between carbon atoms

[Selangaor2023 Set 01-12] Antara struktur berikut, yang manakah hidrokarbon tepu?
Which of the following structures is a saturated hydrocarbon?

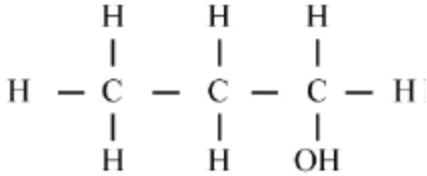
A



B

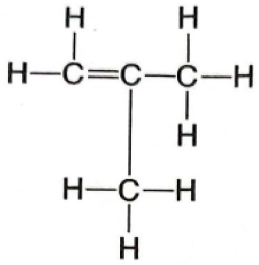


C

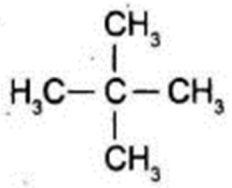


[Putrajaya2023-26] Antara yang berikut, yang manakah merupakan hidrokarbon tepu?
Which of the following are saturated hydrocarbon?

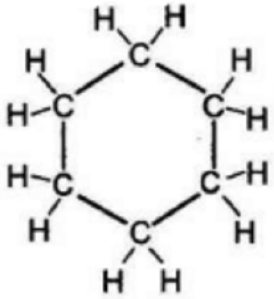
I



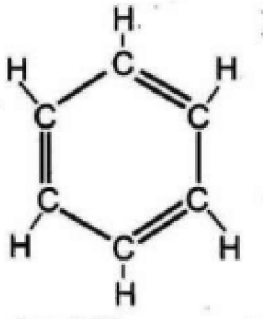
III



II



IV



A I dan III
I and III

B I dan IV
I and IV

C II dan III
II and III

D II dan IV
II and IV

[Johor PPD Tangkak 2023 23] Sebatian manakah adalah hidrokarbon tak tepu?
Which compound is an unsaturated hydrocarbon?

A $CH_2CHCH_2CH_2CH_3$
B $CH_3CHCH_3CH_3$
C $CH_3CH_2CH_2CH_2CH_3$
D $CH_3CH_2CH_2CH_3$

[Johor Skudai2023-28] Sebatian manakah adalah hidrokarbon tak tepu?
Which compound is an unsaturated hydrocarbon?

A $CH_3CHCH_3CH_3$
B $CH_3CH_2CH_2CH_3$
C $CH_2CHCH_2CH_2CH_3$
D $CH_3CH_2CH_2CH_2CH_3$

[Kedah2023-13] Antara formula am berikut, yang manakah sebatian hidrokarbon tak tepu?
Which of following general formula are unsaturated hydrocarbon?

I C_nH_{2n+2}
II C_nH_{2n}
III C_nH_{2n-2}
IV $C_nH_{2n+1}OH$

A I dan II
I and II

CIII dan IV
III and IV

B II dan III
II and III

D I dan IV
I and IV

[Pahang JUJ Set 1 2023-10] Antara yang berikut, yang manakah merupakan hidrokarbon tak tepu?
Which of the following are unsaturated hydrocarbon?

I Propuna
Propyne

III Propena
Propene

II Propana
Propane

IV Propanol
Propanol

A I dan II
I and II

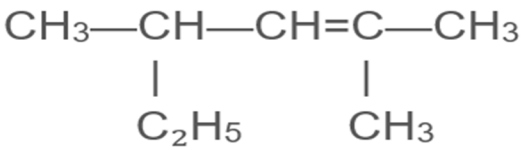
C III dan IV
III and IV

B I dan III
I and III

D II dan IV
II and IV

2.2 Siri homolog

[Perlis 2023-09] Rajah 2 menunjukkan formula struktur suatu sebatian organik.
Diagram 2 shows the structural formula of an organic compound.



Apakah siri homolog bagi sebatian organik?
What is the homologous series for the organic compound?

A Asid karboksilik
Carboxylic acids

C Alkohol
Alcohols

B Alkana
Alkanes

D Alkena
Alkenes

[Pahang JUJ Set 2 2023-05] Antara berikut yang manakah formula am bagi alkuna?
Which of the following is general formula for alkyne?

A C_nH_{2n} B C_nH_{2n-2} C C_nH_{2n+2}

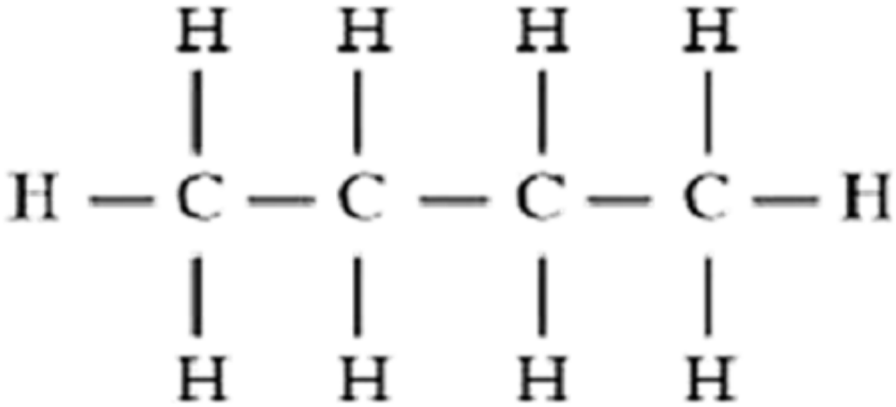
[Johor Bahru 2023-33] Apakah jisim molekul relatif bagi 4-metilpent-2-ena?
What is the relative molecular mass of 4-methylpent-2-ene?
[Jisim atom relatif: H = 1; C = 12]*[Relative atomic mass: H = 1; C - 12]*

A 56 B 70 C 84 D 86

[Melaka 2023-25] S ialah asid karboksilik yang mempunyai tiga atom karbon per molekul. Apakah jisim molekul relatif S?
S is a carboxylic acid that has three carbon atoms per molecule. What is the relative molecular mass of S?
[Jisim atom relatif: H = 1, C = 12, 0=16]
[Relative atomic mass : H = 1, C = 12, 0=16]

A 44 B 56 C 60 D 74

[Johor PPD Tangkak 2023 20] Rajah 10 menunjukkan formula struktur bagi satu hidrokarbon.
Diagram 10 shows the structural formula of hydrocarbon.



Rajah 10
Diagram 10

Hidrokarbon dalam rajah 10 dapat dihasilkan apabila hidrokarbon X dan hydrogen dilalukan ke atas mangkin nikel pada suhu 180°C.
Apakah nama bagi hidrokarbon X tersebut?
Hydrocarbon in diagram 10 can be obtained when hydrocarbon X and hydrogen are passed over a nickel catalyst at temperature 180°C.
What is the name of the hydrocarbon X?

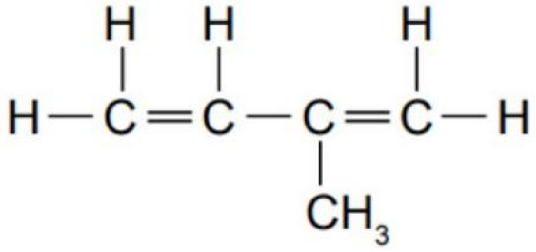
A Butana
Butane

C Butena
Butene

B Butuna
Butyne

D Butanol
Butanol

[Perlis 2023-26] Rajah 7 menunjukkan formula struktur monomer getah.
Diagram 7 shows the structural formula of rubber monomer.



Apakah nama sebatian tersebut berdasarkan sistem penamaan IUPAC?
What is the name of the compound based on the IUPAC nomenclature?

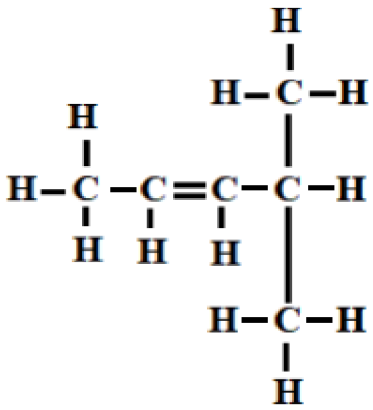
A 3-metilbutena
3-methylbutene

C 2-metilbut-1,3-diena
2-methylbut-1,3-diene

B 2-metilpentena
2-methylpentene

D 3-metilbut-1,3-diena
3-methylbut-1,3-diene

[Putrajaya2023-12] Rajah 3 menunjukkan formula struktur bagi satu sebatian hidrokarbon, W.
Diagram 3 shows the structural formula of a hydrocarbon compound, W.



Rajah 3 / Diagram 3

Apakah nama W? / *What is the name of W?*

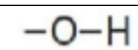
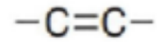
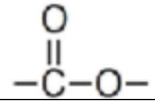
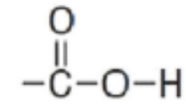
A 2-metilpent-3-ena
2-methylpent-3-ene

C 1,1-dimetilbut-2-ena
1,1-dimethylbut-2-ene

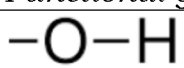
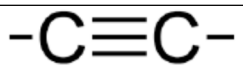
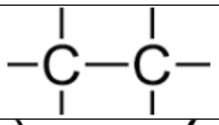
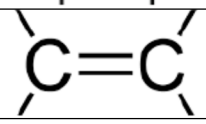
B 4 -metilpent-2-ena
4-methylpent-2-ene

D 4,4-dimetilbut-1-ena
4,4-dimetilbut-1-ena

[Johor PPD Tangkak 2023 22] Apakah kumpulan berfungsi yang betul bagi siri homolog yang berikut?
What is the correct functional group for the following homologous series?

	Siri homolog *Homologous series*	Kumpulan berfungsi Functional group
A	Ester *Ester*	
B	Alkuna *Alcyne*	
C	Alkohol *Alcohol*	
D	Asid karboksilik *Carboxylic acid*	

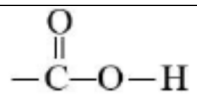
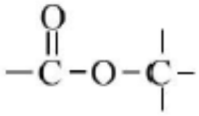
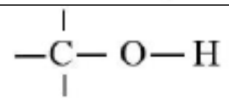
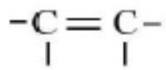
[Pahang JUJ Set 1 2023-15] Antara berikut, yang manakah benar tentang siri homolog dengan kumpulan berfungsinya.
Which of the following is true about homologous series and its functional group.

	Siri homolog *Homologous series*	Kumpulan berfungsi *Functional group*
A	Alkohol *Alcohol*	
B	Alkana *Alkane*	
C	Alkena *Alkene*	
D	Alkuna Alkyne	

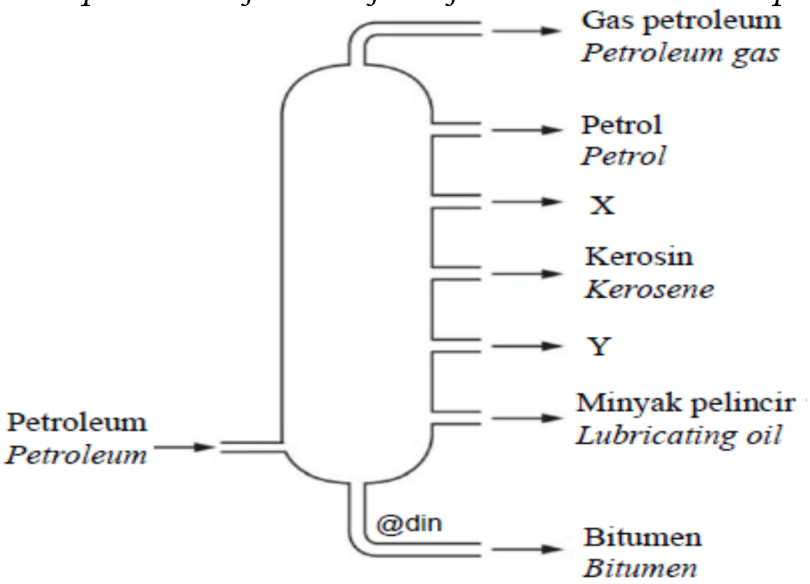
[Pahang 2023-10] Antara berikut, padanan manakah yang benar?
Which of the following is the correct match?

	Siri homolog *Homologous series*	Formula am *General formula*	Nama kumpulan berfungsi *Name of functional group*
A	Alkana *Alkane*	CnH2n+1 n= 1,2,..	Ikatan tunggal *Single bond*
B	Alkena *Alkene*	CnH2n n= 2,3..	Ikatan ganda dua *Double bond*
C	Alkohol *Alcohol*	CnH2n+1 COOH, n= 0,1,2,.	Karboksil *Carboxyl*
D	Asid karboksilik *Carboxylic acid*	CnH2n+1OH, n= 1,2,..	Hidroksil *Hydroxyl*

[MRSM2023-10] Apakah kumpulan berfungsi bagi 2,3-dimetilbutan-2-ol?
What is the functional group for 2,3-dimethylbutan-2-ol?

A	
B	
C	
D	

[MRSM2023-11] Rajah 4 menunjukkan pecahan petroleum dari proses penyulingan berperingkat.
Diagram 4 shows petroleum fraction from fractional distillation process.



Antara yang berikut, pasangan pecahan petroleum manakah yang sepadan dengan kegunaannya?
Which of the following pairs of petroleum fraction is correctly matched to its use?

	X	Y
A	Gas memasak *Cooking gas*	Minyak pelincir *Lubricating oil*
B	Bahan mentah industri petrokimia *Raw materials for petrochemical industry*	Bahan api kenderaan berat *Fuel for heavy vehicles*
C	Bahan api kapal terbang *Fuel for aircraft*	Menurap jalan raya *Road pavement*
D	Bahan api kenderaan *Fuel for motor vehicles*	Bahan api kapal terbang *Fuel for aircraft*

[Selangor2023 Set 1-33] Siri homolog yang manakah mempunyai formula am $C_nH_{2n+1}COOCC_mH_{2m+1}$ di mana n = 0, 1, 2, ... dan m = 1, 2, 3, ... ?
Which homologous series has the general formula of $C_nH_{2n+1}COOCC_mH_{2m+1}$ where n = 0, 1, 2, ... and m = 1, 2, 3, ... ?

A Alkohol
Alcohol

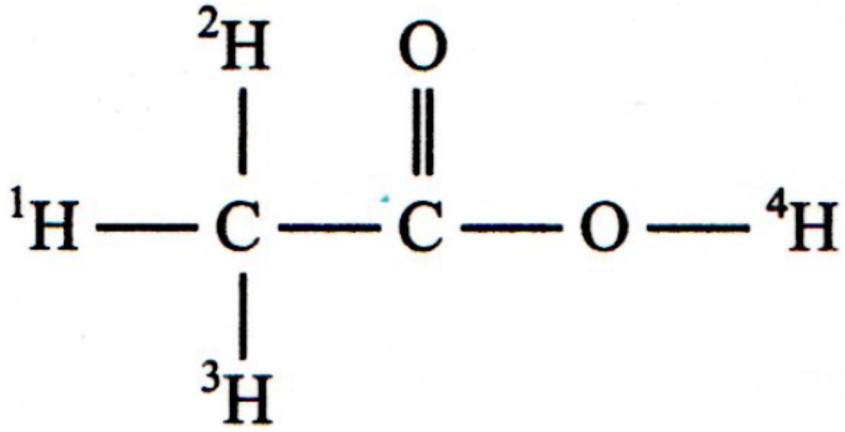
C Ester
Ester

B Asid karboksilik
Carboxylic acid

D Alkuna
Alkyne

2.3 Sifat kimia dan saling pertukaran sebatian antara siri homolog

[Selangor2023 Set 1-18] Rajah 6 menunjukkan formula struktur bagi asid etanoik.
Diagram 6 shows the structural formula of ethanoic acid.



Rajah 6 / Diagram 6

Antara berikut, atom hidrogen yang manakah akan terlibat dalam tindak balas kimia?
Which of the following hydrogen atom will be involved in a chemical reaction?

A ^1H B ^2H C ^3H D ^4H

[Selangaor2023 Set 01-33] Persamaan yang berikut menunjukkan tindak balas yang menghasilkan etanol.
The following equation shows the reaction that produces ethanol.

$$\text{Bahan V} \xrightarrow[\text{Yis}]{} \text{Etanol} + \text{Karbon dioksida}$$

$$\textit{Substance V} \xrightarrow[\text{Yeast}]{} \textit{Ethanol} + \textit{Carbon dioxide}$$

Apakah bahan V? / *What is substance V?*

A Selulosa
Cellulose

C Etena
Ethene

B Asid etanoik
Ethanoic acid

D Glukosa
Glucose

[Selangor2023 Set 01-07] Minyak bunga matahari wujud sebagai cecair pada suhu bilik.
Minyak bunga matahari tergolong dalam siri homolog yang mana?
Sunflower oil exists as a liquid at room temperature.
In which homologous series does sunflower oil belong to?

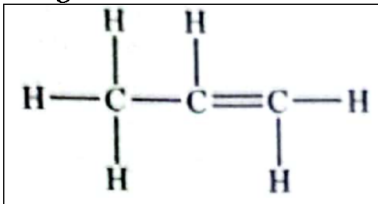
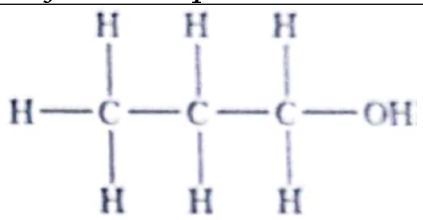
A Ester
Ester

C Alkena
Alkene

B Alkohol
Alcohol

D Asid karboksilik
Carboxylic acid

[SBP2023-27] Rajah 6 menunjukkan formula struktur bagi dua sebatian
Diagram 6 shows the structural formulae of two compounds

	
Sebatian P/ *Compound P*	Sebatian Q/ *Compound Q*

Antara yang berikut, sifat-sifat manakah yang sama bagi P Jan Q?
Which of the following properties are similar for P and Q?

I Tidak larut dalam air
Does not dissolve in water

II Wujud dalam keadaan gas pada suhu bilik
Exist as gas at room temperature

III Menyahwarnakan larutan kalium manganat(VII) berasid
Decolourise acidified potassium mangante (VII) solution

IV Menjalani tindak balas pembakaran dengan oksigen
Undergo combustion reaction with oxygen

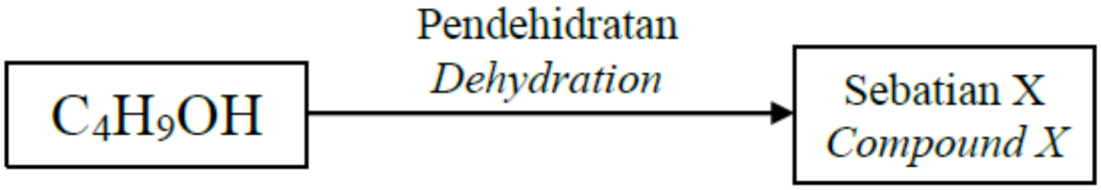
A I dan II
I and II

C II dan III
II and III

B I dan IV
I and IV

D III dan IV
III and IV

[Pahang 2023-38] Rajah 13 menunjukkan satu siri perubahan butanol.
Diagram 13 shows a conversion of butanol.



Rajah 13/ Diagram 13

Antara yang berikut, yang manakah isomer bagi sebatian X?
Which of the following is the isomer of compound X?

I But-1-ena
But-1-ene

II 2-metilpropana
2-methylpropane

III 2-metilprop-1-ena
2-methylprop-1-ene

IV 2,2-dimetilbutana
2,2-dimethylbutane

A I dan III
I and III

B I dan IV
I and IV

C II dan III
II and III

D II dan IV
II and IV

[Pahang 2023-15] Antara yang berikut, yang manakah merupakan ciri-ciri ahli dalam siri homolog alkena ?
Which of the following are characteristics of the homologous series of alkenes?

I Sebatian hidrokarbon tepu
Saturated hydrocarbon compounds

II Menghasilkan nyalaan lebih berjelaga
Produces more sooty flame

III Ikatan kovalen tunggal dalam molekul
Single covalent bond in a molecule

IV Peratus jisim karbon per molekul lebih tinggi
The percentage of carbon by mass per molecule is higher

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

[Kelantan 2023-11] Hidrokarbon tak tepu boleh ditukarkan kepada hidrokarbon tepu melalui tindak balas penambahan hidrogen dengan menggunakan bahan X sebagai mangkin. Apakah bahan X?
Unsaturated hydrocarbons can be converted to saturated hydrocarbons through a hydrogen addition reaction using substance Xas a catalyst. What is substance X?

A. Nikel
Nickel

C. Mangan (IV) oksida
Manganese oxide

B. Ferum
Iron

D. Asid fosforik
Phosphoric acid

[Kelantan 2023-04] Apakah bahan yang terhasil apabila etanol terbakar dalam oksigen berlebihan?
What substance is produced when ethanol bums in excess oxygen?

A. Karbon dioksida dan karbon monoksida
Carbon dioxide and carbon monoxide

B. Karbon dioksida, karbon monoksida dan air
Carbon dioxide, carbon monoxide and water

C. Karbon dioksida dan air
Carbon dioxide and water

[Kedah2023-38] Rajah menunjukkan satu produk bagi satu jenis sebatian karbon digunakan sebagai antiseptik.
Diagram shows a product of a type of carbon compound that used as antiseptic.

Berdasarkan rajah di atas, formula molekul yang manakah mempunyai sifat yang sama seperti di atas?
Based on the above diagram, which molecular formula has the same characteristic as above?

A CH_3COOH B C_2H_5OH C $CH_3COOC_2H_5$

[Melaka 2023-14] Kandungan cecair antiseptik mengandungi siri homolog Z. Siri homolog ini juga digunakan sebagai pelarut dalam ubat batuk. Apakah siri homolog Z?
The content of the antiseptic liquid contains homologous series Z. This homologous series is also used as a solvent in cough medicine. What is homologous series of Z?

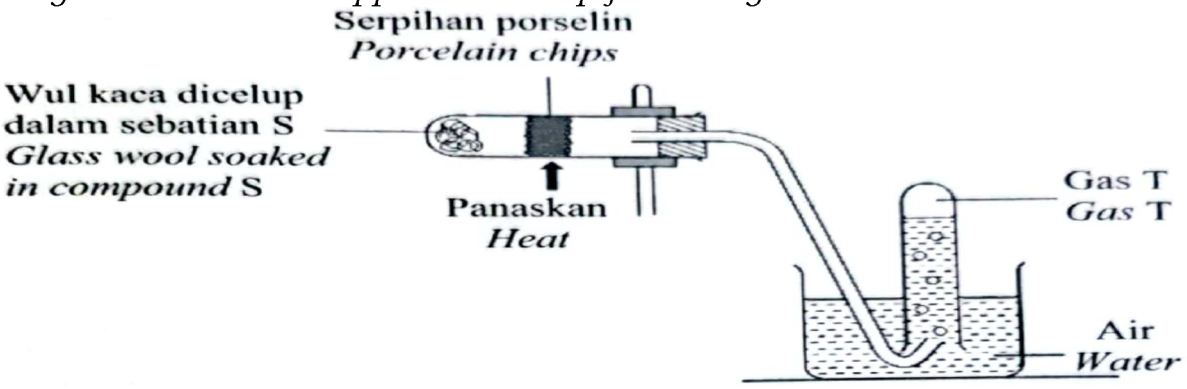
A Alkena
Alkene

C Ester
Ester

B Alkohol
Alcohol

D Asid karboksilik
Carboxylic acid

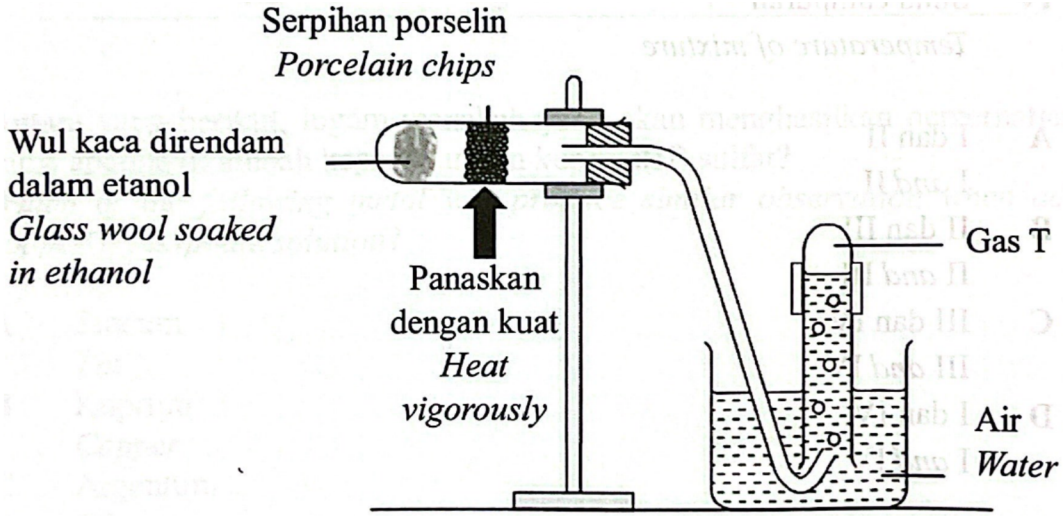
[SBP2023-12] Rajah 2 menunjukkan susunan radas bagi satu tindak balas pendehidratan.
Diagram 2 shows the apparatus set up for a dehydration reaction.



Apakah S dan T?/ *What are S and T?*

	S	T
A	Asid etanoik *Ethanoic acid*	Etana *Ethane*
B	Asid etanoik *Ethanoic acid*	Etena *Ethene*
C	Etanol *Ethanol*	Etana *Ethane*
D	Etanol *Ethanol*	Etena *Ethene*

[Negeri Sembilan 2023-15] Rajah 3 menunjukkan susunan radas bagi satu tindak balas untuk menghasilkan gas T.
Diagram 3 shows the apparatus set-up for a reaction to produce gas T.
Serpihan porselin



Antara yang berikut, penyataan manakah yang betul tentang gas T?
Which of the following statements is correct about gas T?

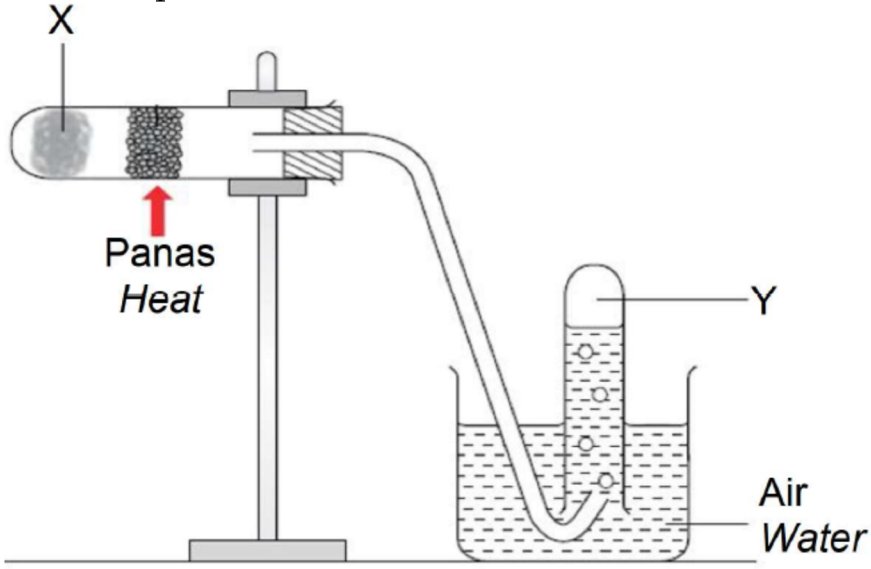
A Menyahwarnakan larutan kalium manganat(VII) berasid
Decolourise acidified potassium manganate(VII) solution

B Menukarkan kertas litmus biru lembap menjadi merah
Change the damp blue litmus paper to red

C Bertindak balas dengan asid etanoik menghasilkan ester
React with ethanoic acid to produce ester

D Larut dalam air
Soluble in water

[Kelantan 2023-35] Rajah 17 menunjukkan susunan radas yang digunakan dalam satu tindak balas kimia melibatkan sebatian karbon.
Diagram 17 shows the arrangement of apparatus used in a chemical reaction involving carbon compounds.



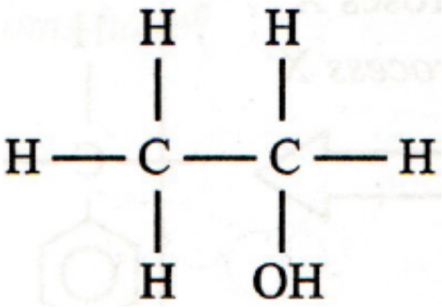
Apakah X, Y dan persamaan kimia bagi tindak balas yang ditunjukkan dalam Rajah 17.
What are X, Y and the chemical equation for the reaction shown in Diagram 17.

	X	Y	Persamaan kimia tindak balas *Chemical equation of the reaction*
A	Etanol *Ethanol*	Etana *Ethane*	$C_2H_5OH \rightarrow C_2H_6 + H_2O$
B	Etena *Ethene*	Etanol *Ethanol*	$C_2H_4 + H_2O \rightarrow C_2H_5OH$
C	Etana *Ethane*	Etanol *Ethanol*	$C_2H_6 + H_2O \rightarrow C_2H_5OH$
D	Etanol *Ethanol*	Etena *Ethene*	$C_2H_50H \rightarrow C_2H_4 + H_2O$

[Pahang JUJ Set 2 2023-35] Antara sebatian karbon berikut, yang manakah terbakar menghasilkan paling banyak jelaga?
Which of the following carbon compound burns producing the most soot?
[Jisim atom relatif: H = 1, C = 12, O = 16, Cl = 35.5]
[Relative atomic mass: H = 1, C = 12, O =16, Cl = 35.5]

A C_3H_6 B C_3H_8 C C_3H_7OH

[Selangor2023 Set 1-121] Rajah 4 menunjukkan formula struktur sebatian organik yang boleh dihasilkan daripada etena.
Diagram 4 shows the structural formula of organic compound that could be produced from ethene.



Apakah nama tindak balas yang menghasilkan sebatian ini daripada etena?
What is the name of the reaction that produces the compound from ethene?

A Penghidratan
Hydration

B Pendehidratan
Dehydration

C Pengoksidaan
Oxidation

D Penghidrogenan
Hydrogenation

[Johor Skudai2023-19] Apakah hasil-hasil yang terbentuk apabila etanol terbakar dengan lengkap dalam udara berlebihan?
What are the products formed when ethanol burns completely in excess air?

A Air dan gas karbon dioksida
Water and carbon dioxide gas

B Air, karbon dan gas karbon dioksida
Water, carbon and carbon dioxide gas

C Air, gas karbon monoksida dan gas karbon dioksida
Water, carbon monoxide and carbon dioxide

D Air, karbon, gas karbon monoksida dan gas karbon dioksida
water, carbon, carbon monoxide gas and carbon dioxide gas

[Negeri Sembilan 2023-30] Bahan Y menghasilkan gas tak berwarna apabila bertindak balas dengan serbuk zink karbonat. Gas itu akan mengeruhkan air kapur. Apakah formula molekul bagi Y?
Substance Y produces a colourless gas when reacted with zinc carbonate powder. The gas turns lime water chalky. What is the molecular formula of Y?

A C_3H_7OH
B CH_3COOH
C CH_3COOCH_3
D $(CH_3COO)_2Zn$

[Pahang JUJ Set 2 2023-20] Apakah nama tindak balas bagi perubahan heksena kepada heksana.
What is the name of the reaction for the changes of hexene to hexane.

A Penghidratan
Hydration

B Pendehidratan
Dehydration

C Penghalogenan
Halogenation

D Penghidrogenan
Hydrogenation

[Johor Skudai2023-21] Persamaan berikut menunjukkan penukaran butanol kepada butena.
The following equation shows the conversion of butanol to butene.

$$C_4H_9OH \xrightarrow[\text{Panaskan/ Heat}]{\text{Proses X/ Process X}} C_4H_8 + H_2O$$

Apakah proses X? / *What is process X?*

A Pengoksidaan
Oxidation

C Pengdehidratan
Dehydration

B Hidrolisis
Hydrolysis

D Penghidrogenan
Hydrogenation

[Johor Bahru 2023-22] Antiseptik mengandungi bahan W yang menyala dengan nyalaan biru. Apakah kumpulan berfungsi bagi W?
Antiseptic contains substance W that burns with a blue flame.
What is the functional group for W?

A -C=C- B -COO- C -COOH D -OH

[Johor PPD Tangkak 2023 24] Antara bahan berikut, yang manakah mengalami tindak balas pendehidratan?
Which of the following substances undergoes dehydration reaction?

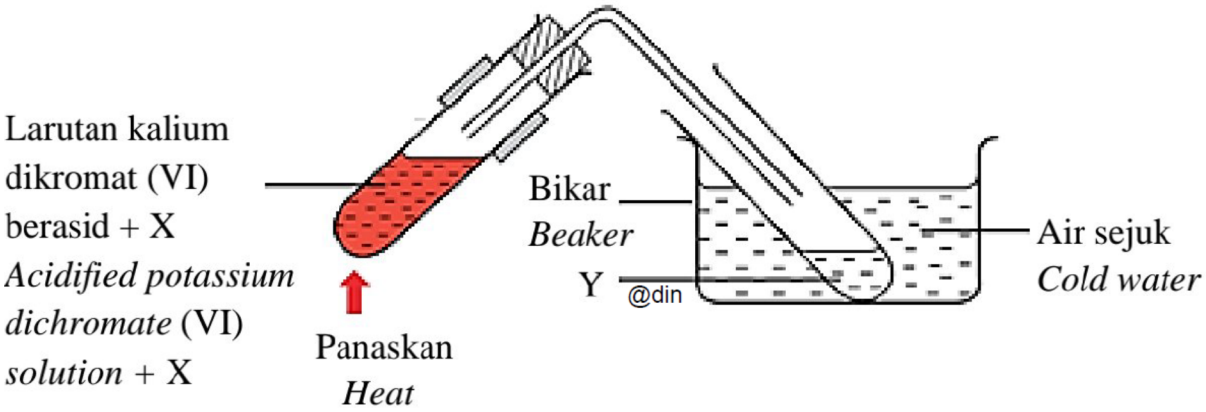
A Methanol
Methanol

C Asid etanoik
Ethanoic acid

B Etanol
Ethanol

D Asid metanoik
Methanoic acid

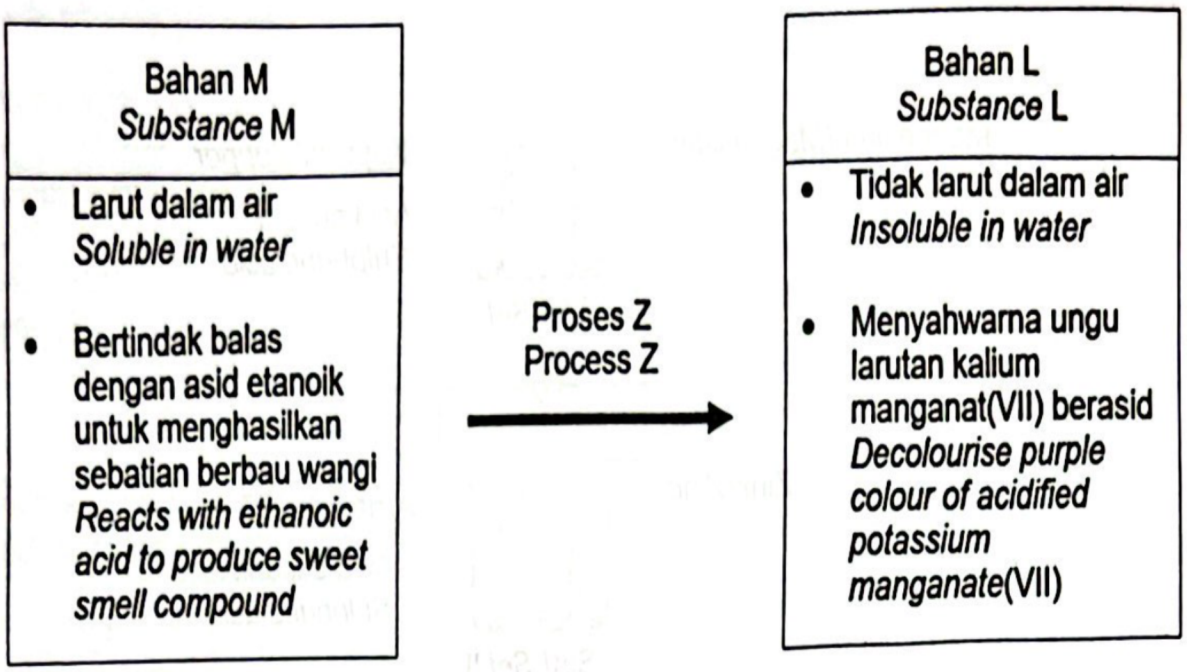
[Melaka 2023-24] Rajah 6 menunjukkan susunan radas bagi mengkaji sifat kimia X yang dijalankan oleh sekumpulan pelajar di dalam makmal.
Diagram 6 shows an apparatus set-up to study chemical properties pfX carried out by a group of students in a laboratory.



Antara berikut, padanan manakah yang betul bagi X dan Y?
Which of the following is correct matches for X and Y?

	X	Y
A	Etanol/ *Ethanol*	Asid etanoik/ *Ethanoic acid*
B	Etanol/ *Ethanol*	Etena/ *Ethene*
C	Etena / *Ethene*	Etanol/ *Ethanol*
D	Etena / *Ethene*	Asid etanoik/ *Ethanoic acid*

[Terengganu2023-33] Rajah 33 menunjukkan perubahan bahan M kepada bahan L melalui proses Z.
Diagram 33 shows the change of substance M to substance L through process Z.



Antara yang berikut, yang manakah betul tentang proses Z?
Which of the following is correct about process Z?
A Dipanaskan pada suhu 180 °C dengan nikel
Heated at 180 °C with nickel

B Distimkan pada suhu 300 °C dengan asid fosforik
Steamed at 300 °C with phosphoric acid

C Bertindak balas dengan hidrogen klorida pada suhu bilik
Reacts with hydrogen chloride at room temperature

D Dialirkan melalui serpihan porselin panas
Passes through hot porcelain chips

[Terengganu2023-15] Apakah hasil yang terbentuk apabila hidrogen dan propena dilalukan ke atas mangkin nikel pada suhu 180°C?
What is the product formed when hydrogen and propene are passed over a nickel catalyst at temperature 180°C?

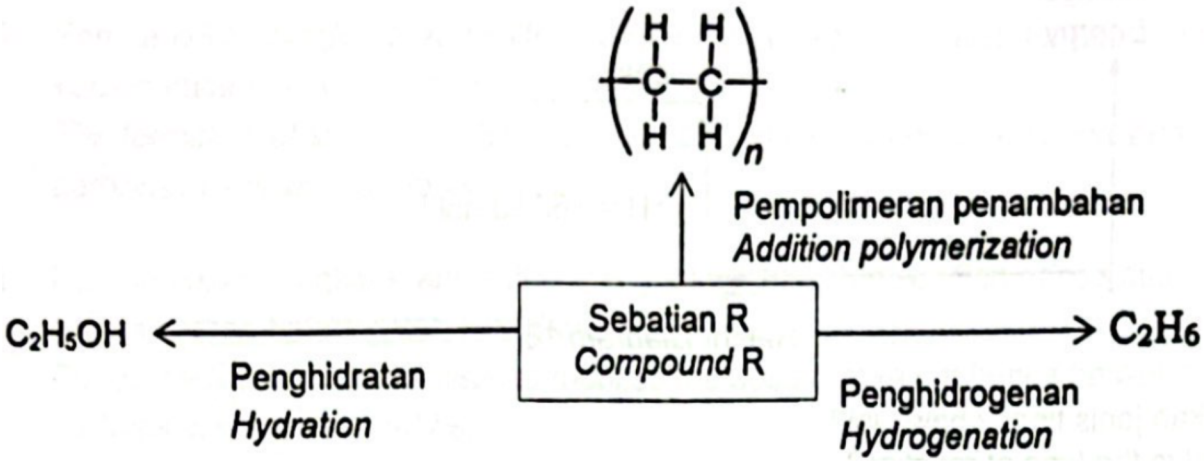
A Propana
Propane

B Propanol
Propanol

C Asid propanoik
Propanoic acid

D Propil propanoat
Propyl propanoate

[Terengganu2023-16] Rajah 16 menunjukkan carta alir bagi tindak balas sebatian R.
Diagram 16 shows a flow chan for the reactions of compound R.

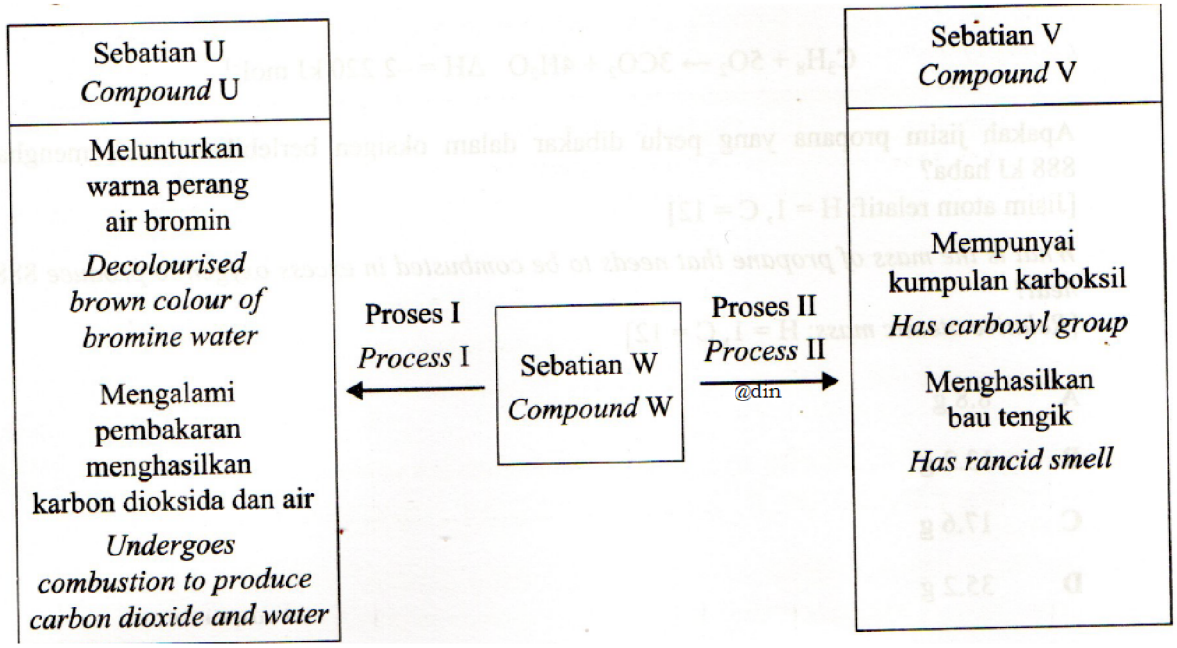


Rajah/ Diagram 16

Apakah formula am bagi R?/ *What is the general formula of R?*

A C_nH_{2n}
B C_nH_{2n+2}
C $C_nH_{2n+1}OH$
D $C_nH_{2n+1}COOH$

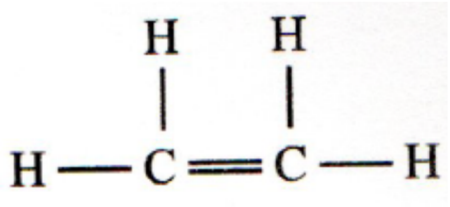
[Selangor2023 Set 39] Rajah 13 menunjukkan dua proses melibatkan sebatian W.
Diagram 13 shows two processes involving compound W.



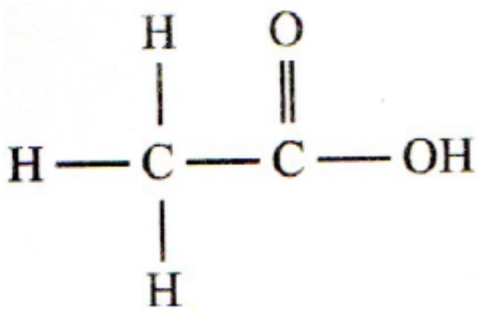
Rajah 13
Diagram 13

Formula struktur yang manakah mewakili sebatian W?
Which structural formula represents compound W?

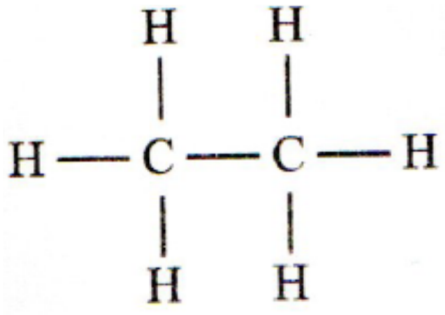
A



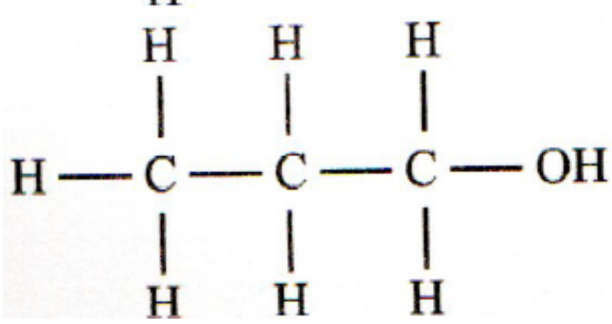
C



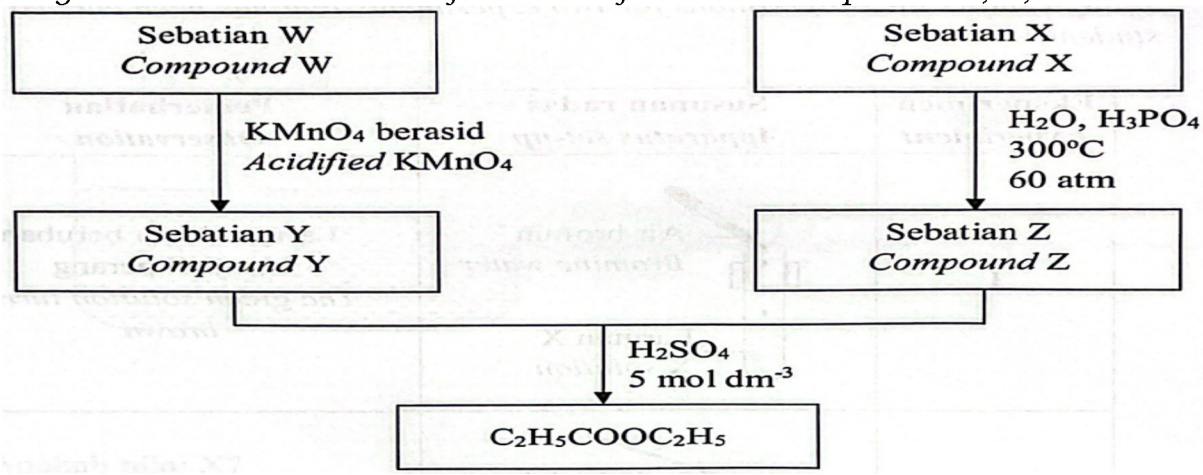
B



D



[Negeri Sembilan 2023-39] Rajah 14 menunjukkan siri tindak balas bagi sebatian karbon W, X, Y dan Z.
Diagram 14 shows a series of reactions for carbon compound W, X, Y and Z.



Antara yang berikut, sebatian manakah yang akan menghasilkan nyalaan biru apabila bertindak balas dengan gas oksigen berlebihan?
Winch of the following compounds will produce blue flame when reacted with excess oxygen gas?

I W II X III Y IV Z

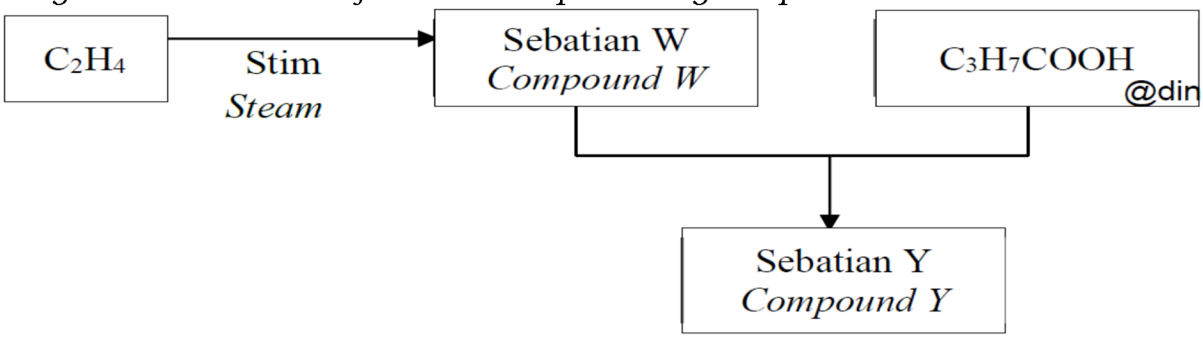
A I dan II
I and II

C III dan IV
III and IV

B II dan III
II and III

D I dan IV
I and IV

[Johor PPD Tangkak 2023 21] Rajah 11 menunjukkan carta alir untuk menghasilkan sebatian Y.
Diagram 11 shows the flow chart in producing compound Y.



Apakah Y ?/ *What is Y ?*

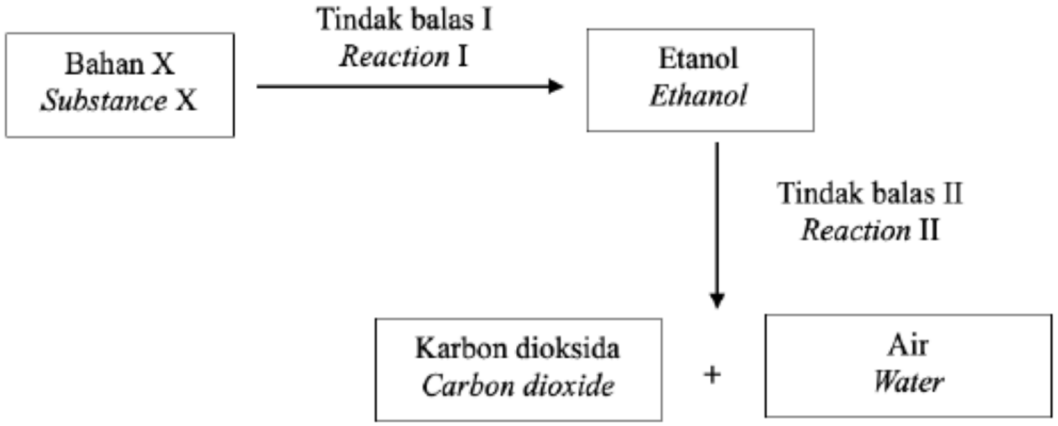
A Etil etanoat
Ethyl ethanoate

B Etil butanoat
Ethyl butanoate

C Propil etanoat
Propyl ethanoate

D Propil butanoat
Propyl butanoate

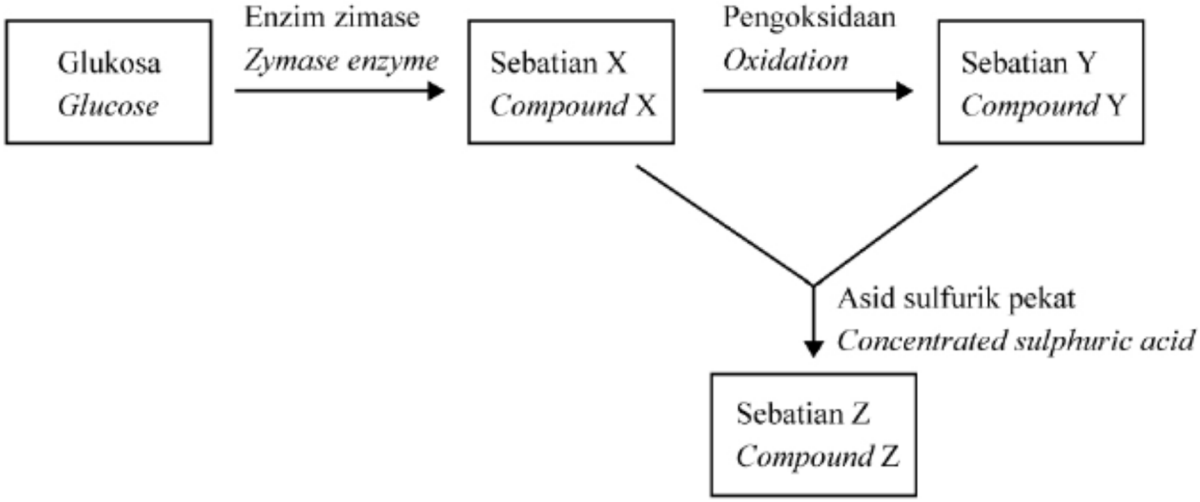
[MRSM2023-26] Rajah 11 adalah satu siri tindak balas kimia bagi bahan X.
Diagram 11 shows a series of chemical reactions for substance X.



Apakah bahan X, tindak balas I dan tindak balas II?
What is substance X, reaction I and reaction II?

	Bahan X *Substance X*	Tindak balas I *Reaction I*	Tindak balas II *Reaction II*
A	Glukosa *Glucose*	Penghidratan *Hydration*	Pembakaran *Combustion*
B	Etena *Ethene*	Penghidratan *Hydration*	Pembakaran *Combustion*
C	Etena *Ethene*	Pengoksidaan *Oxidation*	Pengesteran *Esterification*
D	Glukosa *Glucose*	Pengoksidaan *Oxidation*	Penapaian *Fermentation*

[Selangaor2023 Set 01-39] Rajah 13 menunjukkan penukaran sebatian X kepada sebatian Y. Sebatian X adalah cecair tanpa warna, mudah meruap dan larut di dalam air.
Diagram 13 shows the conversion of compound X into compound Y. Compound X is a colourless liquid, volatile easily and soluble in water.



Tindak balas antara sebatian X dan sebatian Y untuk menghasilkan sebatian Z. Apakah sebatian Z?
Reaction between compound X and compound Y to produce compound Z. What is compound Z?

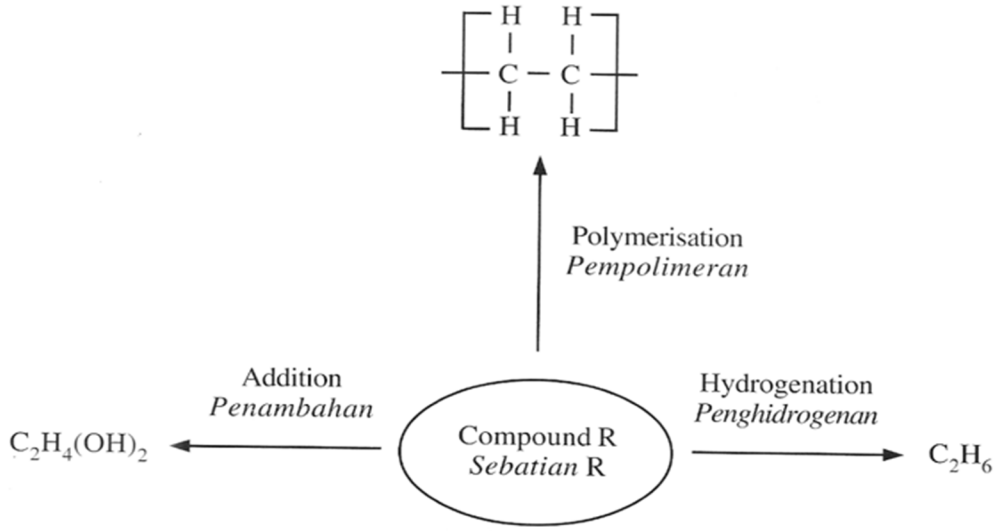
A Etanol
Ethanol

B Asid etanoik
Ethanoic acid

C Metil propanoat
Methyl propanoate

D Etil etanoat
Ethyl ethanoate

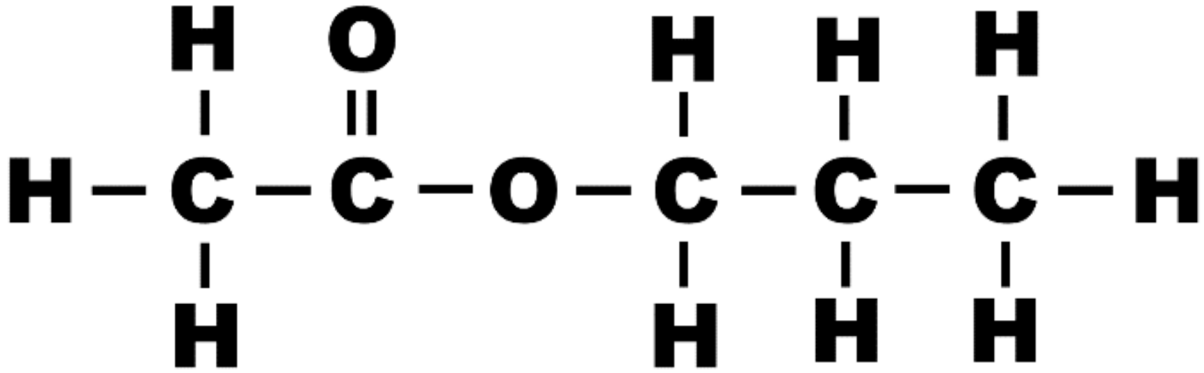
[Johor Skudai2023-22] Rajah 22 menunjukkan carta alir bagi tindak balas sebatian R
Diagram 22 shows a flow chart for the reactions of compound R.



Apakah formula am bagi R?/ *What is the general formula of R?*

A C_nH_{2n}
B C_nH_{2n+2}
C $C_nH_{2n+1}OH$
D $C_nH_{2n+1}COOH$

[Pahang JUJ Set 2 2023-24] Rajah 6 menunjukkan formula struktur bagi suatu sebatian karbon.
Diagram 6 shows the structural formula of a carbon compound.



Apakah nama sebatian organik itu?
What is the name of the organic compound?

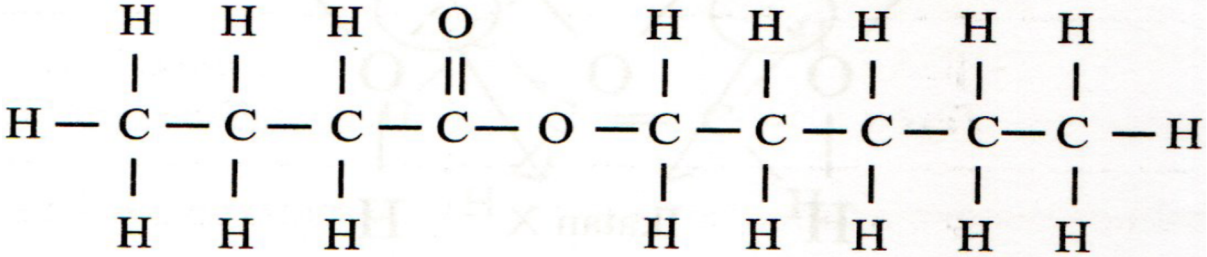
A Etil pentanoat
Ethyl pentanoate

B Etil propanoate
Ethyl propanoate

C Propil ethanoat
Propyl ethanoate

D Pentil ethanoate
Pentyl ethanoate

[Selangor2023 Set 1-36] Rajah 11 menunjukkan formula struktur bagi suatu sebatian yang digunakan sebagai perisa pisang tiruan.
Diagram 11 shows a structural formula of a compound that is used as an artificial banana flavouring.



Apakah bahan tindak balas bagi menghasilkan sebatian ini?
What is the reactants used to produce this compound?

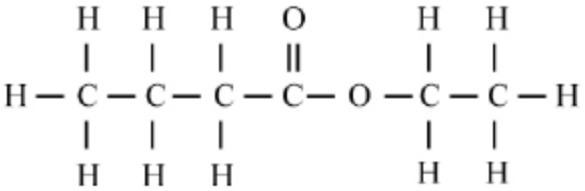
A Butanol + Asid butanoik
Butanol + Butanoic acid

B Butanol + Asid pentanoik
Butanol + Pentanoic acid

C Pentanol + Asid butanoik
Pentanol + Butanoic acid

D Pentanol + Asid pentanoik
Pentanol + Pentanoic acid

[Selangaor2023 Set 01-18] Rajah 4 menunjukkan formula struktur yang mewakili satu bahan perisa makanan.
Diagram 4 shows a structural formula that represents a food flavouring substance.



Antara yang berikut, yang manakah boleh digunakan untuk membuat perisa tersebut?
Which of the following can be used to make the flavouring?

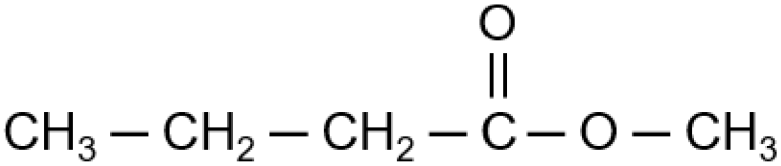
A Butanol dan asid etanoik
Butanol and ethanoic acid

B Propanol dan asid propanoik
Propanol and propanoic acid

C Propanol dan asid etanoik
Propanol and ethanoic acid

D Etanol dan asid butanoik
Ethanol and butanoic acid

[Perlis 2023-33] Rajah 10 menunjukkan formula struktur bagi suatu sebatian.
Diagram 10 shows the structural formula of a compound.



Apakah nama bagi sebatian tersebut?
What is the name of the compound?

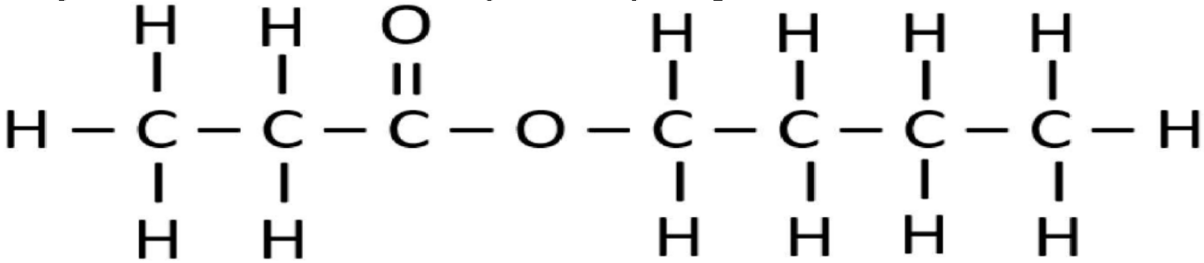
A Butil pentanoat
Butyl pentanoate

B Butil propanoat
Butyl propanoate

C Pentil pentanoat
Pentyl pentanoate

D Metil butanoat
Methyl butanoate

[Kelantan 2023-37] Rajah 19 menunjukkan formula struktur bagi sebatian P.
Diagram 19 shows a structural formula of compound P.



Apakah alkohol yang di gunakan untuk menyediakan sebatian P?
What alcohol is used to prepare compound P?

A. Metanol
Methanol

C. Propanol
Propanol

B. Etanol
Ethanol

D. Butanol
Butanol

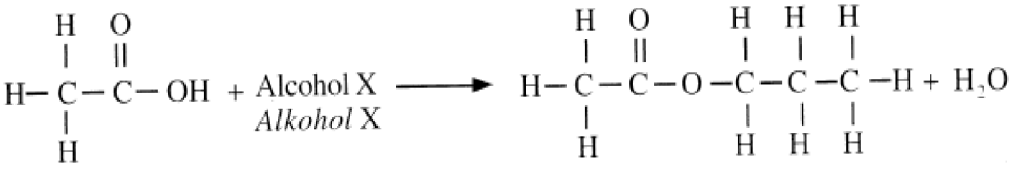
[Perlis 2023-22] Formula molekul berikut mewakili satu sebatian karbon yang terbentuk daripada tindak balas antara sebatian X dan sebatian Y.
The following molecular formula represents a carbon compound formed from the reaction between compounds X and Y.

$C_2H_5COOC_3H_7$

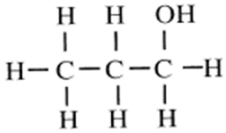
Apakah sebatian X dan sebatian Y?/ *What are compounds X and Y?*

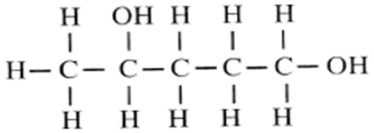
	Sebatian X *Compound* X	Sebatian Y *Compound* Y
A	CH_3CH_2COOH	CH_3CH_2OH
B	$CH_2CH_2CH_2CH_2COOH$	$CH_3CH_2CH_2OH$
C	$CH_3CH_2CH_2COOH$	CH_3CH_2OH
D	CH_3CH_2COOH	$CH_3CH_2CH_2OH$

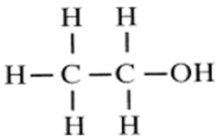
[Johor Skudai2023-24] Persamaan mewakili satu tindak balas pengesteran
The equation represents an esterification reaction.

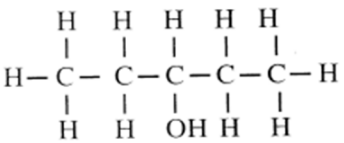


Apakah X?/ *What is X?*

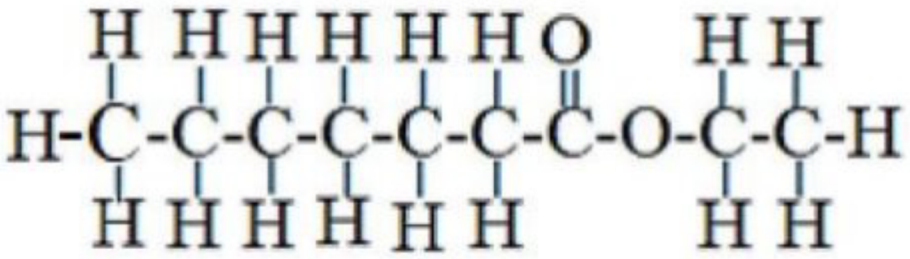
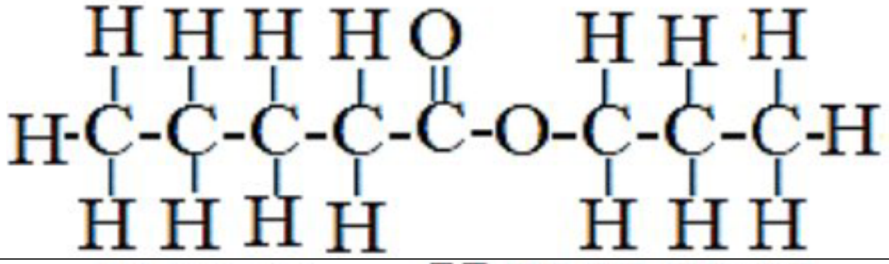
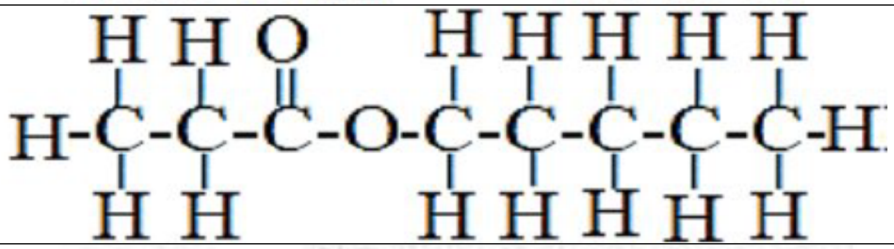
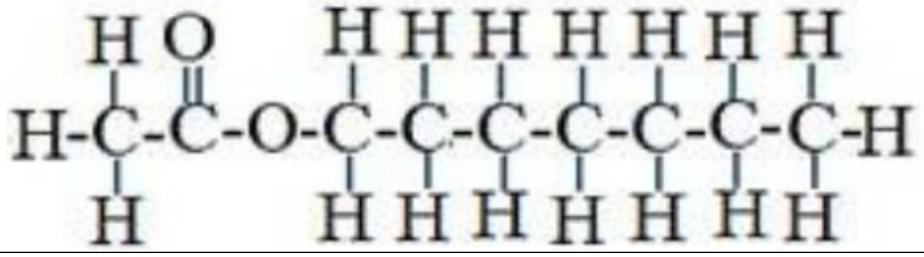
A


C


B


D


[Melaka 2023-26] Apabila etanol ditindakbalaskan dengan asid heptanoik, suatu ester yang mempunyai aroma seperti anggur terhasil. Antara berikut yang manakah menunjukkan formula struktur bagi ester tersebut?
When ethanol is reacted with heptanoic acid[an ester with grape-like aroma is produced. Which of the following shows the structural formula for the ester?

A	
B	
C	
D	

[Pahang JUJ Set 2 2023-06] Antara berikut, yang manakah sifat fizik ester?
Which of the following is the physical property of ester?

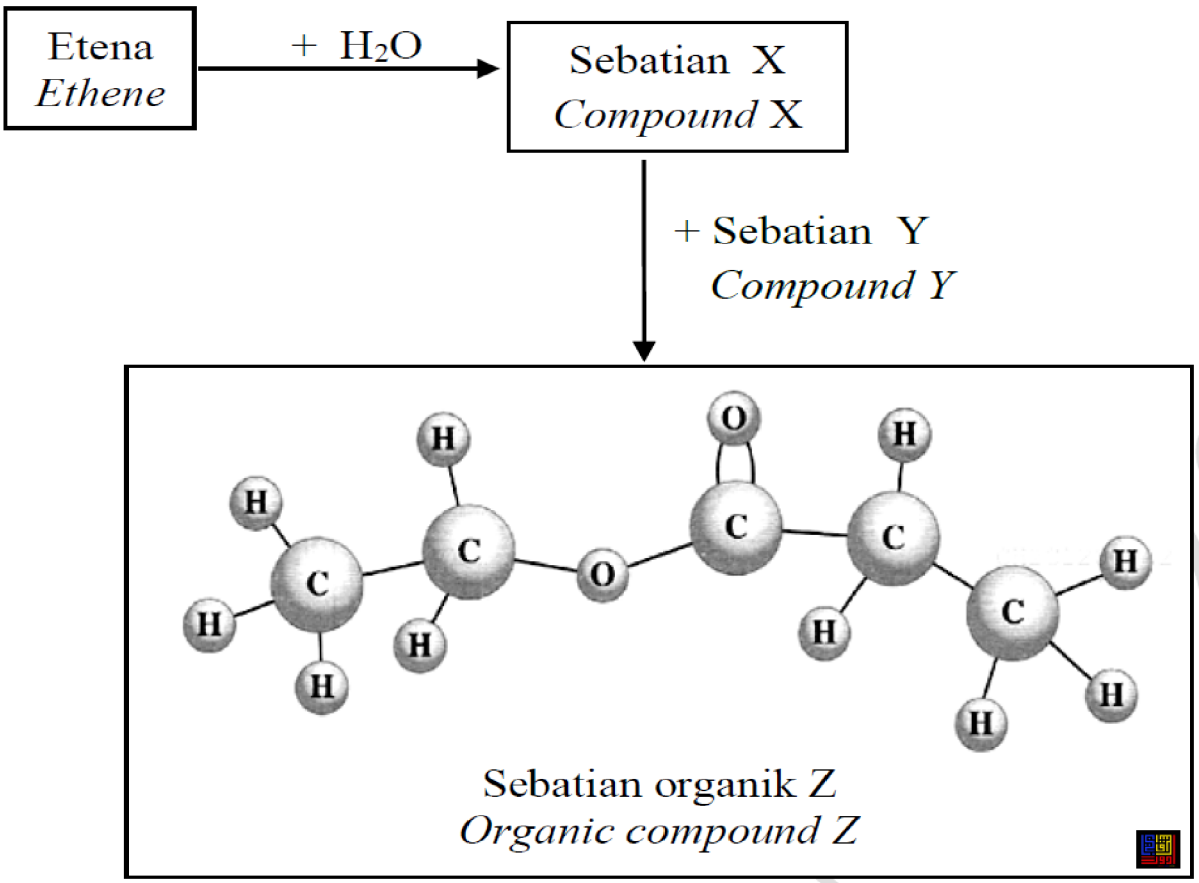
A Larut dalam air
Soluble in water

B Takat didih tinggi
High boiling point

C Lebih tumpat daripada air
More dense than water

D Mudah meruap pada suhu bilik
Easily vaporized at room temperature

[Pahang JUJ Set 1 2023-40] Rajah 21 menunjukkan siri tindak balas bagi menghasilkan sebatian organik Z.
Diagram 21 shows series of reactions t0 produce organic compound Z.



Antara berikut yang manakah mewakili sebatian X, sebatian Y dan sebatian Z?
Which of the following represent compound X, compound Y and compound Z ?

	Sebatian X *Compound X*	Sebatian Y *Compound Y*	Sebatian Z *Compound*
A	Etanol *Ethanol*	Asid propanoic *Propanoic acid*	Propil etanoat *Propyl ethanoate*
B	Etanol *Ethanol*	Asid propanoic *Propanoic acid*	Etil propanoat *Ethyl propanoate*
C	Propanol *Propanol*	Asid etanoik *Ethanoic acid*	Etil propanoat *Ethyl propanoate*
D	Propanol *Propanol*	Asid etanoik *Ethanoic acid*	Propil etanoat *Propyl ethanoate*

2.4 Isomer dan penamaan mengikut IUPAC

[Johor Bahru 2023-11] Antara yang berikut, pernyataan manakah yang betul tentang isomer?
Which of the following statements is correct about isomer?

A Takat lebur dan takat didih yang sama
Same melting and boiling point

B Sifat kimia yang berbeza
Different chemical properties

C Sifat fizik yang sama
Same physical properties

D Kumpulan berfungsi yang sama
Same functional group

[Selangaor2023 Set 01-36] Antara berikut, yang manakah isomer bagi butanol?
Which of the following are isomers of butanol?

I 2-metilpropan-l-ol
2-methylpropan-1-ol

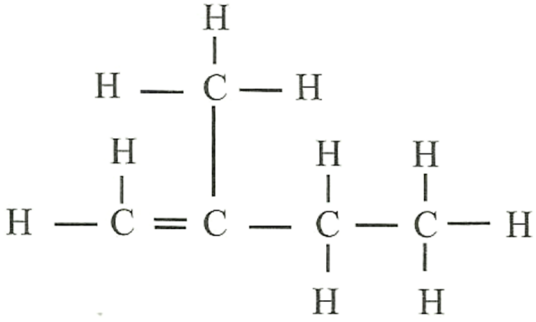
II Propan-2-ol
Propan-2-ol

III 2-metilpropan-2-ol
2-methylpropan-2-ol

IV 3-metilbutan-2-ol
3 -methylbutan-2-ol

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*

[Johor Skudai2023-36] Rajah 36 menunjukkan formula struktur suatu sebatian organik
Diagram 36 shows the structural formula of an organic compound.



Apakah nama IUPAC bagi sebatian organik itu?
What is the IUPAC name of the organic compound?

A 2-metilbut-1-ena
2-methylbut-l-ene

B 2-metilbut-2-ena
2-methylbut-2-ene

C 2-etilbut-3-ena
2-ethylbut-3-ene

D 3-metilbut-3-ena
3-methylbut-3-ene

[Johor Bahru 2023-26] Antara yang berikut, yang manakah isomer bagi butanol?
Which of the following is an isomer for butanol?

I Butan-l-ol
Butan-1-ol

II 2-metilpropan-l-ol
2-methylpropan-1-ol

III 2-metilpropan-3-ol
2-methylpropan-3-ol

IV 3-metilpropan-l-ol
3-methylpropan-1-ol

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

Bab 3 Termokimia

3.1 Perubahan haba dalam tindak balas

[Kedah2023-07] Contoh tindak balas endotermik adalah
Example of endothermic reaction is

A respirasi
respiration

B fotosintosis
photosynthesis

C pengaratan besi
rusting of iron

[MRSM2023-13] Antara yang berikut, yang manakah menyerap haba daripada persekitaran?
Which of the following reactions absorbs heat from the surroundings?

A $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$
B $HCl + NaOH \rightarrow NaCl + H_2O$
C $CaCO_3 \rightarrow CaO + CO_2$
D $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

[Selangor2023 Set 1-06] Antara pernyataan berikut, yang manakah benar tentang tindak balas eksotermik?
Which of the following statements is true about exothermic reactions?

A Menyebabkan suhu persekitarannya meningkat
Cause the temperature of the surroundings to increase

B Tindak balas yang menyerap tenaga haba dari persekitaran
Reactions that absorb heat energy from the surroundings

C Hasil tindak balas mengandungi lebih banyak tenaga berbanding dengan bahan tindak balas
The products contain more energy than the reactants

[Selangor2023 Set 1-24] Persamaan berikut menunjukkan tindak balas antara ion Ca^{2+} dan ion SO_4^{2-}.
The following equation shows the reaction between Ca^{2+} ion and SO_4^{2-} ion.

$$Ca^{2+} + SO_4^{2-} \rightarrow CaSO_4 \; ; \; \Delta H = -56 \text{ kJ mol}^{-1}$$

Antara pernyataan berikut, yang manakah benar tentang persamaan ini?
Which of the following statements is true about the equation?

A 56 kJ haba diserap apabila 1 mol kalsium sulfat dihasilkan
56 kJ of heat is absorbed when 1 mole of calcium sulphate is produced

B Haba dibebaskan ke persekitaran
Heat is released to the surroundings

C Tindak balas itu adalah endotermik
The reaction is endothermic

D Suhu persekitaran berkurang semasa tindak balas
The temperature of surroundings decreases during the reaction

[Selangaor2023 Set 01-06] Antara proses berikut, yang manakah endotermik?
Which of the following processes is endothermic?

A Melarutkan serbuk natrium hidroksida dalam air
Dissolving sodium hydroxide powder in water

B Melarutkan ammonium nitrat dalam air
Dissolving ammonium nitrate in water

C Menambahkan pita magnesium kepada asid sulfurik cair
Adding a magnesium ribbon to dilute sulphuric acid

D Menambahkan larutan natrium hidroksida kepada asid sulfurik cair
Adding sodium hydroxide solution to dilute sulphuric acid

[Selangaor2023 Set 01-24] Berikut menunjukkan persamaan termokimia suatu tindak balas kimia.
The following shows the thermochemical equation of a chemical reaction.

$$C + O_2 \rightarrow CO_2 \qquad \Delta H = -394 \text{ kJ mol}^{-1}$$

Antara pernyataan berikut, yang manakah benar tentang tindak balas tersebut?
Which of the following statements are true about the reaction?

I 394 kJ tenaga diserap apabila I mol karbon bertindak balas dengan 1 mol gas oksigen
394 kJ energy is absorbed when 1 mole of carbon reacts with 1 mole of oxygen gas

II Karbon dioksida mengandungi lebih banyak tenaga berbanding dengan karbon dan gas oksigen
Carbon dioxide contains more energy than carbon and oxygen gas

III Suhu persekitaran meningkat apabila tindak balas itu berlaku
The temperature of the surroundings increases when the reaction occurs

IV 197 kJ tenaga haba dibebaskan apabila 0.5 mol karbon dioksida dihasilkan
197 kJ heat energy is released when 0.5 mole of carbon dioxide is produced

A I dan II
I and 11

C II dan IV
II and IV

B I dan III
I and III

D III dan IV
III and IV

[Negeri Sembilan 2023-16] Persamaan termokimia berikut menunjukkan satu tindak balas kimia.
The following thermochemical equation shows a chemical reaction.

$$N_2 + O_2 \rightarrow 2NO \; ; \Delta H = + Y \text{ kJ mol}^{-1}$$

Antara yang berikut, aspek manakah yang mempunyai nilai yang lebih besar?
Which of the following aspects have a bigger value?

I Tenaga haba yang dibebaskan semasa pembentukan ikatan dalam hasil tindak balas
The heat energy released during the formation of bond in products

II Tenaga haba yang diserap untuk memutuskan ikatan dalam bahan tindak balas
The heat energy absorbed to break the bonds in the reactants

III Jumlah kandungan tenaga hasil tindak balas
The total energy content of the products

IV Suhu campuran
Temperature of mixture

A I dan II
I and II

C III dan IV
III and IV

B II dan III
II and III

D I dan IV
I and IV

[Kelantan 2023-15] Pernyataan yang manakah betul tentang tindak balas endotermik?
Which statement is correct about endothermic reaction?

A. Haba yang dibebaskan semasa pembentukan ikatan lebih rendah berbanding haba yang diserap semasa pemecahan ikatan.
The heat released during bond formation is lower than the heat absorbed during bond breaking.

B. Haba yang dibebaskan semasa pembentukan ikatan lebih tinggi berbanding haba yang diserap semasa pemecahan ikatan.
The heat released during bond formation is higher than the heat absorbed during bond breaking.

C. Haba yang dibebaskan semasa pembentukan ikatan sama dengan haba yang diserap semasa pemecahan ikatan.
The heat released during bond formation is equal to the heat absorbed during bond breaking.

[Pahang JUJ Set 1 2023-11] Jika tindak balas endotermik berlaku, suhu tindak balas akan
If endothermic reaction occurs, temperature of the reaction will

A menurun
decreases

B meningkat
increases

C tidak berubah
not change

D meningkat dan akhirnya menurun
increases and finally decreases

[Pahang JUJ Set 2 2023-10] Antara berikut, yang manakah benar tentang tindak balas endotermik?
Which of the following is true about an endothermic reaction?

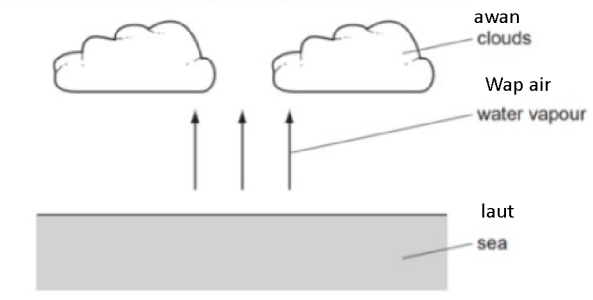
A Bekas menjadi semakin panas
The container becomes hot

B Nilai ΔH mempunyai tanda negatif
The value of ΔH has negative sign

C Jumlah kandungan tenaga dalam bahan tindak balas lebih tinggi daripada hasil tindak balas
The total energy content of reactants is higher than products

D Haba yang diserap untuk memutuskan ikatan lebih tinggi daripada haba yang dibebaskan semasa pembentukan ikatan baru
Heat absorbed to break the bonds is higher than the heat release during the formation of the new bond

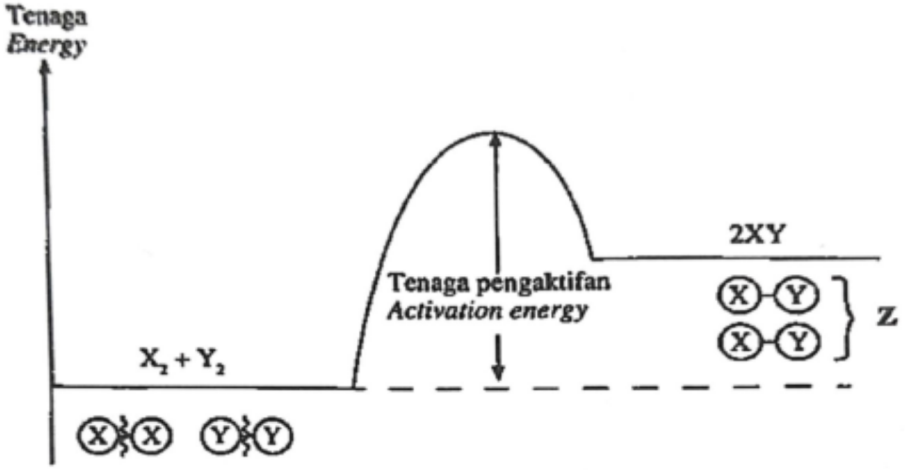
[Johor Skudai2023-26] Rajah 26 menunjukkan kejadian awan yang terbentuk apabila wap air tersejat dari laut.
Diagram 26 shows the formation of clouds when water vapour evaporates from the sea.



Apakah perubahan tenaga haba dan jenis tindak balas yang terlibat ketika air menyejat?
What is the heat energy change and the type of reaction occur when water evaporates?

	Perubahan tenaga haba ***Heat energy change***	**Jenis tindak balas** ***Type of reaction***
A.	Tenaga haba dibebaskan *Heat energy given out*	Endotermik *Endothermic*
B.	Tenaga haba dibebaskan *Heat energy given out*	Eksotermik *Exothermic*
C.	Tenaga haba diserap *Heat energy absorb*	Endotermik *Endothermic*
D.	Tenaga haba diserap *Heat energy absorb*	Eksotermik *Exothermic*

[Johor PPD Tangkak 2023 39] Rajah 21 menunjukkan gambar rajah pemutusan dan pembentukan ikatan dalam suatu tindak balas,
Diagram 21 shows the diagram of the breakage and formation of bonds in a reaction.



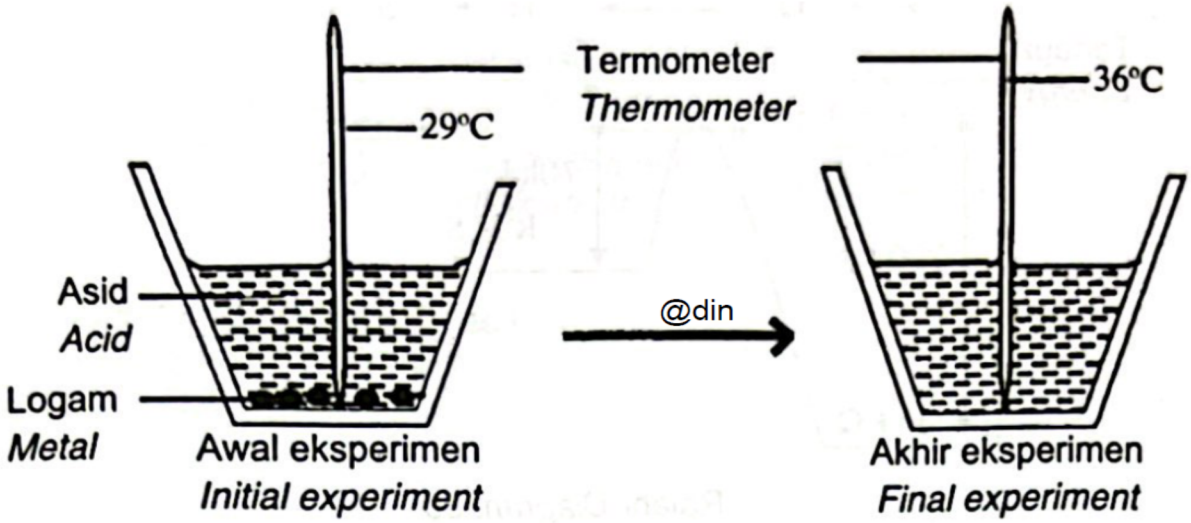
Jadual 6 menunjukkan aras tenaga bagi tiga ikatan kimia.
Table 6 shows the energy level of three chemical bonds.

Ikatan *Bond*	Tenaga ikatan (kJ mol^{-1}) *Bond energy (kJ mol^{-1})*
X – X	160
X – Y	201
Y – Y	204

Berdasarkan rajah 21 dan jadual 6, apakah nilai Z?
Based on diagram 21 and table 6, what is the value of Z?

A +38 kJ mol^{-1}
B −38 kJ mol^{-1}
C +163 kJ mol^{-1}
D −163 kJ mol^{-1}

[Terengganu2023-34] Rajah 34 menunjukkan susunan radas untuk menentukan haba tindak balas.
Diagram 34 shows the setup of apparatus for the determination of heat of reaction.



Antara pernyataan berikut manakah benar?
Which of the following statements is true?

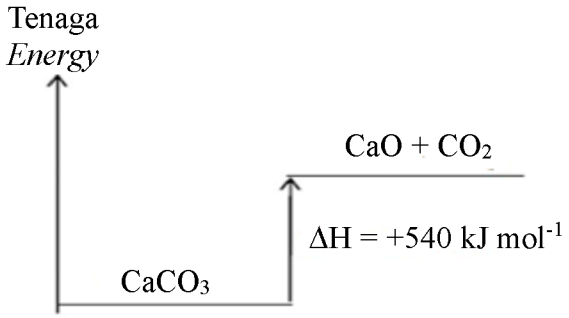
A Proses pemecahan ikatan berlaku.
The process of bond breaking occurs.

B Suhu meningkat semasa tindak balas berlaku.
The temperature increases during the reaction.

C Nilai AH dalam tindak balas ini adalah positif
The value of AH for the reaction is positive.

D Kandungan tenaga hasil tindak balas lebih tinggi daripada kandungan tenaga bahan tindak balas.
The energy content of the products is higher than the energy content of the reactants.

[Putrajaya2023-28] Rajah 10 menunjukkan gambar rajah aras tenaga bagi penguraian kalsium karbonat.
Diagram 10 shows an energy level diagram for the decomposition of calcium carbonate.



Penyataan manakah boleh dirumuskan daripada Rajah 10?
Which statement can be deduced from Diagram 10?

A Tindak balas eksotermik
Exothermic reaction

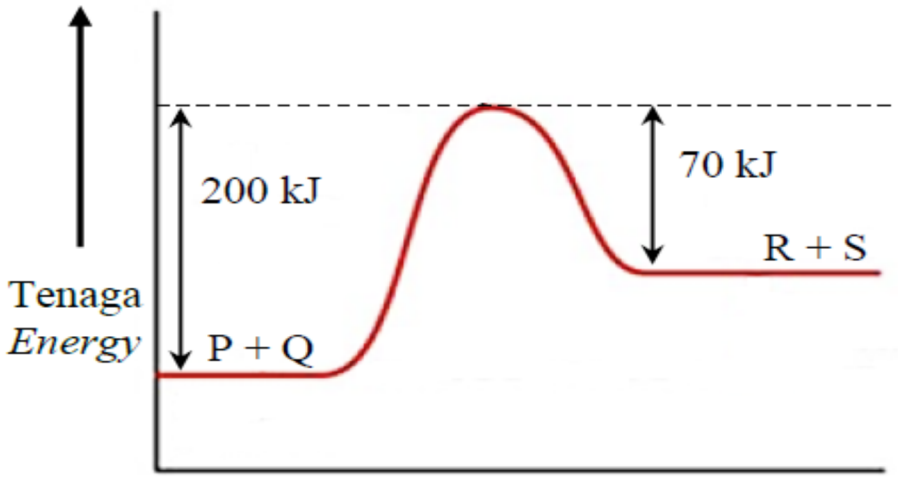
B Haba diserap dalam tindak balas itu
Heat is absorbed in the reaction

C Suhu campuran meningkat semasa tindak balas
Temperature of mixture increased during the reaction

D Bahan tindak balas mempunyai jumlah kandungan tenaga lebih tinggi daripada hasil tindak balas
The reactant has higher total energy content than the product

[Pahang 2023-30] Rajah 10 menunjukkan gambar rajah aras tenaga bagi tindak balas kimia berikut.
Diagram 10 shows the energy level diagram of the following chemical reaction.

$$P + Q \rightarrow R + S$$



Antara penyataan berikut, yang manakah benar?
Which of the following statement is true?

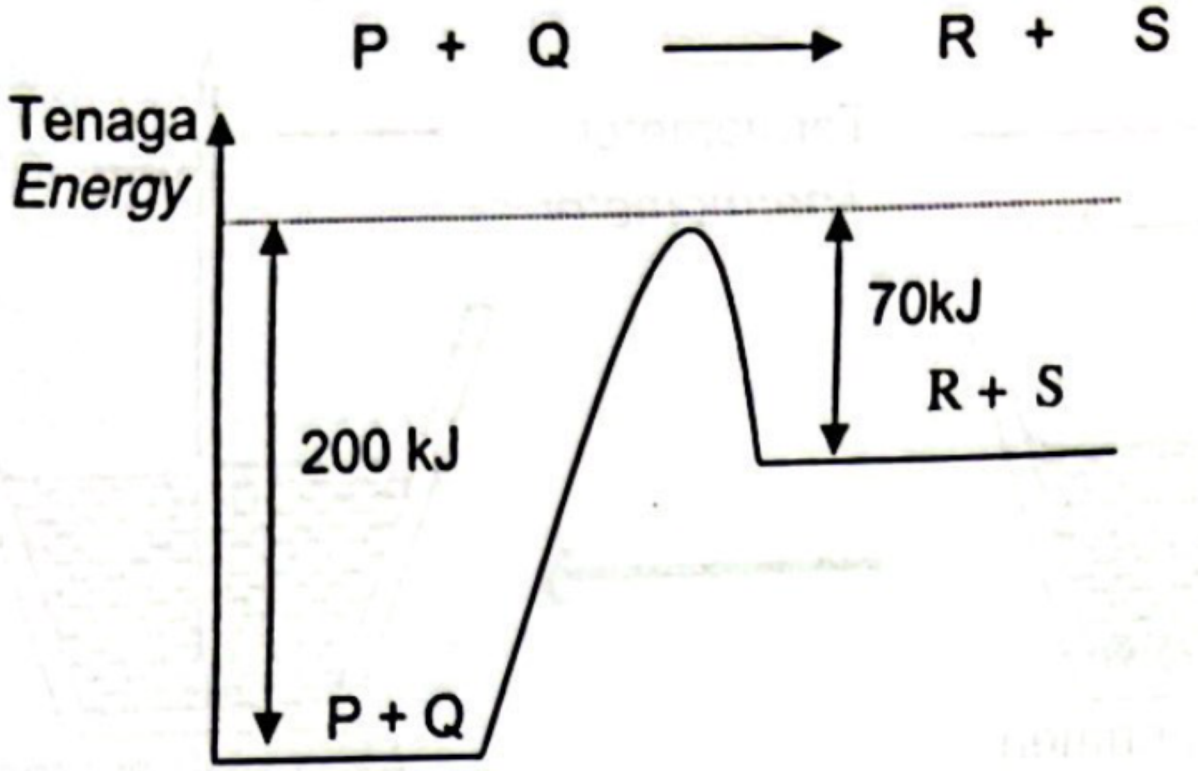
A Haba tindak balas ialah 70 kJ
The heat of reaction is 70 kJ

B R dan S adalah lebih stabil daripada P dan Q
R and S are more stable than P and Q

C Tenaga pengaktifan bagi tindak balas ialah 200 kJ
The activation energy of the reaction is 200 kJ

D Haba dibebaskan apabila P bertindak balas dengan Q untuk menghasilkan R dan S.
Heat is released when P reacts with Q to produce R and S

[Terengganu2023-35] Rajah 35 menunjukkan gambar rajah aras tenaga bagi tindak balas kimia berikut.
Diagram 35 shows the energy level diagram of the following chemical reaction.



Antara pernyataan berikut yang manakah benar?
Which of the following statements is true?

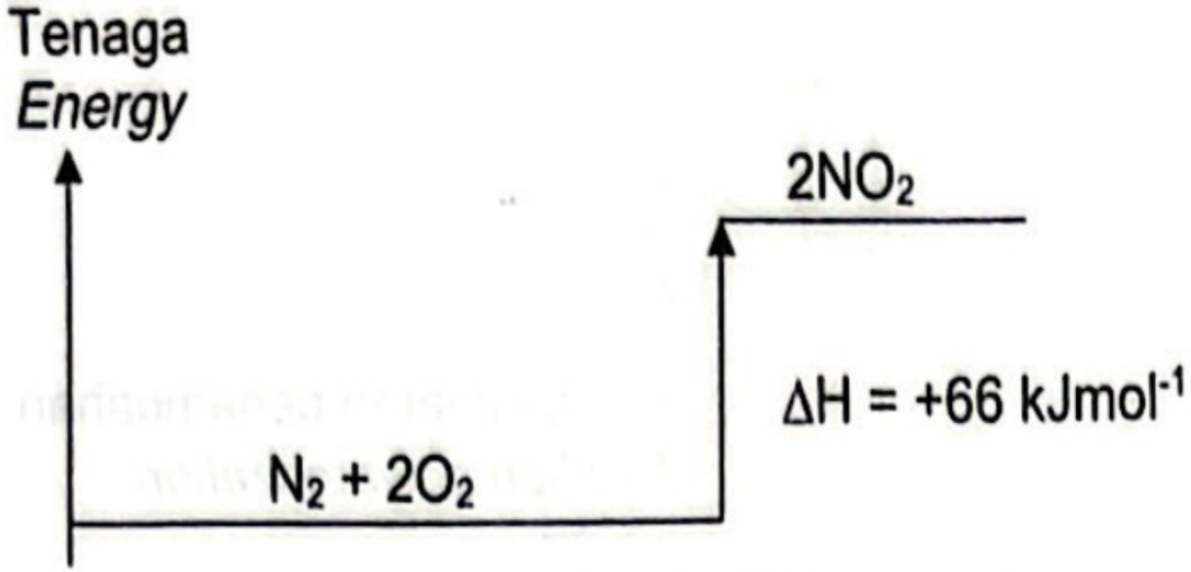
A Haba bagi tindak balas ialah 70 kJ.
The heat of reaction is 70 kJ

B R dan S adalah lebih stabil daripada P dan Q.
R and S are more stabil than P and Q.

C Tenaga pengaktifan bagi tindak balas adalah 200 kJ.
The activation energy is 200 kJ.

D Haba terbebas apabila P bertindak balas dengan Q untuk menghasilkan R dan S.
Heat is released when P reacts with Q to produce R and S.

[Terengganu2023-18] Rajah 18 ialah gambar rajah aras tenaga bagi satu tindak balas.
Diagram 18 is an energy level diagram of a reaction.



Apakah jenis tindak balas ini?
What is the type of reaction?

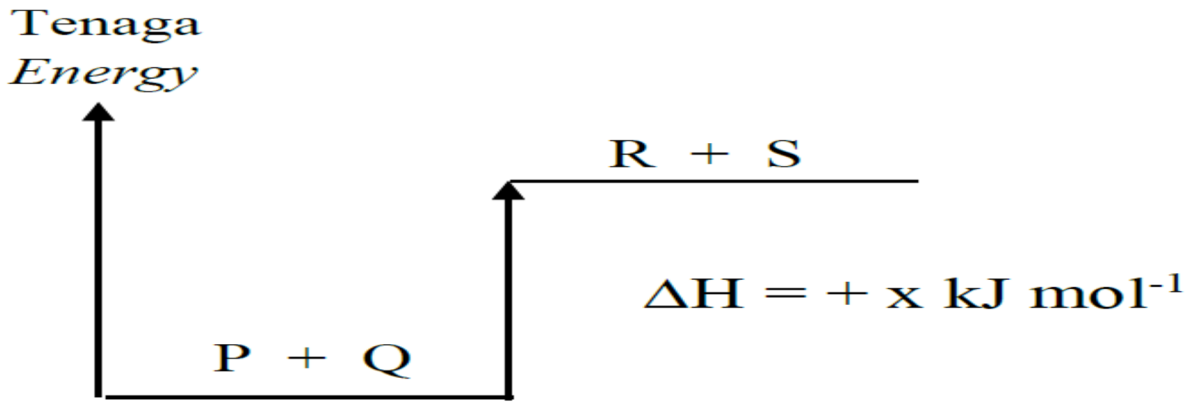
A Eksotermik
Exothermic

C Penurunan
Reduction

B Endotermik
Endothermic

D Penambahan
Addition

[Pahang JUJ Set 1 2023-30] Rajah 15 menunjukkan gambar rajah aras tenaga.
Diagram 15 is an energy level diagram.



Rajah 15
Diagram 15

Pernyataan manakah yang betul mengenai tindak balas di atas?
Which statement is correct about the above reaction?

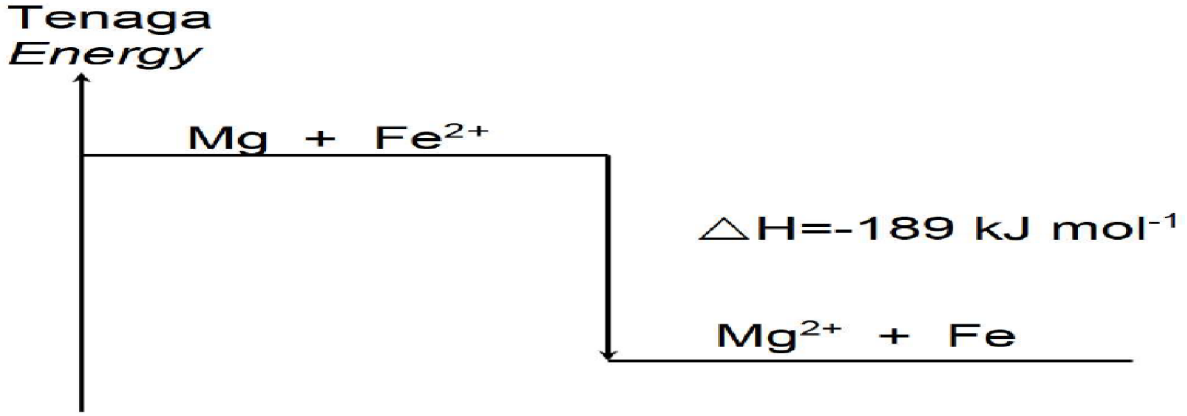
A Tiada haba diserap atau dibebaskan semasa pemutusan ikatan dan pembentukan ikatan.
No heat absorbed or released during the bond breaking and the bond formation.

B Haba yang diserap semasa pemutusan ikatan adalah sama dengan haba yang dibebaskan semasa pembentukan ikatan.
The heat absorbed during the bond breaking is equal to the heat released during the bond formation.

C Haba yang diserap semasa pemutusan ikatan adalah lebih tinggi daripada haba yang dibebaskan semasa pembentukan ikatan.
The heat absorbed during the bond breaking is higher than the heat released during the bond formation.

D Haba yang diserap semasa pemutusan ikatan adalah lebih rendah daripada haba yang dibebaskan semasa pembentukan ikatan.
The heat absorbed during the bond breaking is lower than heat released during the bond formation.

[Kelantan 2023-26] Rajah 10 menunjukkan aras tenaga bagi suatu tindak balas penyesaran.
Diagram 10 shows the energy levels for a displacement reaction.



Antara berikut, yang manakah benar tentang maklumat yang dapat diperolehi dari rajah aras tenaga tersebut.
Which of the following is true about the information that can be obtained from the energy level diagram.

I. Tindak balas adalah eksotermik
Exothermic reaction

II. Suhu menurun semasa tindak balas
The temperature decrease during reaction

III. Bekas campuran tindak balas semakin panas
The container of mixture become hot

IV. Haba diserap lebih banyak semasa pembentukan ikatan baru
Heat is absorbed more during the formation of new bonds

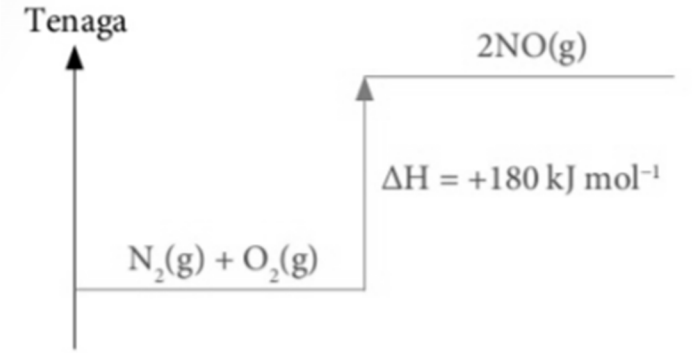
A. I dan II
I and II

C. II dan IV
II and IV

B. I dan III
I and III

D. III dan IV
III and IV

[Perlis 2023-31]



Rajah 9 menunjukkan gambarajah aras tenaga. Manakah antara berikut menerangkan tindak balas dalam Rajah 9?
Diagram 9 shows an energy level diagram. Which of the following explain the reaction in Diagram 9?

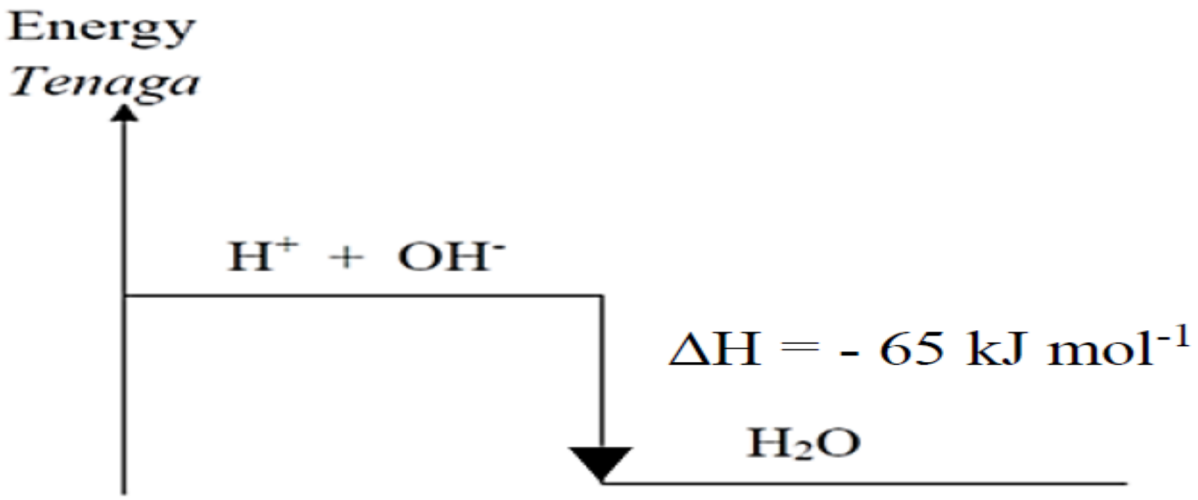
A Tindak balas endotermik
Endothermic reaction

C Suhu meningkat
Temperature increase

B Tindak balas eksotermik
Exothermic reaction

D Haba dibebaskan
Heat released

[Pahang JUJ Set 2 2023-15] Rajah 1 menunjukkan satu rajah aras tenaga.
Diagram 1 shows an energy level diagram.



Rajah 1/ Diagram 1

Pernyataan manakah yang betul tentang rajah aras tenaga itu?
Which statement is correct about the energy level diagram?

A 65 kJ tenaga diperlukan untuk tindak balas itu.
65 kJ of energy is needed for the reaction.

B Haba peneutralan ialah - 65 kJ mol^{-1}.
The heat of neutralization is - 65 kJ mol^{-1}.

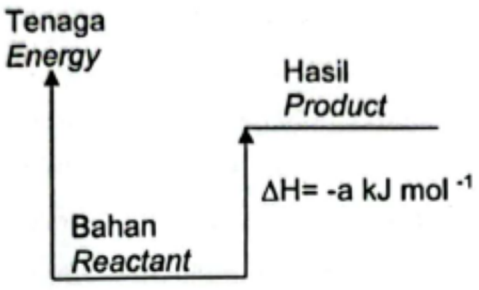
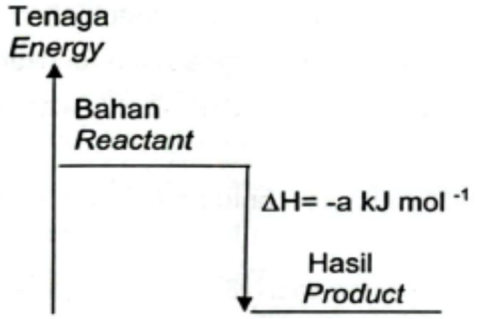
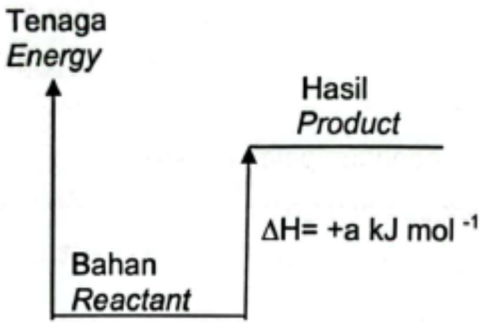
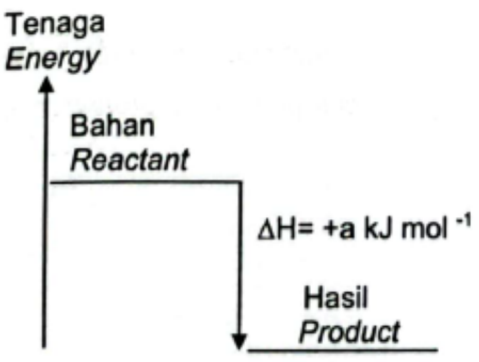
C Hasil tindak balas mengandungi lebih tenaga berbanding bahan tindak balas.
The products of reaction contain more energy than the reactants.

D Suhu pada akhir tindak balas adalah lebih rendah berbanding pada awal tindak balas.
The temperature at the end of the reaction is lower than that at the beginning of the reaction.

[Kedah2023-28] Artikel berikut mengenai suatu tindak balas.
The following article is about a reaction

> **Tindak balas kimia yang berlaku antara simen dan air dipanggil penghidratan simen. Percampuran simen dengan air akan menghasilkan pembebasan haba yang cepat selama beberapa minit.**
> *The chemical reaction that occurs between the cement and water is called cement hydration. The mixing of cement with water will result in rapid liberation of heat for few minutes.*

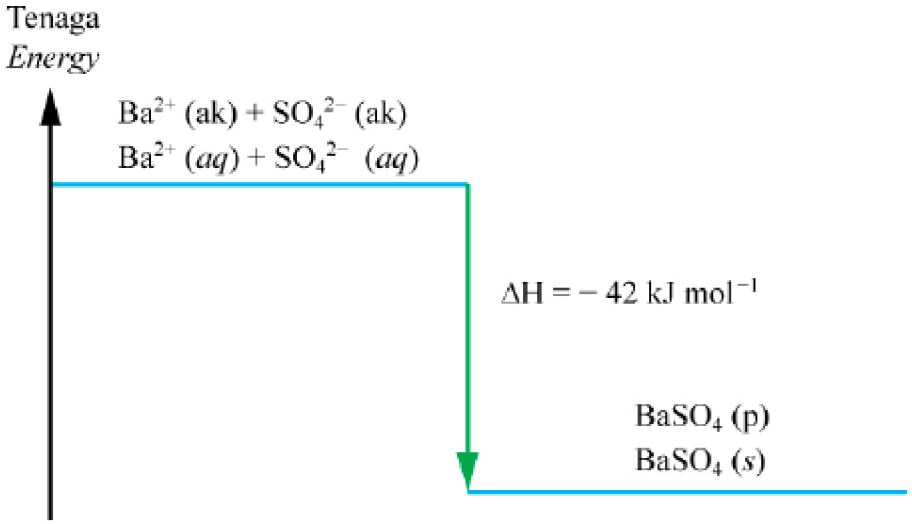
Gambar rajah aras tenaga yang manakah betul bagi tindak balas itu ?
Which energy level diagram Is correct for the reaction?

<table>
<tr>
<td>A</td>
<td> 
</td>
<td>C</td>
<td> 
</td>
</tr>
<tr>
<td>B</td>
<td> 
</td>
<td>D</td>
<td> 
</td>
</tr>
</table>

3.2 Haba tindak balas

Pemendakan

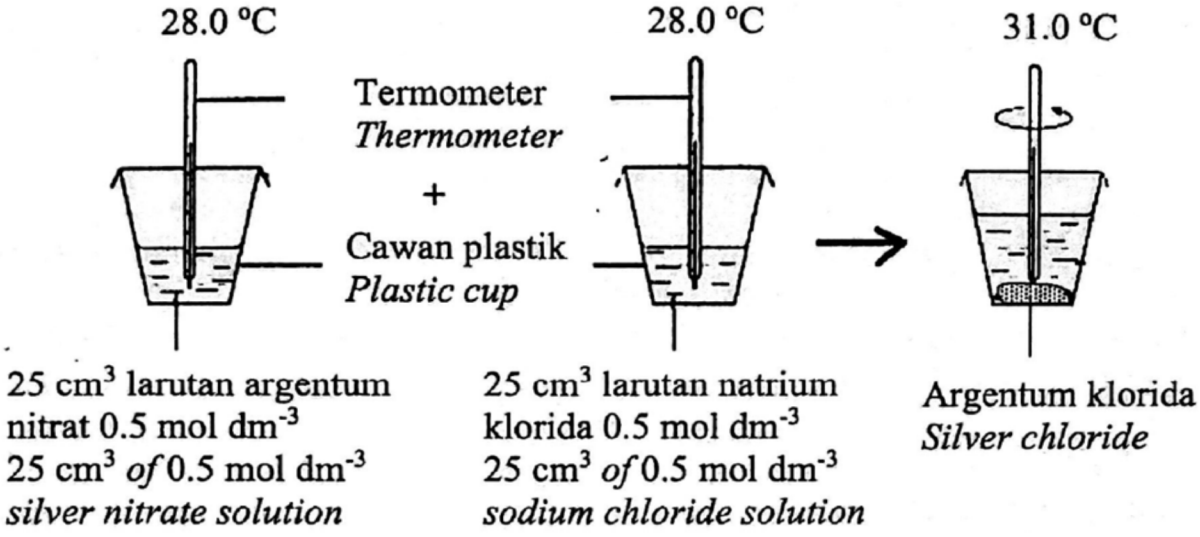
[Selangaor2023 Set 01-32] Rajah 10 menunjukkan aras tenaga bagi tindak balas pemendakan barium sulfat.
Diagram 10 shows energy level for the precipitation reaction of barium sulphate.



Berapakah haba yang dibebaskan apabila 48 g barium sulfat terbentuk?
[Jisim atom relatif: Ba = 137, S = 32, O = 16]
What is the heat released when 48 g of barium sulphate is formed]
[Relative atomic mass: Ba = 137, S = 32, 0=16]

A 0.865 kJ B 86.5 kJ C 865 kJ D 8.65 kJ

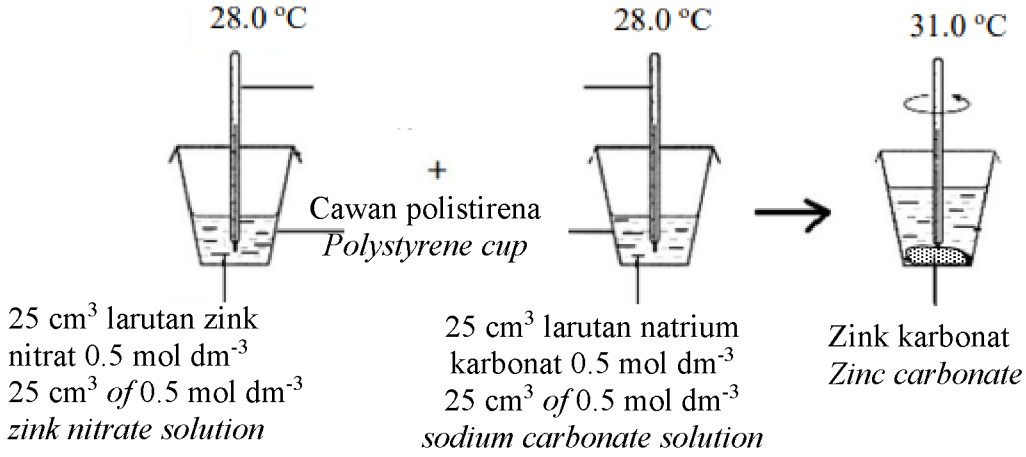
[Johor PPD Tangkak 2023 37] Rajah 19 menunjukkan susunan radas untuk menentukan haba pemendakan argentum klorida.
Diagram 19 shows the apparatus set-up to determine the heat of precipitation of silver chloride.



Berapakah haba pemendakan argentum klorida?
[Muatan haba tentu larutan = 4.2 J g^{-1} $°C^{-1}$; Ketumpatan larutan = 1 g cm^{-3}]
What is the heat of precipitation of silver chloride?
[Specific heat capacity of solution = 4.2 J g^{-1} $°C^{-1}$, Density of solution= 1 g cm^{-3}]

A – 6.3 kJ mol^{-1}
B – 12.6 kJ mol^{-1}
C – 25.2 kJ mol^{-1}
D – 50.4 kJ mol^{-1}

[Putrajaya2023-38] Rajah 16 menunjukkan susunan radas untuk menentukan haba pemendakan zink karbonat
Diagram 16 shows the apparatus set-up to determine the heat of precipitation zinc carbonate.



Berapakah haba pemendakan zink karbonat?
[Muatan haba tentu larutan = 4.2 J g^{-1} $°C^{-1}$; Ketumpatan larutan = 1 g cm^{-3}]
What is the heat of precipitation of zinc carbonate?
[Specific heat capacity of solution = 4.2 J g^{-1} $°C^{-1}$;
Density of solution = 1 g cm^{-3}]

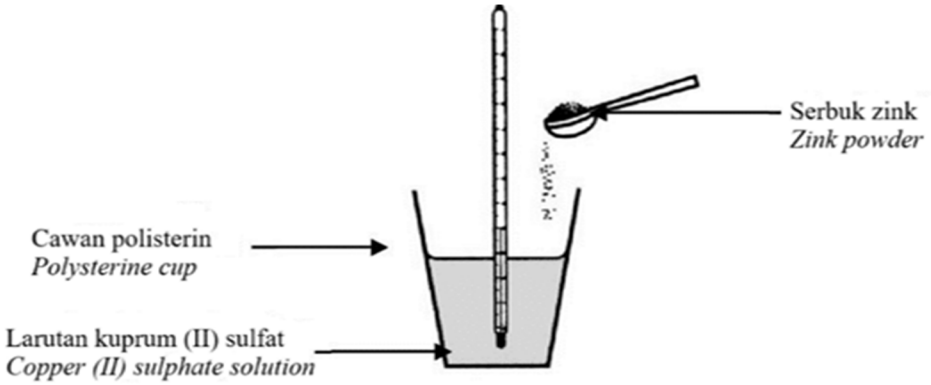
A – 6.3 kJ mol^{-1}
B – 6.3 kJ mol^{-1}
C – 50.4 kJ mol^{-1}
D – 25.2 kJ mol^{-1}

[MRSM2023-29] 100 cm^3 larutan plumbum(II) nitrat 1.0 mol dm^{-3} ditambahkan kepada 100 cm^3 larutan kalium sulfat 1.0 mol dm^{-3} di dalam sebuah cawan plastik. Perubahan suhu ialah 5.0 °C. Eksperimen diulang dengan menggunakan 100 cm^3 larutan plumbum(II) nitrat 1.0 mol dm^{-3} dan 100 cm^3 larutan natrium sulfat 1.0 mol dm^{-3}. Berapakah perubahan suhu untuk tindak balas ini?
100 cm^3 of 1.0 mol dm^{-3} lead(II) nitrate solution was added to 100 cm^3 of 1.0 mol dm^{-3} potassium sulphate solution in a plastic cup. The temperature change is 5.0 °C. The experiment is repeated by using 100 cm^3 of 1.0 mol dm^{-3} lead(II) nitrate solution and 100 cm^3 of 1.0 mol dm^{-3} sodium sulphate solution. What is the change in temperature of the reaction?

A 2.5 °C B 5.0 °C C 7.5 °C D 10.0 °C

Penyesaran

[Perlis 2023-24] Rajah 5 menunjukkan tindak balas antara serbuk zink dan larutan kuprum(II) sulfat.
Diagram 5 shows reaction between zinc powder and copper(II) sulphate solution.



Antara yang berikut, yang manakah menerangkan tindak balas di atas?
Which of the following explained about the reaction?

A Perubahan haba apabila 1 mol halogen disesarkan oleh larutan halidanya.
Heat changes when 1 mol of halogen is displaced from its salt solution.

B Perubahan haba apabila 1 mol ion dihasilkan daripada logamnya.
Heat changes when 1 mol of ion is produced from its metal.

C Perubahan haba apabila 1 mol logam disesarkan daripada larutan garamnya.
Heat changes when 1 mol of metal is displaced from its salt solution.

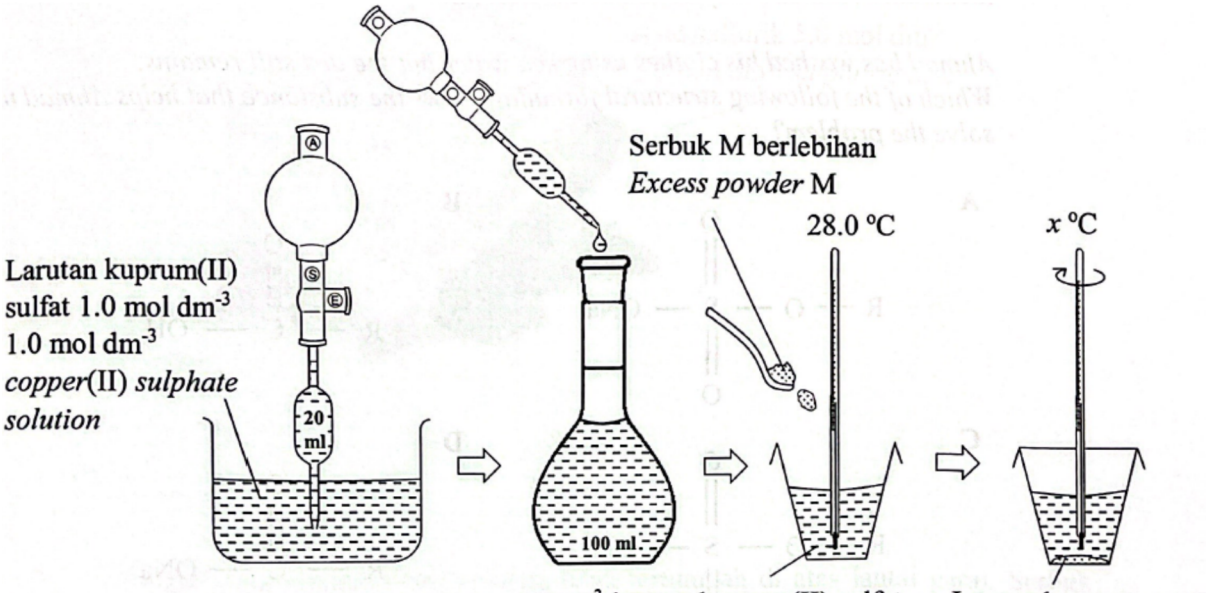
[Pahang 2023-33] Persamaan termokimia berikut menunjukkan tindak balas antara magnesium dan larutan kuprum(II) sulfat.
The following thermochemical equation shows the reaction between magnesium and copper(II) sulphate solution.

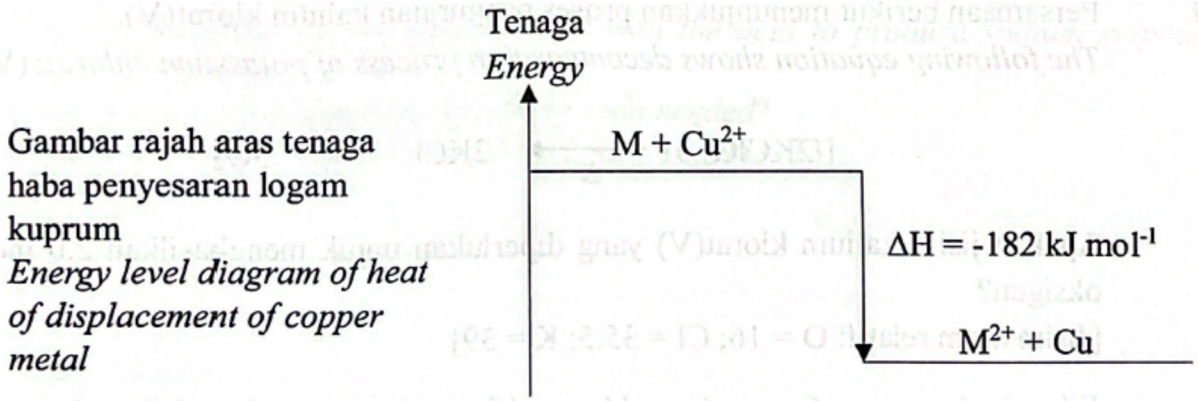
$$Mg + CuSO_4 \rightarrow MgSO_4 + Cu \; ; \Delta H = -630 \text{ kJ mol}^{-1}$$

Hitung perubahan suhu apabila 100 cm^3 larutan kuprum(II) sulfat 0.1 mol dm^{-3} bertindak balas dengan serbuk magnesium berlebihan.
[Muatan haba tentu larutan = 4.2 J g^{-1} °C^{-1}]
Calculate the temperature change when 100 cm^3 of 0.1 mol dm-3 copper(II) sulphate solution reacts with excess magnesium powder.
[Specific heat capacity of solution = 4.2 J g^{-1} °C^{-1}]

A 10 °C B 12 °C C 15 °C D 17 °C

[Negeri Sembilan 2023-32] Rajah 10 menunjukkan langkah-langkah untuk menentukan haba penyesaran logam kuprum daripada larutan garamnya oleh logam M berserta dengan gambar rajah aras tenaganya.
Diagram 10 shows the steps to determine the heat of displacement of copper metal from its salt solution by metal M with its energy level diagram.





Gambar rajah aras tenaga haba penyesaran logam kuprum
Energy level diagram of heat of displacement of copper metal

Apakah nilai x? [Muatan haba tentu air, c = 4.2 J g^{-1} $°C^{-1}$]
What is value of x? [Specific heat capacity of water, c = 4.2 J g^{-1} $°C^{-1}$]

A 31.5 °C B 36.7 °C C 43.3 °C D 45.4 °C

[Negeri Sembilan 2023-18] Seorang pelajar menambahkan sekeping zink ke dalam bikar yang berisi larutan kuprum(II) sulfat. Dia menyentuh bikar tersebut dan berasa panas.
A student adds a piece of zinc into a beaker containing copper(II) sulphate solution. He touches the beaker andfeels warm.

Diberi sebahagian nilai keupayaan elektod piawai, E°
Given a part of the standard electrode potential, E°

Tindak balas sel setengah *Half -cell equation*	E° / V
Zn^{2+} + 2e → Zn	-0.76
Sn^{2+} + 2e →Sn	-0.14
Cu^{2+} + 2e →Cu	+ 0.34
Ag+ + e → Ag	+ 0.80

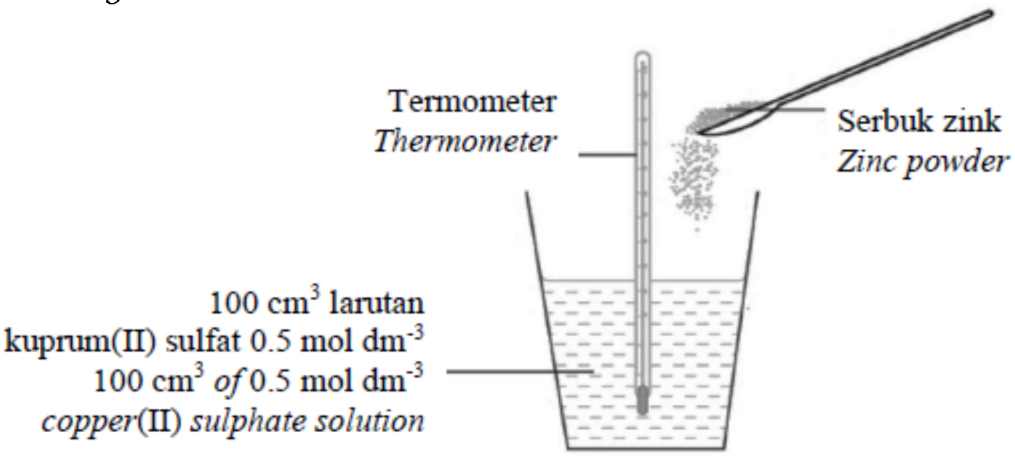
Antara yang berikut, logam manakah yang akan menghasilkan pemerhatian yang sama apabila ditambah kepada larutan kuprum(II) sulfat?
Which of the following metal will produce similar observation when added to copper(II) sulphate solution?

A Stanum
Tin

B Kuprum
Copper

C Argentum
Silver

[MRSM2023-39] Rajah 16 menunjukkan susunan radas dan pemerhatian bagi satu aktiviti yang dilakukan oleh seorang murid.
Diagram 16 shows the apparatus set up and observation for an activity carried out by a student.



Perubahan suhu/ *Temperature change*	T °C
Haba tindak balas, ΔH/ *Heat of reaction, ΔH*	- 210 kJ mol^{-1}

Aktiviti tersebut diulang dengan mengubah isipadu dan kepekatan larutan kuprum(II) sulfat bagi mendapatkan perubahan suhu sebanyak dua kali ganda, 2T °C dari aktiviti pertama.
The activity is repeated by changing the volume and concentration of copper(II) sulphate solution to obtain two times of temperature change, 2T °C from the first activity.

Manakah antara berikut merupakan isipadu dan kepekatan yang digunakan dalam aktiviti kedua?
Which of the following is the correct volume and concentration used for the second activity?

	Isipadu (cm^3) *Volume (cm^3)*	Kepekatan (mol dm^{-3}) *Concentration (mol dm^{-3})*
A	100	2.0
B	50	1.0
C	100	0.5
D	50	0.25

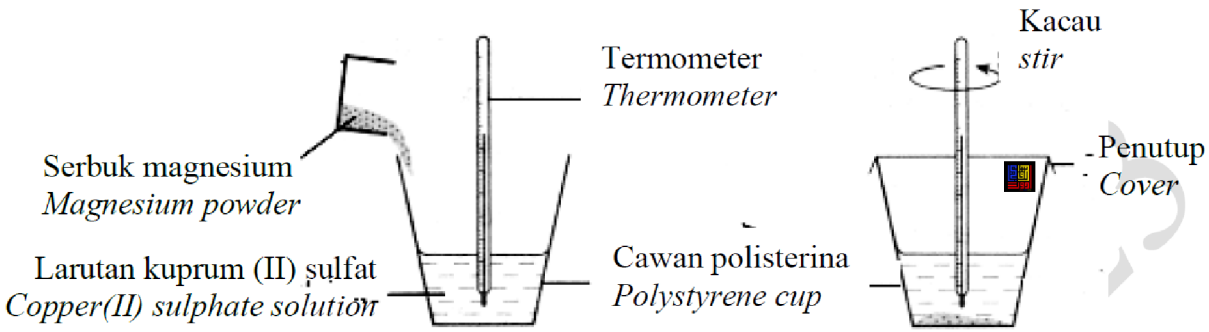
[Melaka 2023-28] Persamaan kimia berikut mewakili tindak balas penyesaran kuprum daripada larutan garamnya.
The following chemical equation represents the displacement reaction of copper from its salt solution.

$$Zn + Cu(NO_3)_2 \rightarrow Zn(NO_3)_2 + Cu$$

Apabila serbuk zink berlebihan ditambahkan ke dalam 50 cm^3 larutan kuprum(II) nitrat 0.1 mol dm^{-3}, suhu campuran meningkat daripada 28.0°C kepada 40.0°C. Berapakah haba penyesaran bagi kuprum?
When excess zinc powder is added into 50 cm^3 of 0.1 mol dm^{-3} of copper(II) sulphate solution, the temperature of the mixture increases from 28.0°C to 40.0°C. What is the heat of displacement of copper?
[Muatan haba tentu larutan = 4.2 J g^{-1} $°C^{-1}$, ketumpatan larutan = 1 g cm^{-3}]
[Specific heat capacity of solution = 4.2 J g^{-1} $°C^{-1}$, density of solution = 1 g cm^{-3}]

A -504 kJ mol^{-1}
B -252 kJ mol^{-1}
C -5.04 kJ mol^{-1}
D -2.52 kJ mol^{-1}

[Pahang JUJ Set 1 2023-33] Rajah 16 menunjukkan bacaan termometer apabila serbuk magnesium berlebihan ditambah kepada 50 cm^3 larutan kuprum(II) sulfat 0.5 mol dm^{-3} dalam cawan polisterina.
Diagram 16 shows the thermometer readings when excess magnesium powder is added to 50cm^3 of 0.5 mo ldm^{-3} copper(II) sulphate solution in a polystyrene cup.

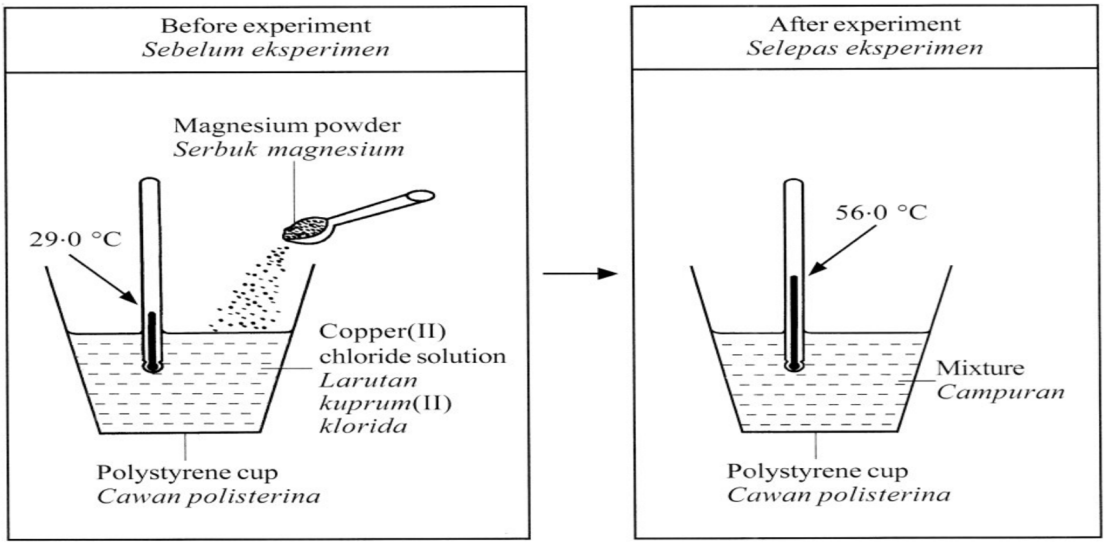


Suhu awal : 28.0°C Initial termperature : 28.0°C	Suhu tertinggi : 36.0°C Highest temperature :36.0°C

Berapakah haba penyesaran bagi tindak balas ini?
[Muatan haba tentu larutan = 4.2 J g^{-1} $°C^{-1}$, ketumpatan air = 1.0 g cm^{-3}]
What is the heat of displacement for the reaction?
[Specific heat capacity of a solution = 4.2 J g^{-1} $°C^{-1}$, Density of water = 1.0 g cm^{-3}]

A – 3.36 kJ mol^{-1}
B – 67.2 kJmol^{-1}
C – 3360 kJmol^{-1}
D – 6720 kJmol^{-1}

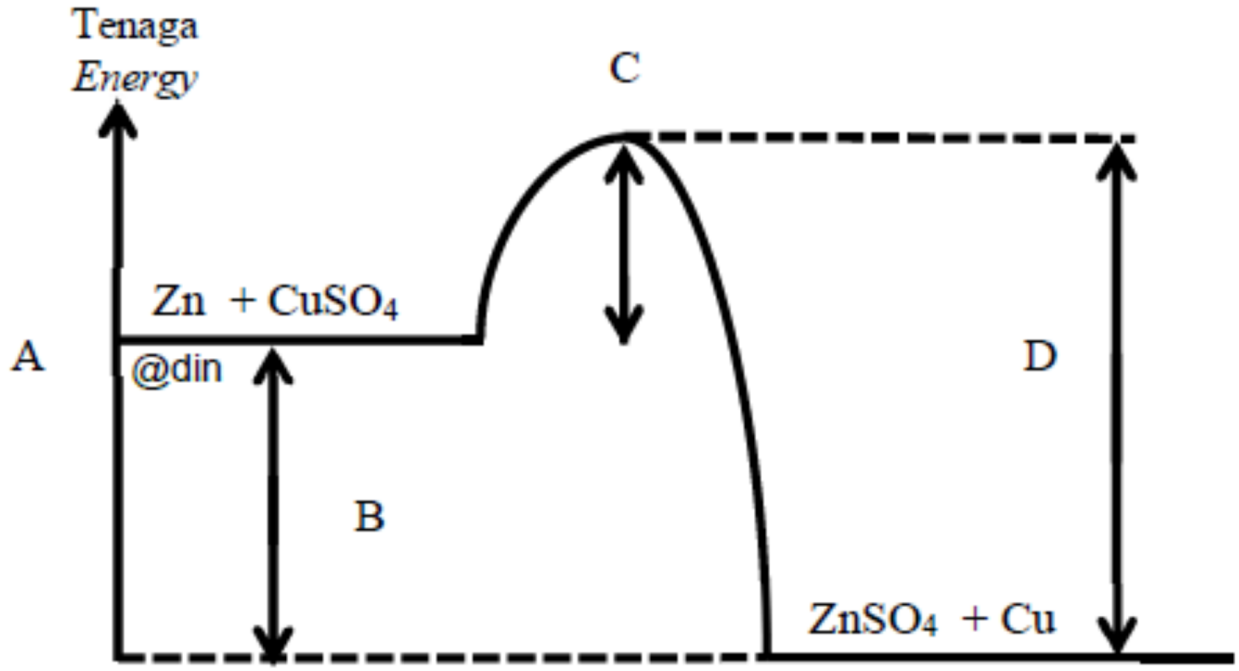
[Johor Skudai2023-38] Rajah 38 menunjukkan bacaan termometer apabila serbuk magnesium berlebihan ditambah kepada 50 cm^3 larutan kuprum(II) nitrat 0.5 mol dm^{-3} dalam suatu cawan polistirena.
Diagram 38 shows the thermometer readings when excess magnesium powder is added into 50 cm^3 of 0.5 mol dm^{-3} copper(II) nitrate solution in a polystyrene cup



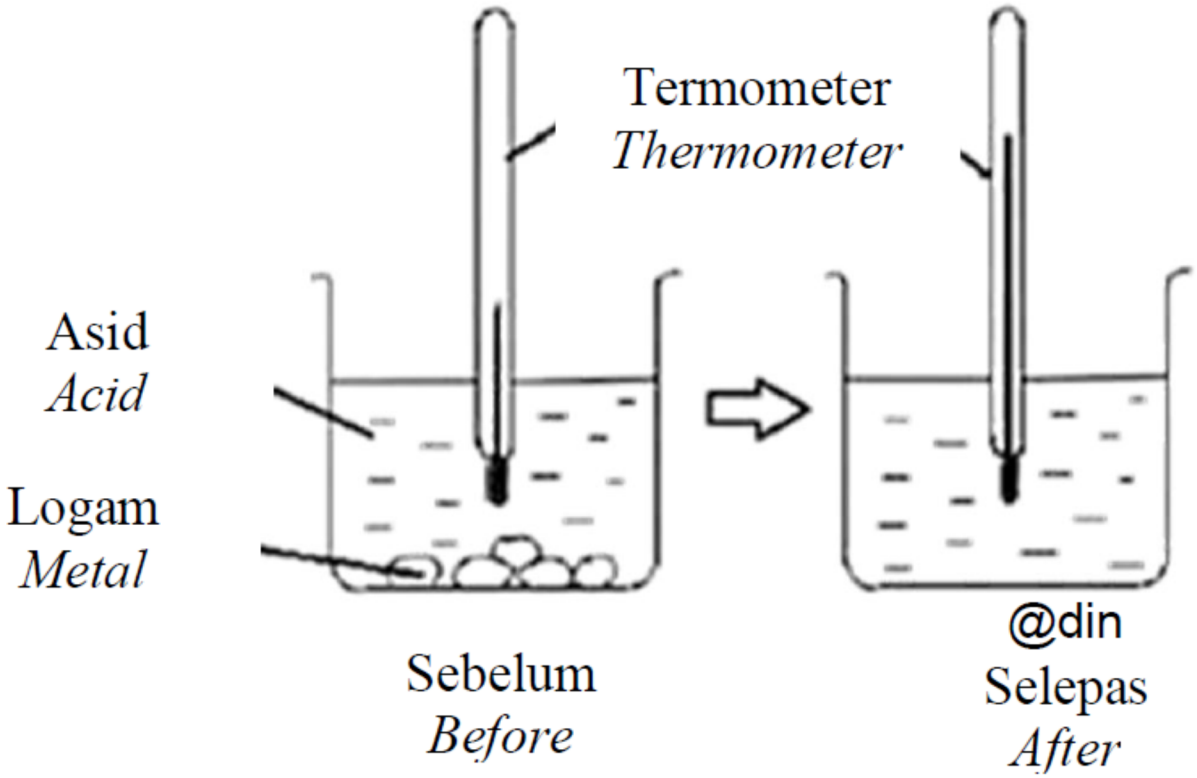
Berapakah haba penyesaran bagi tindak balas ini?
What is the heat of displacement for the reaction?
[Muatan haba tentu air = 4.2 J g^{-1} $°C^{-1}$; Ketumpatan air = 1.0 g cm^{-3}]
[*Specific heat of capacity* = 4.2 J g^{-1} $°C^{-1}$ *; Density of water* = 1.0 g cm^{-3}]

A - 226.8 kJ mol^{-1}
B - 243.6 kJ mol^{-1}
C - 470.4 kJ mol^{-1}
D - 5670.0 kJ mol^{-1}

[Johor PPD Tangkak 2023 26] Manakah antara A, B, C dan D, mewakili nilai haba penyesaran bagi tindak balas ini?
Among A, B, C and D, which represents the value of heat of displacement for this reaction?



[Johor PPD Tangkak 2023 25] Rajah 12 menunjukkan pemerhatian bagi satu tindak balas.
Diagram 12 shows the observation of a reaction.



Antara pernyataan berikut, maklumat manakah yang betul bagi tindak balas itu?
Which of the following information are correct about the reaction?

I Bekas menjadi sejuk
Container becomes cold.

II Haba diserap dari persekitaran.
Heat is absorbed from surrounding.

III Nilai ΔH bagi tindak balas ini adalah negatif
The value of ΔH in the reaction is negative.

IV Jumlah kandungan tenaga bahan tidak balas adalah lebih tinggi berbanding jumlah kandungan tenaga hasil tindak balas.
The total energy content of the reactants is higher than the energy content of the products.

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

Peneutaralan

[Johor Bahru 2023-10] Apakah yang dimaksudkan dengan haba peneutralan?
What is the meaning of heat of neutralisation?

A Perubahan haba apabila asid bertindak balas dengan alkali
Heat change when acid reacts with alkali

B Perubahan haba apabila satu mol asid bertindak balas dengan satu mol alkali
Heat change when one mole of acid reacts with one mole of alkali

C Perubahan haba apabila air terbentuk daripada tindak balas antara asid dan alkali
Heat change when water is formed from the reaction between an acid and an alkali

D Perubahan haba apabila satu mol air terbentuk daripada tindak balas antara asid dan alkali
Heat change when one mole of water is formedfrom the reaction between an acid and an alkali

[Terengganu2023-17] Rajah 17 menunjukkan persamaan termokimia bagi asid dan alkali adalah seperti di bawah:
Diagram 17 show the thermochemical equation of acids and alkalis are given as below.

$HCl + NaOH \rightarrow NaCl + H_2O$; $\Delta H = -57$ kJ mol^{-1}

$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$; $\Delta H = -55$ kJ mol^{-1}

Rajah/ Diagram 17

Haba peneutralan bagi HCI adalah lebih tinggi kerana
Heat of neutralisation of HCI is higher because

A HCI adalah asid kuat
HCI is a strong acid

B HCI adalah asid monoprotik
HCI is monoprotic acid

C CH_3COOH adalah asid kuat
CH_3COOH is strong acid

D CH_3COOH adalah asid diprotik
CH_3COOH is diprotic acid

[SBP2023-28] Jadual 1 menunjukkan haba peneutralan bagi dua tindak balas kimia.
Table 1 shows the heat ofnetitralisation of two chemical reactions.

Tindak balas *Reaction*	Bahan tindak balas *Reactants*	Haba peneutralan *Heat of neutralisation* (kJ mol^{-1})
I	HCl + NaOH	-57.3
II	CH_3COOH + NaOH	-55.0

Antara yang berikut, pernyataan manakah yang paling tepat menerangkan mengapa nilai haba peneutralan bagi tindak balas I dan II berbeza?
Which of the following statements is the best to explain why the value of heat of neutralisation for reactions I and II are different?

A Semua tenaga haba terbebas dalam tindak balas I manakala sebahagian tenaga haba yang terbebas diserap semula dalam tindak balas II
All heat energy is released in reaction I while some of the heat energy released is reabsorbed in reaction II

B HC1 mengion sepenuhnya dalam air tetapi CH_3COOH mengion separa dalam air
HC1 is completely ionise in water but CH_3COOH is partially ionise in water

C Kepekatan ion hidrogen dalam HC1 lebih tinggi daripada CH_3COOH
The concentration of hydrogen ion in HC1 is higher than CH_3COOH

D HC1 ialah asid kuat tetapi CH_3COOH ialah asid lemah
HC1 is strong acid but CH_3COOH is weak acid

[Putrajaya2023-13] Antara yang berikut, persamaan kimia yang manakah mewakili tindak balas yang menghasilkan haba yang paling tinggi?
Which of the following chemical equation represents the reaction that produces the highest heat?

A $HCl + KOH \rightarrow KCl + H_2O$
B $HCl + NH_4OH \rightarrow NH4\ Cl + H_2O$
C $H_2SO_4 + 2KOH \rightarrow K2\ SO_4 + 2H_2O$
D $H_2SO_4 + 2NH_4OH \rightarrow (NH_4)_2SO_4 + 2H_2O$

[Kedah2023-18] Manakah antara tindak balas peneutralan berikut membebaskan kuantiti haba paling rendah?
Which of the following neutralisation reaction releases lowest amount of heat ?

A Asid sulfurik dan kalium hidroksida
Sulphuric acid and potassium hydroxide

B Asid sulfurik dan ammonia
Sulphuric acid and ammonia

C Asid propanoik dan kalium hidroksida
Propanoic acid and potassium hydroxide

D Asid propanoik dan ammonia
Propanoic acid and ammonia

[Pahang 2023-40] Jadual 4 menunjukkan haba peneutralan bagi pelbagai tindak balas peneutralan.
Table 4 shows the heat of neutralisation of various neutralisation reactions.
Eksperimen

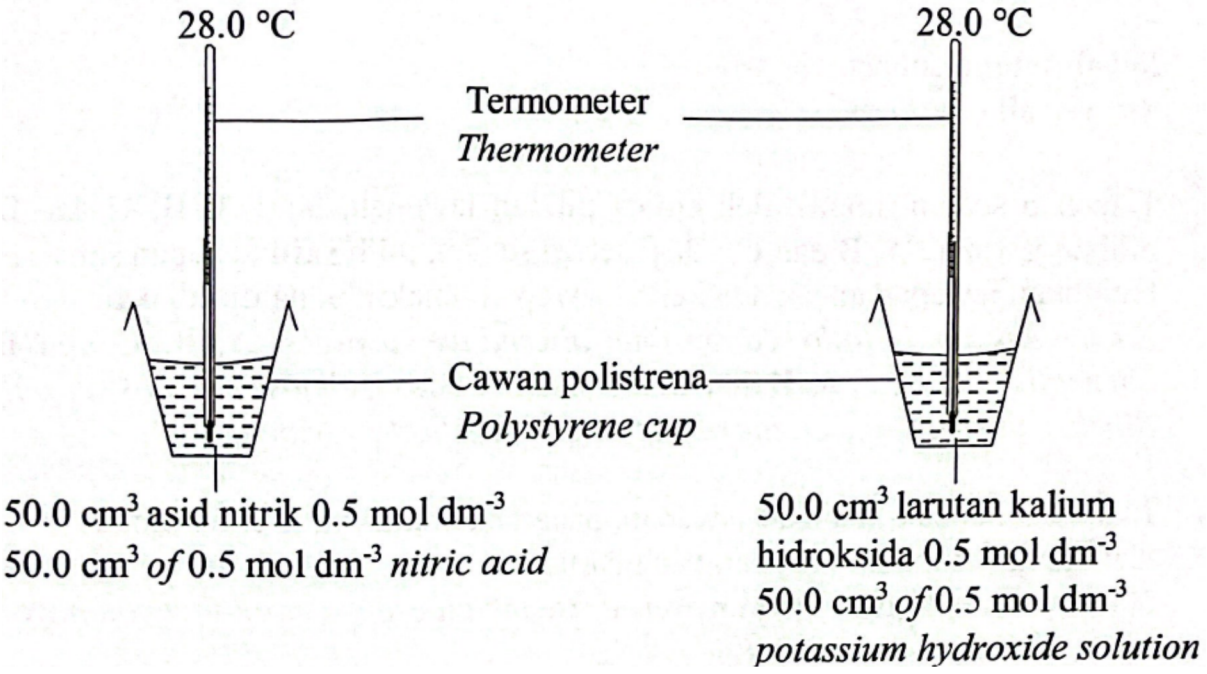
Experiment	Bahan tindak balas *Reactants*	Haba peneutralan, ΔH (kJ mol^{-1}) *Heat of neutralisation, ΔH (kJ mol^{-1})*
I	50 cm^3 asid R 1.0 mol dm^{-3} + 50 cm^3 alkali S 1.0 mol dm^{-3} *50 cm^3 of 1.0 mol dm^{-3} of acid R +* *50 cm^3 of 1.0 mol dm^{-3} of alkali S*	-57

II	50 cm^3 asid T 1.0 mol dm^{-3} + 50 cm^3 alkali S 1.0 mol dm^{-3} *50 cm^3 of 1.0 mol dm^{-3} of acid T +* *50 cm^3 of 1.0 mol dm^{-3} of alkali S*	-55
III	50 cm^3 asid R 1.0 mol dm^{-3} + 50 cm^3 alkali U 1.0 mol dm^{-3} *50 cm^3 of 1.0 mol dm^{-3} of acid R +* *50 cm^3 of 1.0 mol dm^{-3} of alkali U*	-52
IV	50 cm3 asid T 1.0 mol dm-3 + 50 cm3 alkali U 1.0 mol dm-3 *50 cm3 of 1.0 mol dm-3 of acid T +* *50 cm3 of 1.0 mol dm-3 of alkali U*	-50

Antara berikut, yang manakah asid dan alkali yang betul digunakan untuk empat eksperimen tersebut?
Which of the following is the correct acid and alkali used for the four experiments?

	Asid R *Acid R*	Alkali S *Alkali S*	Asid T *Acid T*	Alkali U *Alkali U*
A	NaOH	HCl	NH_3	CH_3COOH
B	CH_3COOH	NH_3	HCl	NaOH
C	HCl	NaOH	CH_3COOH	NH_3
D	NH_3	CH_3COOH	NaOH	HCl

[Negeri Sembilan 2023-40] Rajah 15 menunjukkan susunan radas yang disediakan oleh seorang murid untuk mengkaji haba peneutralan.
Diagram 15 shows the apparatus set-up prepared by a student to investigate the heat of neutralisation.



Antara yang berikut, tindak balas manakah yang akan membebaskan haba yang sama seperti tindak balas di atas?
Which of the following reactions will release the same amount of heat as above reaction?

A Gunakan 50.0 cm^3 asid hidroklorik 0.5 mol dm^{-3} dengan 50.0 cm^3 larutan ammonia 0.5 mol dm^{-3}
Use 50.0 cm^3 of 0.5 mol dm^{-3} hydrochloric acid with 50.0 cm3 of 0.5 mol dm^{-3} ammonia solution

B Gunakan 50.0 cm^3 asid etanoik 0.5 mol dm^{-3} dengan 50.0 cm^3 larutan natrium hidroksida 0.5 mol dm^{-3}
Use 50.0 cm^3 of 0.5 mol dm^{-3} ethanoic acid with 50.0 cm^3 of 0.5 mol dm^{-3} sodium hydroxide solution

C Gunakan 50.0 cm^3 asid hidroklorik 0.5 mol dm^{-3} dengan 50.0 cm^3 larutan natrium hidroksida 0.5 mol dm^{-3}
Use 50.0 cm^3 of 1.0 mol dm^{-3} hydrochloric acid with 50.0 cm^3 of 1.0 mol dm^3 sodium hydroxide solution

D Gunakan 50.0 cm^3 asid etanoik 0.5 mol dm^{-3} dengan 50.0 cm^3 larutan ammonia 0.5 mol dm^{-3}
Use 50.0 cm^3 of 0.5 mol dm^{-3} sulfuric acid with 50.0 cm^3 of 0.5 mol dm^{-3} ammonia solution

[Perlis 2023-38] Persamaan termokimia berikut mewakili tindak balas peneutralan di antara 25 cm^3 asid nitrik dan 25 cm^3 larutan kalium hidroksida yang sama kemolaran. Suhu campuran meningkat sebanyak 7°C.
[Muatan haba tentu larutan = 4.2 J g^{-1} $°C^{-1}$, Ketumpatan larutan = 1 g cm^{-3}]

The following thermochemical equation represents the neutralization reaction between 25 cm^3 nitric acid and 25 cm^3 potassium hydroxide solution of the same molarity. The temperature of the mixture increased by 7°C.
[Specific heat capacity of the solution = 4.2 J g^{-1} $°C^{-1}$, Density of the solution = 1 g cm^{-3}]

HNO_3 (ak) + KOH(ak) → KNO_3 (ak) + H_2O (ce) ΔH = -57.3 kJ mol^{-1}

Apakah kemolaran bagi kedua-dua larutan?
What is the molarity of both solutions?

A 0.52 mol dm^{-3}
B 1.03 mol dm^{-3}
C 2.10 mol dm^{-3}
D 2.24 mol dm^{-3}

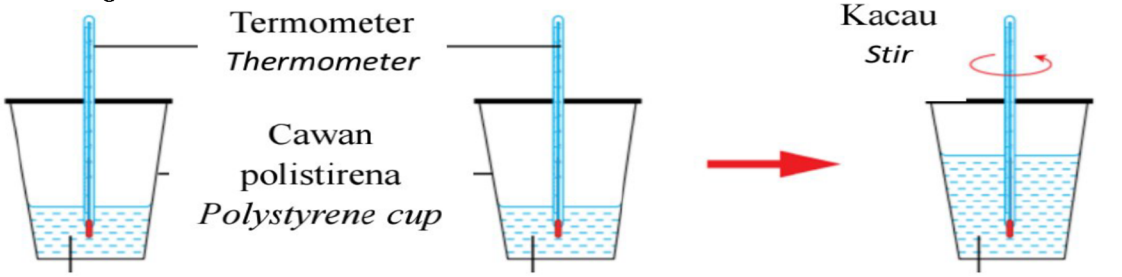
[Kelantan 2023-38] Jadual 4 menunjukkan perbandingan dua tindak balas peneutralan antara asid HX dan alkali Y.
Table 4 shows a comparison of two neutralization reactions between acid HX and alkali Y.

Bahan tindak balas *Reactants*	Suhu awal campuran *Initial temperature* °C	Suhu akhir campuran *Final temperature* °C
50 cm^3 asid HX, 1 mol dm^{-3} + 50 cm^3 alkali Y, 1 mol dm^{-3} *50 cm^3, 1 mol dm^{-3} of asid HX,* *+ 50 cm^3, 1 mol dm-3 of alkali Y*	30.0	36.8
50 cm^3 asid HX, 2 mol dm^{-3} + 50 cm^3 alkali Y, 2 mol dm^{-3} *50 cm^3, 2 mol dm^{-3} of asid HX,* *+ 50 cm^3, 2 mol dm^{-3} of alkali Y*	30.0	P

Apakah nilai P?/ *What is the value of P?*

A. 6.8 °C
B. 13.6 °C
C. 36.8 °C
D. 43.6 °C

[Melaka 2023-36] Rajah 9 menunjukkan tindak balas peneutralan di antara asid sulfurik dan larutan kalium hidroksida.
Diagram 9 shows the neutralisation reaction between sulphuric acid and potassium hydroxide solution.



50 cm^3 asid sulfurik 2.0 mol dm^{-3}
50 cm^3 *of sulphuric acid* 2.0 mol dm^{-3}

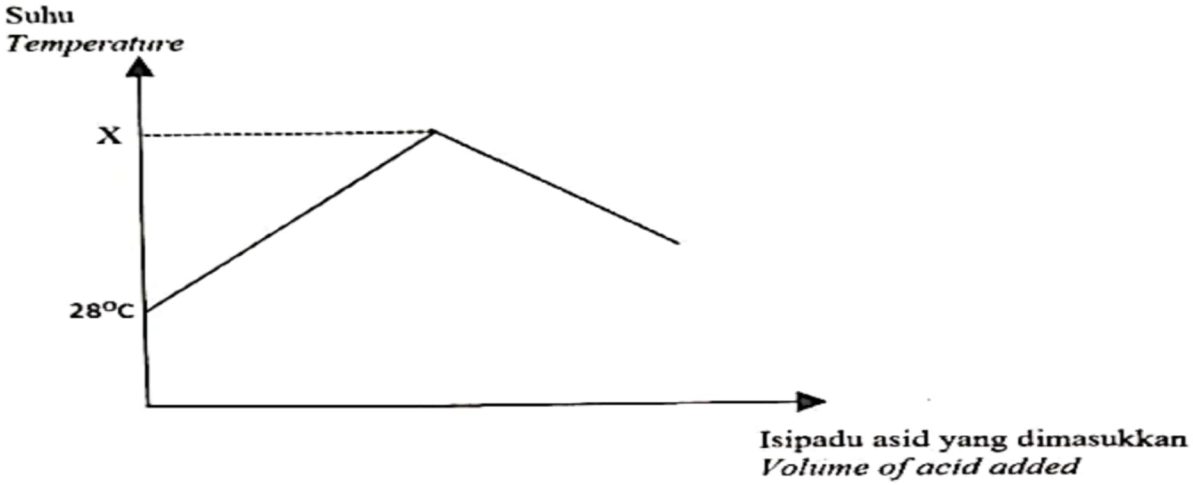
50 cm^3 larutan kalium hidroksida 2.0 mol dm^{-3}
50 cm^3 *of potassium hydroxide solution* 2.0 mol

Larutan campuran
Mixed solution

Haba peneutralan bagi tindak balas tersebut ialah -57 kJ mol^{-1}. Hitungkan suhu tertinggi campuran jika purata suhu awal campuran ialah 29.0 °C.
The heat of neutralisation for the reaction is -57 kJ mol^{-1}. Calculate the highest temperature of the mixture if the average initial temperature of the mixture is 29.0°C.

A 16.2 °C B 32.5 °C C 40.3 °C D 42.6 °C

[Johor Bahru 2023-40] Rajah 15 menunjukkan graf suhu melawan isi padu asid yang dimasukkan bagi tindak balas di antara asid sulfurik dan larutan natrium hidroksida yang membebaskan 5.7 kJ tenaga haba.
Diagram 15 shows the graph of temperature against volume of acid added for the reaction between sulphuric acid and sodium hydroxide solution that released 5.7 kJ of heat energy.

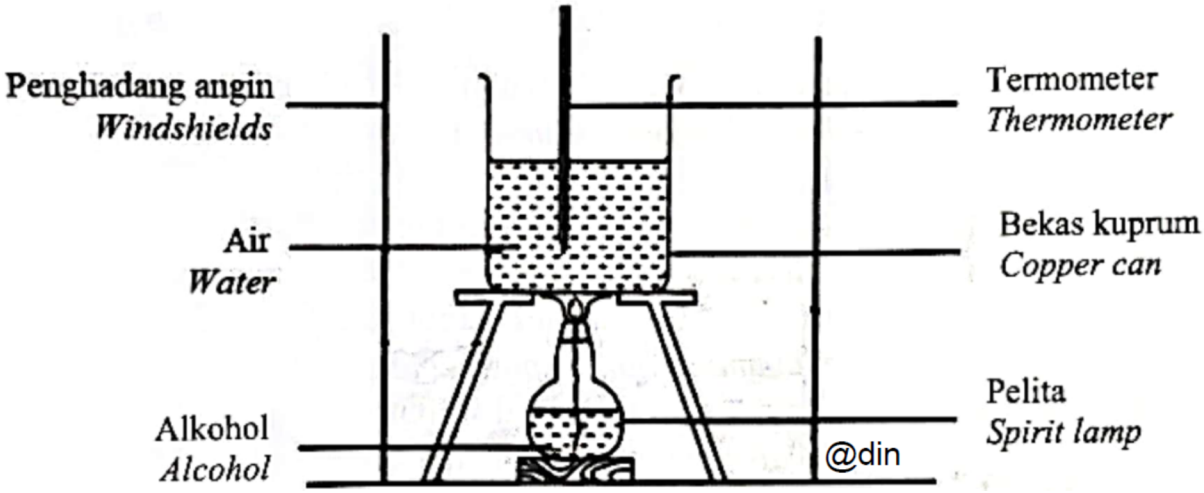


50 cm^3 asid sulfurik 1 mol dm^{-3} bertindak balas lengkap dengan 100 cm^3 larutan natrium hidroksida 1.0 mol dm^{-3}. Antara yang berikut, padanan manakah yang betul tentang haba peneutralan dan nilai X?
50 cm^3 of 1 mol dm^{-3} sulphuric acid reacts completely with 100 cm^3 of 1.0 mol dm^{-3} sodium hydroxide solution. Which of the following pairs is correct about the heat of neutralisation and the value of X?
[Muatan haba tentu larutan = 4.2 J g^{-1} $°C^{-1}$, ketumpatan larutan = 1.0 g cm^{-3}]
[Specific heat capacity of solution = 4.2 J g^{-1} $°C^{-1}$, density of solution = 1.0 g cm^{-3}]

	Haba peneutralan (kJ mol^{-1}) *Heat of neutralisation (kJ mol^{-1})*	Nilai X (°C) *Value of X (°C)*
A	57	9
B	57	37
C	114	9
D	114	37

Pembakaran

[Johor Bahru 2023-29] Rajah 8 menunjukkan susunan radas bagi menentukan haba pembakaran alkohol.
Diagram 8 shows the apparatus set-up to determine the heat of combustion of alcohols.



Antara yang berikut, alkohol manakah yang memberikan nilai haba pembakaran yang paling tinggi?
Which of the following alcohol gives the highest value of heat of combustion?

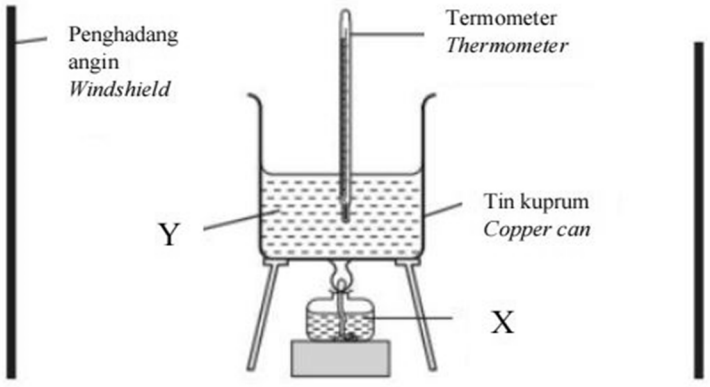
A Metanol
Methanol

B Etanol
Ethanol

C Propanol
Propanol

D Butanol
Butanol

[Perlis 2023-10] Rajah 3 menunjukkan susunan radas bagi menentukan haba pembakaran etanol, C_2H_5OH.
Diagram 3 shows the experimental set-up to determine the heat of combustion of ethanol, C_2H_5OH.



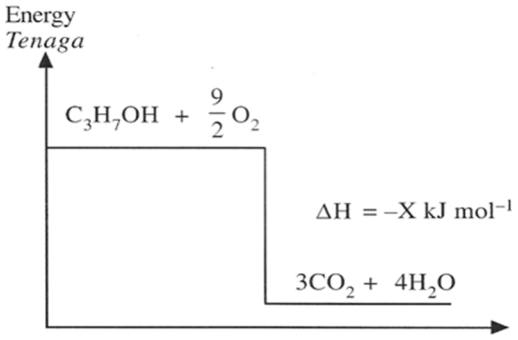
Apakah yang sesuai bagi X dan Y?/ *What is appropriate for X and Y?*

	X	Y
A	Etanol /*Ethanol*	Air / *Water*
B	Air / *Water*	Etanol / *Ethanol*
C	Naftalena / *Naphthalene*	Air / *Water*
D	Air / *Water*	Naftalena / *Naphthalene*

[Selangaor2023 Set 1-40] 1 376 kJ haba dibebaskan apabila 1 mol etanol dibakar dengan lengkap dalam oksigen berlebihan.
Berapakah jisim etanol yang perlu dibakar untuk menghasilkan haba yang dapat memanaskan 200 g air daripada suhu 30°C ke 80°C?
[Muatan haba tentu air = 4.2 J g^{-1} $°C^{-1}$, ketumpatan air =1 g cm^{-3},
jisim molar etanol = 46 g mol^{-1}]
1 376 kJ of heat is released when 1 mole of ethanol is completely burnt in excess oxygen. What is the mass of ethanol need to be burnt to produce heat that can heat up 200 g of water from 30°C to 80°C?
[Specify heat capacity of water = 4.2 J g^{-1} $°C^{-1}$, density of water = 1 g cm^{-3}, molar mass of ethanol = 46 g mol^{-1}]

A 46.00 g
B 1 404.07 g
C 1.40 g
D 6.55 g

[Johor Skudai2023-23] Rajah 23 menunjukkan gambar rajah aras tenaga bagi pembakaran propan-l-ol
Diagram 23 shows the energy level diagram for the combustion of propan-l-ol.



A X kJ haba diserap untuk tindak balas tersebut
X kJ of heat is absorbed for the reaction

B Suhu akhir adalah lebih rendah daripada suhu awal
The final temperature is lower than the initial temperature

C Haba pembakaran propan-l-ol ialah -X kJ mol^{-1}
The heat of combustion of propan-l-ol is -X kJ mol^{-1}

D Jumlah kandungan tenaga hasil tindak balas adalah lebih tinggi daripada bahan tindak balas
The total energy content of products is higher than the reactants

[Pahang JUJ Set 1 2023-38] Persamaan kimia berikut menunjukkan pembakaran lengkap bagi butanol.
The following chemical equation shows the complete combustion of butanol.

$$C_4H_9OH + 6O_2 \rightarrow 4CO_2 + 5H_2O$$

Berapakah jisim butanol yang diperlukan untuk menghasilkan 360 cm^3 gas karbon dioksida pada keadaan bilik ?
[Jisim molar butanol = 74 gmol-1; Isipadu molar gas = 24 dm^3 mol^{-1} pada keadaan bilik]
What is the mass of butanol needed to produce 360 cm^3 of carbon dioxide gas at room conditions?
[molar mass of butanol = 74 gmol-1; molar volume gas = 24 dm^3 mol^{-1} at room condition]

A 0.09 g
B 0.28 g
C 0.59 g
D 1.11 g

[Pahang JUJ Set 2 2023-37] Apabila 4.5 g bahan api T terbakar, suhu 100 cm^3 air meningkat sebanyak 15.0°C. Hitungkan haba pembakaran bahan api T.
[Jisim molar T = 180 g mol-1, muatan haba tentu air = 4.2 J g^{-1} $°C^{-1}$, ketumpatan air = 1.0 g cm^{-3}]
When 4.5 g of fuel T was burnt, it raised the temperature of 100 cm^3 of water by 15.0°C. Calculate the heat of combustion of fuel T.
[Molar mass of T = 180 g mol-1,
specific heat capacity of water = 4.2J g^{-1} $°C^{-1}$, density of water = 1.0 g cm^{-3}]

A 140 kJ mol^{-1}
B 252 kJ mol^{-1}
C 350 kJ mol^{-1}
D 630 kJ mol^{-1}

[Kelantan 2023-21] Berikut ialah persamaan termokimia bagi pembakaran butan-1-ol.
The following is the thermochemical equation for the combustion of butan-1-ol.

$$C_4H_9OH + 6O_2 \rightarrow 4CO_2 + 5H_2O; \ \Delta H = -2675 \text{ kJ mol}^{-1}$$

Berapakah nilai bahan api bagi butan-1-ol?
What is the fuel value of butan-1-ol?
[Jisim atom relative/*Relative atomic mass : H=1, C=12, 0=16]*

A. 36.15 kJ g^{-1}
B. 41.15 kJ g^{-1}
C. 46.93 kJ g^{-1}
D. 55.73 kJ g^{-1}

[Selangor2023 Set 1-40] Persamaan berikut menunjukkan pembakaran propana dalam oksigen berlebihan.
The following equation shows the combustion ofpropane in excess oxygen.

$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O \; ; \Delta H = -2\,220 \text{ kJ mol}^{-1}$$

Apakah jisim propana yang perlu dibakar dalam oksigen berlebihan untuk menghasilkan 888 kJ haba? [Jisim atom relatif: H = 1, C = 12]
What is the mass of propane that needs to be combusted in excess oxygen to produce 888 kJ of heat? [Relative atomic mass: H = 1, C = 12]

A 8.8 g
B 13.2 g
C 17.6 g
D 35.2 g

[Terengganu2023-40] Persamaan termokimia bagi pembakaran lengkap etanol, C2H5OH ditunjukkan di bawah.
The thermochemical equation for the complete combustion of ethanol, C2H5OH is shown below.

$$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O \; ; \Delta H = -1376 \text{ kJ mol}^{-1}$$

Jika 6.9 g etanol terbakar dalam oksigen berlebihan, berapakah haba yang dibebaskan?
If 6.9 g of ethanol is burnt in excess oxygen, how much is the heat released?
[Jisim atom relatif/ Relative atomic mass: C = 12; H = 1,0 = 16]

A 9173.3 kJ B 206.4 kJ C 198.69 kJ D 0.15 kJ

[Melaka 2023-16] Antara faktor berikut, yang manakah akan meningkatkan haba pembakaran bagi alkohol?
Which of the following factors will increase the heat of combustion for alcohol?

A Saiz molekul alkohol bertambah
The molecular size of alcohol increases

B Bilangan ion OH- bagi setiap molekul bertambah
The number of OH- ions per molecule increases

C Daya tarikan antara molekul alkohol bertambah
The attraction between alcohol molecules increases

D Bilangan atom karbon per molekul bertambah
The number of carbon atoms per molecule increases

[SBP2023-13] Tindak balas manakah yang mempunyai "ΔH" positif ?
Which reaction has positive "ΔH"?

A Asid sulfurik cair ditambahkan kepada larutan natrium hidroksida
Dilute sulphuric acid is added to sodium hydroxide solution

B Serbuk zink ditindak balaskan dengan larutan kuprum(II) sulfat
Zinc powder is reacted with copper(II) sulphate solution

C Kalsium karbonat dipanaskan dengan kuat
Calcium carbonate is heated strongly

D Secebis kalium diletakkan ke dalam air
A piece of potassium is put into water

Bahan Api

[Selangor2023 Set 1-32] Jadual 4 menunjukkan jisim molekul relatif dan haba pembakaran bagi empat jenis bahan api.
Table 4 shows the relative molecular mass and the heat of combustion off our types of fuel.

Bahan api *Fuel*	Jisim molekul relatif *Relative molecular mass*	Haba pembakaran, kJ mol^{-1} *Heat of combustion, kJ mol^{-1}*
K	16	-520
L	28	-940
M	46	-1 680
N	72	-2 250

Dari segi nilai bahan api, bahan api yang manakah paling baik?
In terms of fuel value, which fuel is the best?

A K B L C M D N

[Putrajaya2023-37] Nilai bahan api bagi kerosin adalah 37 kJ g^{-1}.
Berapakah jisim kerosin perlu dibakar untuk mendidihkan 1 dm^3 air?
[Suhu bilik bagi air = 27°C]
The fuel value of kerosene is 37 kJ g^{-1}. What is the mass of kerosene must be burnt to boil 1 dm^3 of water? [Room temperature of water = 27°C]

A 0.73 g B 3.06 g C 3.06 g D 8.29 g

[SBP2023-37] Sekumpulan murid pergi berkhemah di topi pantai. Mereka ingin mendidihkan 5 dm_3 air dengan menggunakan kayu yang dikutip berhampiran khemah mereka Jika nilai bahan api bagi kayu ialah 20 kJ g^{-1} berapakah jisim kayu yang perlu dibakar?
[Muatan baba tentu air = 4.2 J g^{-1} °C^{-1}; Ketumpatan air = 1 g cm^3;
Suhu bilik bagi air = 27 °C]
A group of students went for romping by the beach. They want to boil 5 dm^3 of water using wood collected near their tent. If the fuel value of wood is 20 kJ g^{-1}. what is the mass of wood needed to be burned?
[Specific heat capacity of air = 4.2 J g^{-1} °C^{-1}; Density of water = 1 g cm^3; Room temperature of water = 27 °C]

A 2.84 g
B 7.67 g
C 28.35 g
D 76.65 g

3.3 Aplikasi tindak balas eksotermik dan endotermik dalam kehidupan harian

[Pahang 2023-19] Rajah 4 menunjukkan rawatan bagi seorang pemain bola sepak yang mengalami kecederaan pada kakinya.
Diagram 4 shows treatment for a football player who suffered injury on his leg.

Pek sejuk
(Air + bahan P)
Cold pack
(water + substance P)

Apakah bahan P?/ *What is substance P?*

A Kalsium klorida
Calcium chloride

B Natrium karbonat
Sodium carbonate

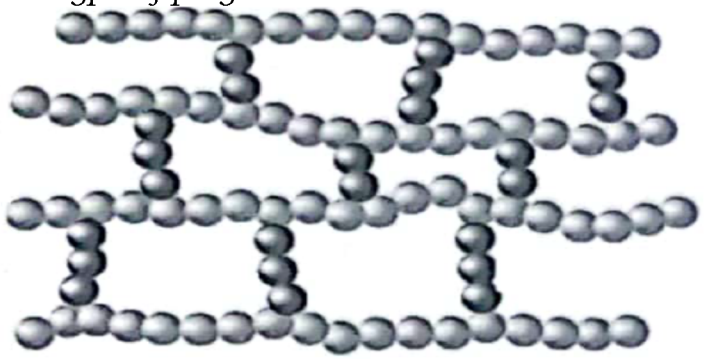
C Ammonium nitrat
Ammonium nitrate

D Magnesium sulfat
Magnesium sulphate

Bab 4 Polimer

4.1 Polimer

[SBP2023-14] Rajah 3 menunjukkan sejenis polimer.
Diagram 3 shows a type of polymer.



Rajah/ Diagram 3

Antara yang berikut, bahan yang manakah adalah contoh bagi polimer itu?
Which of the following substances is the example of the polymer?

A Nilon
Nylon

C Polietene
Polyethene

B Bakelit
Bakelite

D Poliuretana
Polyurethane

[Terengganu2023-19] Antara berikut, polimer manakah terhasil daripada tindak balas pempolimeran kondensasi?
Among the following, which polymer results from a condensation polymerization reaction?

A Terilena
Terylene

C Polivinil klorida
Polyvinyl chloride

B Polietena
Polyethene

D 1, 2-etanadiol
1, 2-ethanediol

[Selangaor2023 Set 01-02] Manakah antara berikut dihasilkan daripada pempolimeran penambahan?
Which of the following is produced from addition polymerisation?

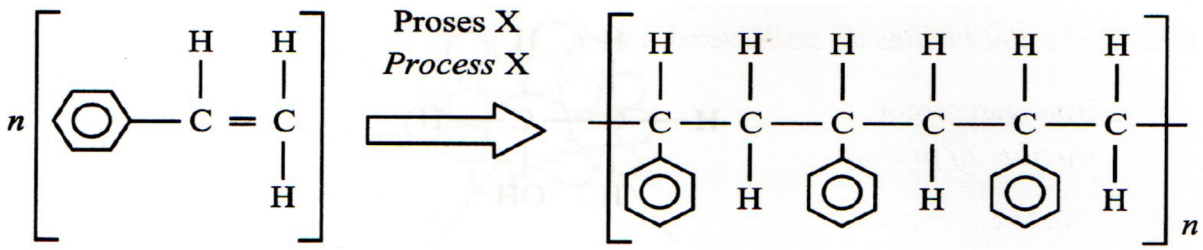
A Polipropena
Polypropylene

C Kapas
Cotton

B Terilena
Terylene

D Nilon
Nylon

[Selangor2023 Set 1-13] Rajah 5 menunjukkan proses X.
Diagram 5 shows process X.



Rajah 5/ *Diagram 5*

Apakah proses X?/ *What is process X?*

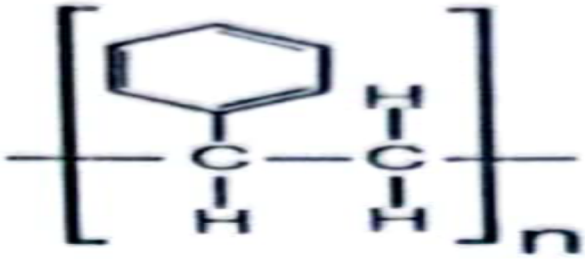
A Pempolimeran
Polymerisation

C Penghidrogenan
Hydrogenation

B Pengesteran
Esterification

D Pengoksidaan
Oxidation

[SBP2023-29] Rajah 7 menunjukkan formula struktur bagi polimer X.
Diagram 7 shows a structural formula of polymer X



Antara yang berikut, manakah yang betul tentang tindak balas pempolimeran polimer X?
Which of the following is correct about the polymerisation reaction of polymer X?

A Pempolimeran ini melibatkan monomer-monomer dari dua siri homolog yang berbeza
The polymerisation involves monomers from two different homologous series

B Tindak balas pempolimeran ini menghasilkan polimer X dan satu basil sampingan yang lain
The polymerisation reaction produces polymer X and another by-product

C Tindak balas pempolimeran ini berlaku pada kumpulan berfungsi monomer- monomer yang terlibat
The polymerisation reaction occurs at the functional groups of the monomers involved

D Pempolimeran ini berlaku terhadap monomer yang mempunyai ikatan kovalen tunggal dalam molekulnya
The polymerisation occurs towards monomer which has single covalent bond in its molecule

[Pahang JUJ Set 2 2023-13] Polimer X ialah molekul berantai panjang diperbuat daripada ulangan unit glukosa. Antara berikut yang manakah ialah polimer X?
Polymer X is a long chain molecule made up from repeating unit of glucose. Which of the following is polymer X?

A Kanji
Starch

C Protein
Protein

B Lemak
Fat

D Getah asli
Natural rubber

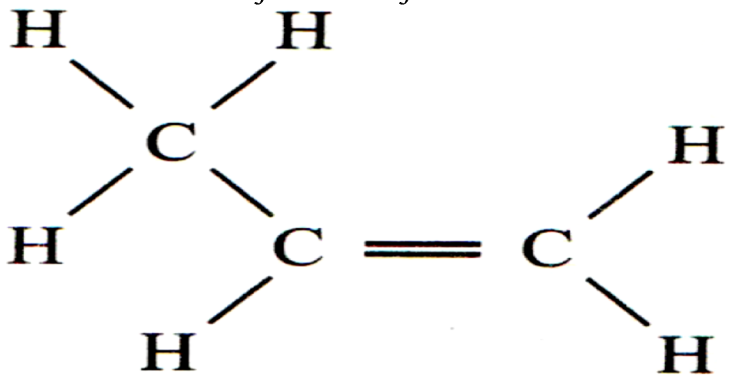
[Kelantan 2023-03] Antara berikut yang manakah merupakan polimer sintetik?
Which of the following is a synthetic polymer?

A. Nilon
Nylon

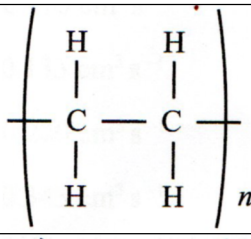
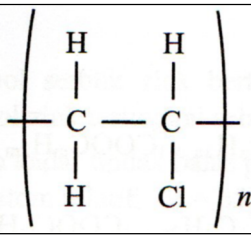
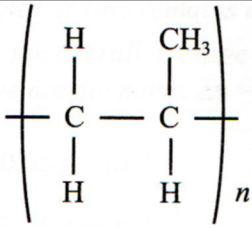
B. Glukosa
Glucose

C.Getah
Rubber

[Selangor2023 Set 1-34] Rajah 9 menunjukkan formula struktur bagi suatu monomer.
Diagram 9 shows the structural formula of a monomer.



Antara berikut, yang manakah formula struktur bagi polimer terbentuk?
Which of the following is the structural formula for the polymer formed?

A		B	
C			

[Melaka 2023-37] Rajah 10 menunjukkan kegunaan sejenis polimer yang terhasil melalui tindak balas pempolimeran.
Diagram 10 shows the uses of a type of polymer produced through polymerisation reaction.

Antara yang berikut, pernyataan manakah adalah betul tentang pempolimeran itu?
Which of the following statements is true about the polymerisation?

A Terbentuk daripada gabungan monomer yang sama jenis
Formed from a combination of the same type of monomers

B Terbentuk daripada gabungan monomer yang berlainan jenis
Formed from a combination of different types of monomers

C Pempolimeran ini menghasilkan polimer terbiodegradasi
This polymerisation produces a biodegradable polymer

D Terbentuk daripada monomer yang mempunyai ikatan kovalen ganda dua
Formed from monomers that have double covalent bonds

[Johor Bahru 2023-05] Polivinil klorida merupakan polimer yang dapat diacu berulang kali selepas dipanaskan. Apakah jenis polimer itu?
Polyvinyl chloride is a polymer which can be repeatedly remoulded upon heating. What is the type of polymer?

A Polimer semula jadi
Natural polymer

B Polimer termoplastik
Thermoplastic polymer

C Polimer termoset
Thermosetting polymer

D Polimer elastomer
Elastomer polymer

[Johor Skudai2023-25] Rajah 25 menunjukkan struktur bagi polimer Q.
Diagram 25 shows the structure of polymer Q.

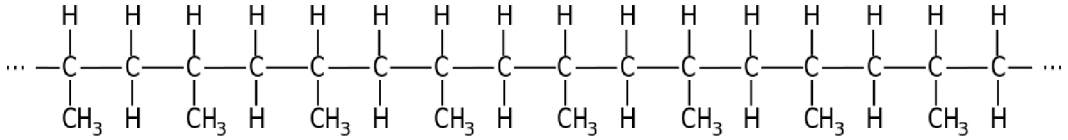
Antara berikut, yang manakah sifat bagi polimer Q?
Which of the following is a property of polymer Q?

A Terurai atau hangus apabila dipanaskan dan tidak dapat dikitar semula
Disintegrate or burn upon heating and cannot be recycled

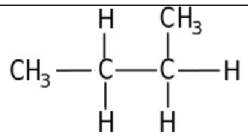
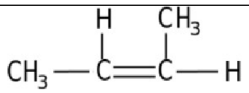
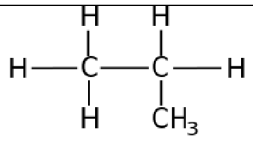
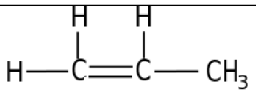
B Dapat diacu berulangkali selepas dipanaskan dan boleh dikitar semula
Can be repeatedly remoulded upon heating and can be recycled

C Dapat diregang dan kembali kepada bentuk asal selepas dilepaskan
Can be stretched and can return to their original shape when released

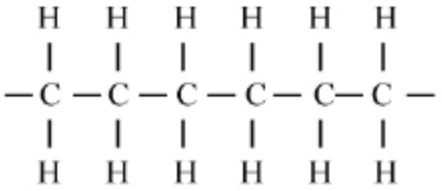
[Johor Skudai2023-29] Rajah 29 menunjukkan struktur bagi suatu polimer.
Diagram 29 shows the structure of a polymer.



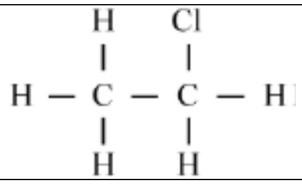
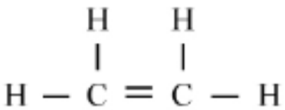
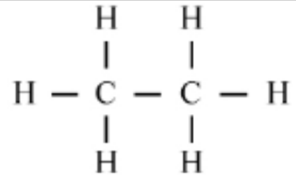
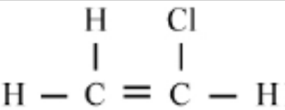
Antara yang berikut, yang manakah monomer bagi polimer tersebut?
Which of the following is the monomer of the polymer?

A		B	
C		D	

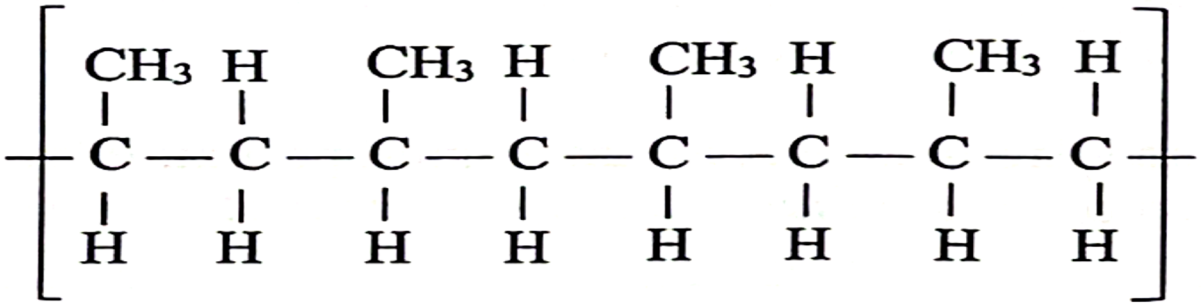
[Selangaor2023 Set 01-13] Rajah 1 menunjukkan tiga unit berulang dalam suatu struktur polimer.
Diagram 1 shows three repeating units in the structure of a polymer.



Antara berikut, yang manakah monomer bagi polimer tersebut?
Which of the following is the monomer of the polymer?

A		B	
C		D	

[Negeri Sembilan 2023-19] Rajah 4 menunjukkan struktur molekul satu polimer.
Diagram 4 shows the molecular structure of a polymer.



Antara yang berikut, yang manakah monomer bagi polimer ini?
Which of the following is the monomer of this polymer?

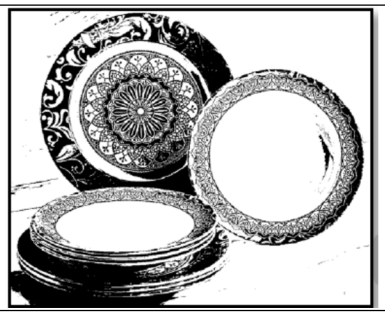
A Etena
Ethene

B Propena
Propene

C But-1-ena
But-1-ene

D But-2-ena
But-2-ene

[Pahang JUJ Set 2 2023-29] ajah 8 menunjukkan dua produk iaitu paip PVC dan pinggan melamin yang diperbuat daripada dua jenis polimer dengan sifat yang berbeza.
Diagram 8 shows two products namely PVC pipes and melamine plates made of two types of polymers with different properties.

	
Paip PVC *PVC pipe*	Pinggan melamin *Melamine plate*

Yang manakah antara pernyataan berikut menjelaskan sifat bagi kedua-dua jenis polimer tersebut?
Which of the following statement explains the characteristic of both types of polymer?

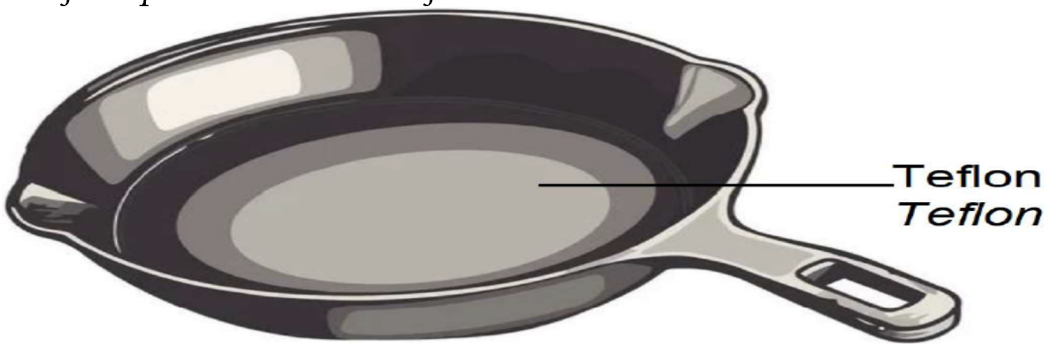
A Paip PVC mempunyai rantai silang antara polimer tetapi pinggan melamin tiada
PVC pipe has cross-links between polymer chain but melamine plate does not

B Paip PVC boleh diacu berulang kali tetapi pinggan melamin hanya boleh diacu sekali
PVC pipe can be moulded repeatedly but melamine plate can only be moulded once

C Paip PVC boleh diregangkan dan akan kembali ke bentuk asal apabila dilepaskan tetapi tidak pada pinggan melamin
PVC pipe can be stretched and returned to their original shape but not for melamine plate

D Paip PVC tidak melebur apabila dipanaskan tetapi pinggan melamin melebur apabila dipanaskan dan menjadi pepejal apabila disejukkan
PVC pipe does not melt when heated but melamine plate melts when heated and solidify when cooled

[Kelantan 2023-31] Permukaan kuali menggoreng disaluti teflon agar tidak melekat. Teflon merupakan polimer yang dikenali sebagai politetrafluoroetena. Rajah 15 menunjukkan permukaan kuali yang disaluti dengan teflon.
The surface of the frying pan is coated with teflon so that it does not stick. Teflon is a polymer known as polytetrafluoroethene. Diagram 15 shows the surface of the pan coated with teflon.



Rajah 15/ Diagram 15

Apakah monomer bagi teflon?
What is the monomer of teflon?

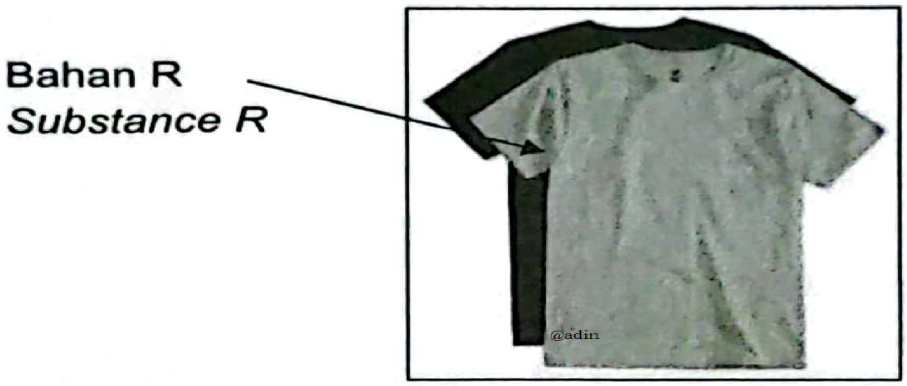
A. Etena
Ethene

B. Fluoroetena
Fluoroethene

C. Fluoroetana
Fluoroethane

D. Tetrafluoroetena
Tetraluoroethene

[Kedah2023-08] Bahan R menunjukkan salah satu polimer sintetik yang digunakan dalam kehidupan harian.
Substance R shows one of synthetic polymer that used in daily life.



Bahan R juga digunakan untuk membuat alat mainan. Apakah bahan R?
Substance R is also used for making toys. What substance R?

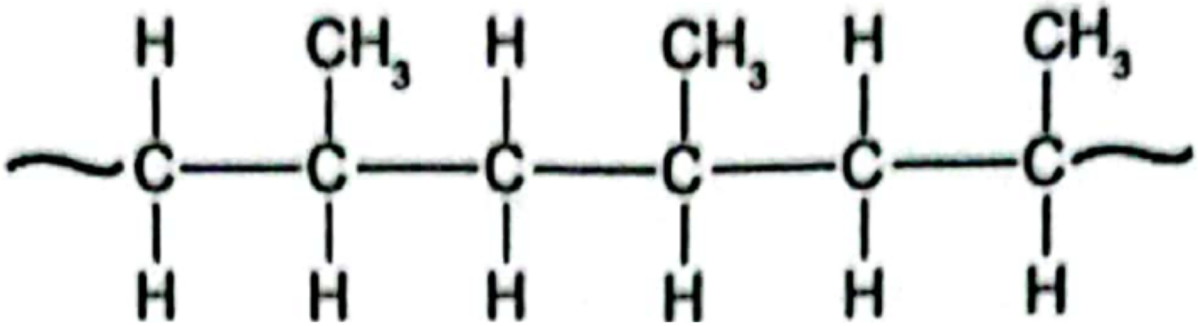
A Teflon
Teflon

C Nilon
Nylon

B Nomex
Nomex

D Kevlar
Kevlar

[Kedah2023-33] Rajah di bawah menunjukkan struktur sejenis polimer
Diagram below shows structure of polymer



Berdasarkan rajah, apakah produk yang boleh dihasilkan daripada polimer tersebut?
Based on the diagram, what can be produces from this polymer?

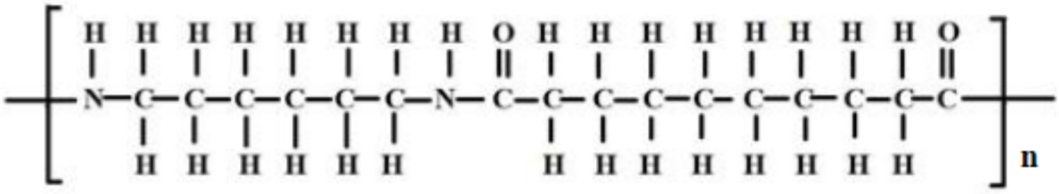
A Beg plastik
Plastic bag

C Barang mainan
Toys

B Tekstil
Textile

D Paip air
Water pipe

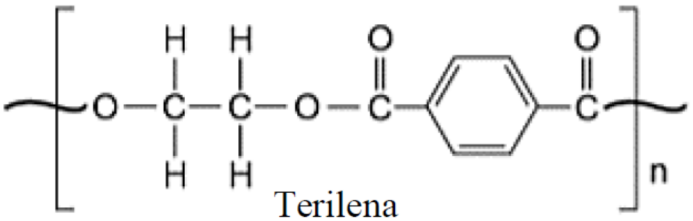
[MRSM2023-27] Rajah 12 menunjukkan formula struktur bagi polimer Y.
Diagram 12 shows the structural formula for polymer Y.



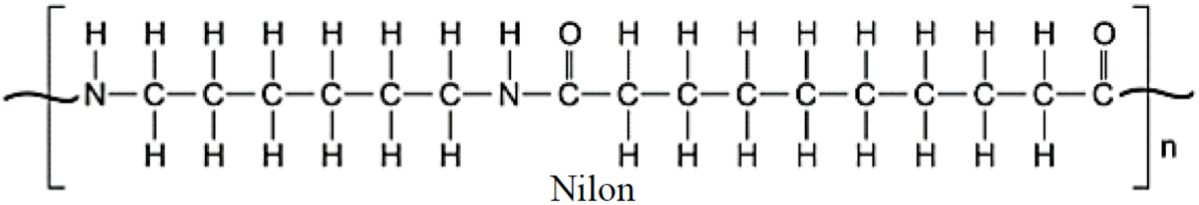
Antara yang berikut, manakah dihasilkan menggunakan polimer Y?
Which of the following is made from polymer Y?

A		B	
C		D	

[Pahang 2023-28] Rajah 8 menunjukkan dua struktur polimer sintetik.
Diagram 8 shows two structures of synthetic polymers.



Terilena
Terylene



Nilon
Nylon

Rajah 8/ Diagram 8

Antara berikut, pernyataan manakah benar bagi kedua-dua polimer tersebut?
Which of the following statements is true for both polymers?

I Terhasil melalui pempolimeran penambahan
Produced through addition polymerisation

II Terhasil melalui pempolimeran kondensasi
Produced through condensation polymerisation

III Monomer yang terlibat memiliki dua kumpulan berfungsi
The monomers involved consist of two functional group

IV Monomer yang terlibat terdiri daripada hidrokarbon tak tepu
The monomers involved consist of unsaturated hydrocarbon

A I dan III
I and III

B I dan IV
I and IV

C II dan III
II and III

D II dan IV
II and IV

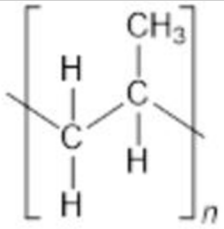
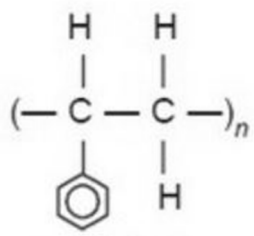
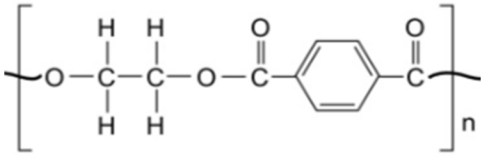
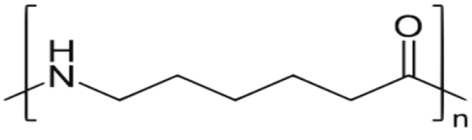
[Perlis 2023-11] Antara yang berikut, yang manakah polimer sintetik?
Which of the following is a synthetic polymer?

A Selulosa
Cellulose

B Polistirena
Polystyrene

C Poliisoprena
Polyisoprene

[Perlis 2023-27] Yang manakah antara berikut merupakan hasil pempolimeran kondensasi?
Which of the following products of condensation polymerisation?

I		II	
III		IV	

A I dan II
I and II

B II dan III
II and III

C III dan IV
III and IV

D I dan IV
I and IV

[Putrajaya2023-14] Antara yang berikut, pernyataan yang manakah merupakan ciri polimer sintetik?
Which of the following statements is the characteristics of synthetic polymers?

A Mengambil masa yang singkat untuk terurai secara biologi
Takes a short time to decompose biologically

B Kurang tahan terhadap pengoksidaan
Less resistance towards oxidation

C Bersifat lengai dan tidak reaktif
Inert and non-reactive

D Ringan dan lembut
Light and soft

4.2 Getah asli

[SBP2023-38] Seorang penoreh getah ingin menghantar lateks ke sebuah kilang getah. Namun dia mendapati lateks itu telah menggumpal selepas beberapa jam pokok getah ditoreh. Apakah yang perlu dia lakukan untuk menyelesaikan masalahnya?
A rubber tapper wants to send latex to a rubber factory. However he found that the latex had coagulated after a few hours of tapping the rubber tree. What should he do to solve his problem?

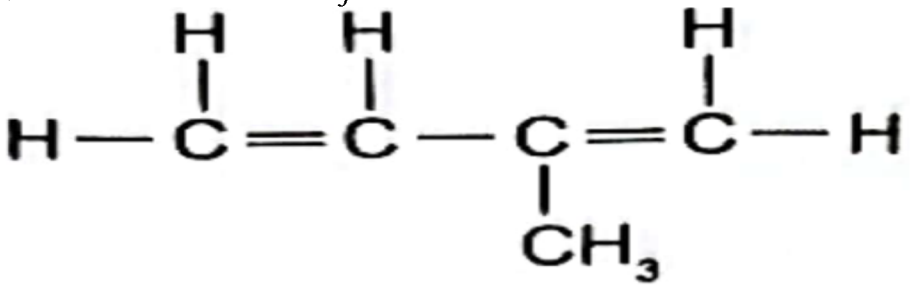
A Cairkan lateks dengan menambahkan sedikit air
Dilute the latex by adding some water

B Tambahkan larutan ammonia ke dalam lateks
Add ammonia solution into the latex

C Masukkan garam biasa ke dalam lateks
Put table salt into the latex

D Tuangkan cuka ke dalam lateks
Pour vinegar into the latex

[Johor Bahru 2023-18] Rajah 2 menunjukkan monomer bagi getah asli.
Diagram 2 shows the monomer for natural rubber.



Apakah nama bagi monomer itu mengikut penamaan IUPAC?
What is the name of the monomer following IUPAC nomenclature?

A 2-metilbut-l,3-diena
2-methylbut-1,3-diene

B 3-metilbut-l,3-diena
3-methylbut-1,2-diene

C 2-metilpent-1,3-ena
2-methylpent-1,2-ene

D 3-metilpent-l,3-ena
3-methylpent-1,3-ene

[Selangaor2023 Set 01-19] Getah memainkan peranan penting dalam pembangunan ekonomi negara kita. Salah satu kegunaan getah ialah membuat tayar seperti yang ditunjukkan dalam Rajah 5.
Rubber plays an important role in the development of our country's economy. One of the uses of rubber is making tyres as shown in Diagram 5.

Bahan yang digunakan untuk membuat tayar ialah getah tervulkan iaitu getah asli ditambahkan dengan sulfur. Apakah yang berlaku apabila sulfur ditambahkan ke dalam getah asli?
The material used to make tyres is vulcanised rubber, which is natural rubber added with sulphur. What happens when sulphur is added into natural rubber?

A Molekul getah menggelongsor lebih mudah antara satu sama lain
Rubber molecules slide more easily over each other

B Atom sulfur membentuk rangkai silang antara molekul getah
Sulphur atoms form cross-links between rubber molecules

C Takat lebur getah berkurangan
The melting point of rubber decreases

D Kekenyalan getah meningkat
Elasticity of rubber increases

[Terengganu2023-20] Apakah yang menyebabkan getah tervulkan lebih kenyal dan tahan haba berbanding getah tak tervulkan?
What makes vulcanized rubber more elastic and heat resistant than unvulcanized rubbed

A Pembentukan rangkai silang sulfur mengurangkan ikatan kovalen tunggal antara karbon dalam getah tervulkan
The formation of sulfur crosslinks reduces the single covalent bonds between carbons in vulcanized rubber

B Pembentukan rangkai silang sulfur mengurangkan ikatan kovalen ganda dua antara karbon dalam getah tervulkan
The formation of sulfur crosslinks reduces the double covalent bonds between carbons in vulcanized rubber

C Pembentukan rangkai silang sulfur mengurangkan ikatan kovalen ganda dua antara karbon dengan atom sulfur dalam getah tervulkan The *formation of sulfur crosslinks reduces the double covalent bond between carbon and sulfur atoms in vulcanized rubber*

D Pembentukan rangkai silang sulfur mengurangkan ikatan kovalen ganda dua antara sulfur dalam getah tervulkan
The formation of sulfur crosslinks reduces the double covalent bond between sulfur in vulcanized rubber

[Pahang 2023-12] Pelajar menggunakan sarung tangan getah yang diperbuat daripada getah tervulkan ketika menjalankan ujikaji di makmal. Apakah ciri getah tervulkan yang menyebabkannya sesuai digunakan dalam pembuatan sarung tangan ini?
Students use rubber gloves made of vulcanised rubber when conducting experiments in the laboratory. What is the characteristic of vulcanised rubber that make it suitable for use in the manufacture of these gloves?

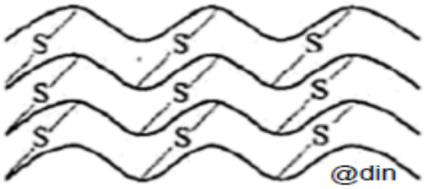
A Mudah teroksida
Easily oxidised

B Lebih kuat daripada getah tak tervulkan
Stronger than unvulcanised rubber

C Lebih mudah larut dalam pelarut organik
More soluble in organic solvents

D Kurang kenyal daripada getah tak tervulkan
Less elastic than unvulcanised rubber

[Johor PPD Tangkak 2023 27] Rajah 14 menunjukkan struktur getah T.
Diagram 14 shows the structure of T.



Yang manakah antara berikut merupakan sifat getah T?
Which of the following is the property of rubber T?

A Mudah melekit apabila dipanaskan
Easily sticky when heated

B Mudah teroksida
Easily oxidized

C Kenyal
Elastic

D Mudah putus
Easily broken

[Pahang JUJ Set 1 2023-12] Apakah bahan kimia yang boleh dicampurkan kepada lateks untuk mencegahnya daripada menggumpal?
What chemical substance that can be added to latex to prevent it from coagulating?

A Air
Water

C Metil etanoat
Methyl ethanoate

B Asid sulfurik
Sulphuric acid

D Larutan ammonia
Ammonia solution

[Kedah2023-30] Yang manakah antara berikut berlaku semasa penggumpalan lateks?
Which of the following occur during the coagulation of latex?

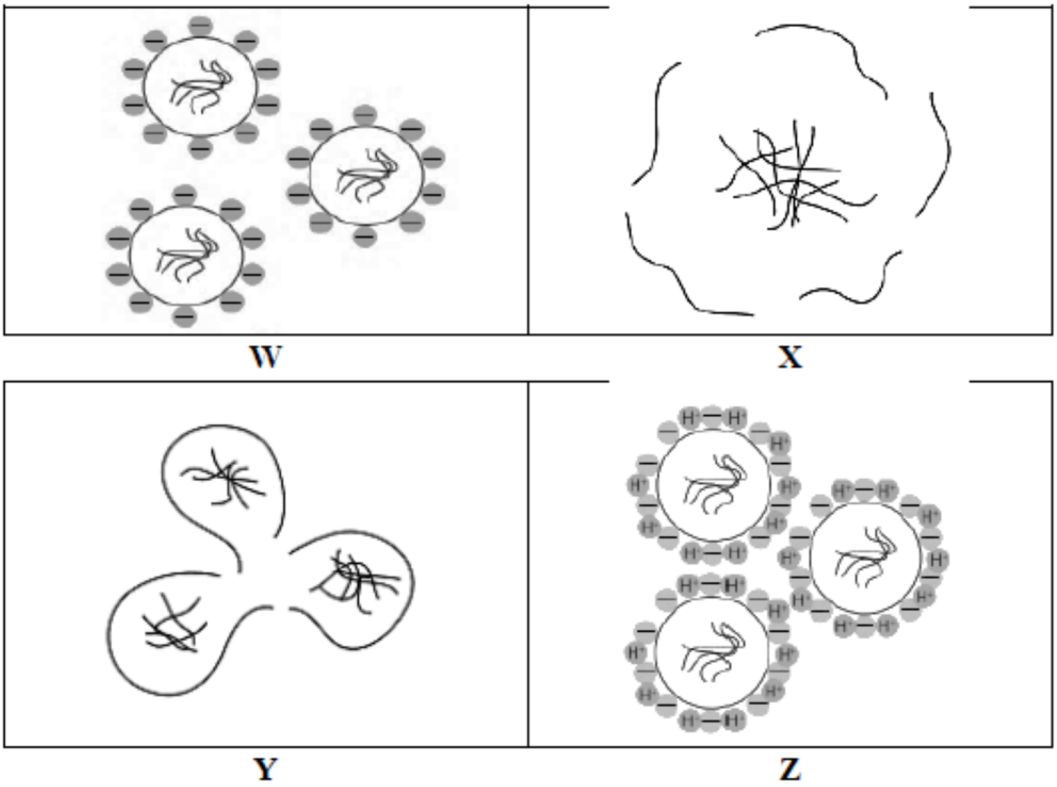
A Zarah-zarah bergabung menyebabkan penggumpalan.
Particles are combined that cause coagulation.

B Ikatan ganda dua antara karbon yang terdapat antara molekul getah akan bertindak balas dengan sulfur atau bahan lain untuk menghasilkan rangkai silang.
Double bond between carbons found in rubber molecules will reacts with sulphur or other substances to produce sulphur cross-links.

C Molekul berantai panjang yang terhasil daripada pencantuman banyak ulangan unit asas.
Long chain molecules that is made from a combination of many repeating basic units.

D Ion hidrogen daripada asid meneutralkan cas negatif pada membran protein.
Hydrogen ion from an acid neutralise negative charges on the protein membrane.

[MRSM2023-12] Rajah 5 menunjukkan proses yang berlaku semasa penggumpalan lateks.
Diagram 5 shows the process that occurs during latex coagulation.

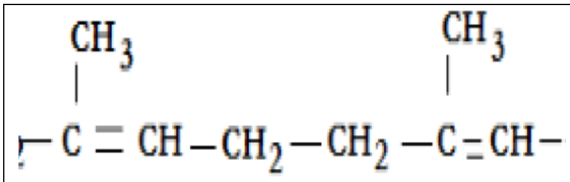
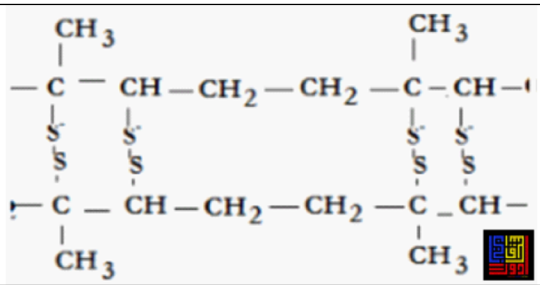


Rajah 5 / *Diagram 5*

Susun proses penggumpalan lateks dalam urutan yang betul.
Arrange the process of latex coagulation in the correct order.

A W → Z → Y → X
B Z → W → Y → X
C W → Z → X → Y
D Z → X → Y → W

[Pahang JUJ Set 1 2023-28] Rajah 13 menunjukkan formula struktur bagi dua jenis getah berbeza, X dan Y.
Diagram 13 shows a structural formula for two different types of rubber, X and Y.

	
Getah X *Rubber X*	Getah Y *Rubber Y*

Apakah sifat getah Y berbanding getah X?
What is the property of rubber Y compare to rubber X ?

A Lebih lembut
Softer

B Kurang kenyal
Less elastic

C Takat lebur lebih rendah
Lower melting point

D Lebih tahan pengoksidaan
More resistance to oxidation

[Negeri Sembilan 2023-17] Antara yang berikut, kaedah manakah yang betul untuk pemvulkanan getah tanpa sulfur?
Which of the following methods is correct for vulcanisation of rubber without sulphur?

A Pendedahan kepada sinaran
Irradiation

B Pendedahan kepada tindakan bakteria
Exposure to bacteria action

C Penambahan cecair ammonia
Addition of liquid ammonia

D Penambahan disulfur diklorida
Addition of disulphur dichloride

[Putrajaya2023-27] Tayar kapal terbang diperbuat daripada getah tervulkan. Apakah ciri getah tervulkan yang menjadikannya sesuai digunakan pada kapal terbang?
The tyres of an aeroplane are made of vulcanised rubber. What characteristic of vulcanised rubber makes it suitable to be used for the aeroplane?

A Ketahanan haba
Resistance towards heat

B Lebih kuat dan ringan
Harder and lighter

C Ketahanan pengoksidaan
Resistance towards oxidation

D Kekenyalan
Elasticity

[Selangor2023 Set 1-19] Apabila suatu bahan R ditambahkan kepada lateks, proses penggumpalan lateks menjadi perlahan. Apakah R?
When a substance R is added to latex, the process of coagulation of latex slows down. What is R?

A Air
Water

B Etanol
Ethanol

C Asid etanoik
Ethanoic acid

D Ammonia akueus
Aqueous ammonia

4.3 Getah sintetik

[Johor PPD Tangkak 2023 28] Maklumat berikut menunjukkan ciri-ciri bagi getah Q.
The following information shows the characteristics of rubber Q.

* Tahan haba/ *Resistant to heat*

*Tidak mudah teroksida/*Does not easily oxidized*

*Tidak mengkonduksikan arus elektrik/*Does not conduct electricity*

*Tidak bertindak balas dengan bahan api
Does not react with fuel

Apakah getah Q?/ *What is rubber Q?*

A Isoprena
Isoprene

B Neoprene
Neoprene

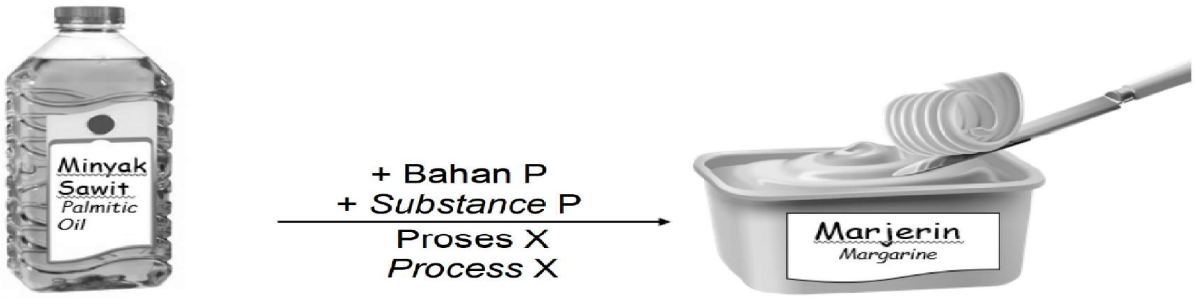
C Getah nitril
Nitrile rubber

D Getah stirena-butadiena
Styrene-butadiene rubber

Bab 5 Kimia Konsumer dan Industri

5.1 Minyak dan lemak

[Kelantan 2023-24] Rajah 9 menunjukkan bagaimana minyak boleh ditukarkan kepada marjerin.
Diagram 9 shows how oil can be converted to margarine.



Apakah bahan P dan proses X? *What is substance P and process X?*

	Bahan P/ *Substance P*	Proses X/ *Process X*
A	Gas hydrogen/ *Hydrogen gas*	Penghidrogenan/ *Hydrogenation*
B	Gas oksigen/ *Oxygen gas*	Pengoksidaan/ *Oxidation*
C	Ion hidroksida/ *Hydroxide ion*	Penghidratan/ *Hydration*

[Melaka 2023-12] Antara yang berikut, yang manakah kegunaan minyak dan lemak dalam kehidupan harian?
Which of the following are the uses of oil and fat in daily life?

I Sumber nutrisi
Source of nutrition

II Bahan api bio
Biofuel

III Pakaian
Clothes

IV Baja
Fertilisers

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

5.2 Bahan pencuci

[Johor Bahru 2023-06] Apakah nama bagi tindak balas penyediaan sabun?
What is the name for the reaction to prepare soap?

A Saponifikasi
Saponification

B Pempolimeran
Polymerisation

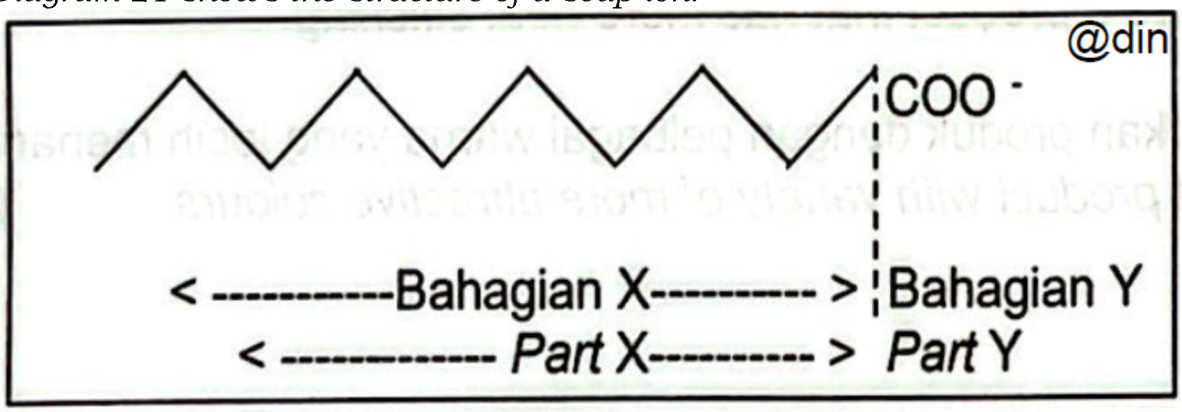
C Peneutralan
Neutralisation

D Penapaian
Fermentation

[Johor Skudai2023-14] Kation manakah yang membentuk kekat dengan sabun?
Which cation forms scum with soap?

A Na^+ B Mg^{2+} C Al^{3+} D NH_4^+

[Terengganu2023-21] Rajah 21 menunjukkan struktur ion sabun.
Diagram 21 shows the structure of a soap ion.



Berdasarkan Rajah, pernyataan yang manakah betul?
Based on Diagram, which of the following statements is true?

A Bahagian X dan Y terlarutkan dalam air
Parts X and Y are soluble in water

B Bahagian X dan Y terlarutkan dalam gris
Parts X and Y are soluble in grease

C Bahagian X terlarutkan dalam gris dan bahagian Y terlarutkan dalam air
Parts X is soluble in grease and part Y are soluble in water

D Bahagian X terlarutkan dalam air dan bahagian Y terlarutkan dalam gris
Parts X is soluble in water and part Y is soluble in grease

[Pahang JUJ Set 1 2023-13] Antara jenis air yang berikut, yang manakah mengandungi banyak ion kalsium, Ca^{2+} dan ion magnesium, Mg^{2+} ?
Which of the following types of water contains a lot of calcium ion, Ca^{2+} and magnesium ion, Mg^{2+}?

A Air laut *Sea water*	B Air tulen *Pure water*	C Air kolam *Pond water*

[Johor Skudai2023-17] Antara berikut, yang manakah betul tentang sabun?
Which of the following is correct about soap?

I Bahagian hidrofobik sabun larut dalam gris
The hydrophobic part of soap dissolves in grease

II Sabun membentuk kekat dalam air lembut
Soap form scum in soft water
III Sabun disediakan melalui hidrolisis lemak dalam keadaan alkali
Soap is prepared through the hydrolysis of fats in alkaline conditions

IV Sabun mengurangkan kebolehan air untuk membasahi permukaan kain
Soap reduces the ability of water to wet the surface of cloth

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

[Putrajaya2023-30] Antara yang berikut, pernyataan yang manakah betul tentang tindakan pencucian bagi sabun?
Which of the following statements is correct about the cleansing action of soap?

A Molekul sabun mengemulsikan air
Soap molecules emulsify water

B Menambah ketegangan permukaan sabun
Increase the surface tension of water

C Bertindak balas dengan ion Ca^{2+} membentuk garam terlarutkan
Reacts with Ca^{2+} ion to form soluble salt

D Bahagian hidrofobik molekul sabun larut dalam gris
Hydrophobic part of soap molecule dissolved in grease

[Perlis 2023-03] Antara yang berikut, yang manakah merupakan detergen?
Which of the following is a detergent?

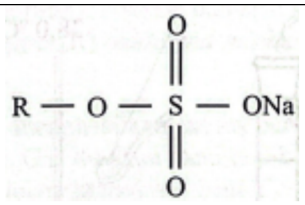
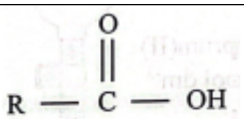
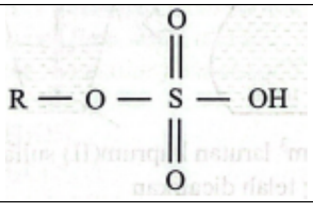
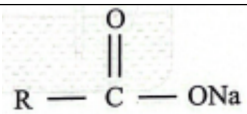
A Natrium palmitat
Sodium palmitate

B Natrium alkil sulfat
Sodium alkyl sulphate

C Kalium laurat
Potassium laurate

D Kalium oleat
Potassium oleate

[Negeri Sembilan 2023-33] Ahmad telah mencuci baju dengan menggunakan air laut dan didapati kesan kotoran masih kekal.
Antara yang berikut, formula struktur manakah menunjukkan bahan yang dapat membantu Ahmad menyelesaikan masalah ini?
Ahmad has washed his clothes using sea water but the dirt still remains. Which of the following structural formulae shows the substance that helps Ahmad to solve the problem?

A		B	
C		D	

[MRSM2023-28] Aida telah mencuci baju dengan menggunakan sabun dan air telaga namun kesan kotoran masih kekal. Antara pernyataan berikut, yang manakah menerangkan dengan tepat situasi itu?
Aida has washed her clothes by using soap and water from a well, but the dirt remains. Which of the following statements best described the situation?

A Terdapat ion Ca^{2+} dan ion Mg^{2+} dalam air telaga
There are Ca^{2+} ions and Mg^{2+} ions in the well water

B Terdapat ion Na^{+} dan ion K^{+} dalam sabun
There are Na^{+} ions and K^{+} ions in the soap

C Pembentukan garam yang terlarutkan
The formation of soluble salts

D Kepekatan anion sabun kekal tidak berubah
The concentration of soap anions remain unchanged

[Johor Bahru 2023-31] Ali telah menggunakan agen pencuci X yang mengandungi anion $CH_3(CH_2)_{16}COO^-$ bagi mencuci pakaiannya semasa perkhemahan di tepi sungai. Didapati dia memerlukan agen pencuci yang banyak semasa membasuh pakaiannya. Apakah yang perlu Ali lakukan untuk mengalasi masalah ini?
Ali used cleansing agent X that contains $CH_3(CH_2)_{16}COO^-$ anions to wash his clothes during camping by a river. It was found that he needed a lot of the cleansing agent X when washing his clothes. What does Ali need to do to overcome this problem?

A Menggunakan air panas semasa membasuh
Use hot water when washing

B Memasukkan garam ke dalam air/ *Add salt into water*

C Merendamkan pakaian lebih lama/ *Soak the clothes for a longer time*

D Menggantikan agen pencuci X dengan detergen
Replace cleansing agent X with detergent

[Pahang JUJ Set 2 2023-28] Siva mencuci bajunya menggunakan sabun dan air laut semasa mengikuti perkhemahan badan beruniform di sekolahnya. Dia mendapati bajunya tidak bersih kerana terdapat mendakan putih yang terbentuk. Apakah kation yang membentuk mendakan putih tersebut?
Siva washed his shirt using soap and sea water when he joined his school uniform unit camping. He found that his shirt is not cleaned because there was white precipitate formed. What is the cation that forms the white precipitate?

A Ca^{2+} B Cu^{2+} C Na^{+} D NH_4^{+}

[Kedah2023-24] Ali mengalami kemalangan kecil menyebabkan sikunya terluka. Kemeja putih yang dipakainya dicemari darah. Antara berikut yang manakah contoh bahan tambah dalam detergen yang boleh menanggalkan kesan darah tersebut?
Ali had a minor accident that injured his elbow. The white shirt he was wearing was stained with blood. Which of the following is an example of an additive in detergent that can remove the blood stains.

A Protease
Protease

B Natrium perborat
Sodium perborate

C Alkil monoetanolamida
Alkyl monoethanolamide

D Natrium karboksilmetilselulosa
Sodium carboxylmethylcellulose

5.3 Bahan tambah makanan

[Selangor2023 Set 1-07] Aiskrim mengandungi minyak dan air yang tidak bercampur. Antara bahan tambah makanan berikut, yang manakah ditambah untuk mengatasi keadaan ini?
Ice cream contains oil and water that do not mix. Which of the following food additive is added to overcome the situation?

A Pengemulsi
Emulsifiers

B Antioksida
Antioxidants

C Pemekat
Thickeners

D Penstabil
Stabilisers

[SBP2023-15] Sorbitol adalah contoh bahan tambah makanan.
Antara yang berikut, bahan manakah yang mempunyai fungsi yang sama seperti sorbitol?
Sorbitol is an example of food additive.
Which of the following substances has the same function as sorbitol?

A Mononatrium glutamat
Monosodium glutamate

B Asid askorbik
Ascorbic acid

C Monogliserida
Monoglycerides

D Gam akasia
Acacia gum

[Perlis 2023-12] Apakah bahan kimia yang ditambah untuk menghalang makanan daripada menjadi tengik?
What are the chemical substances added to prevent food from becoming rancid?

A Pengantioksida
Antioxidant

B Penstabil
Stabiliser

C Pewarna
Dye

D Pemekat
Thickener

[Pahang 2023-13] Apakah jenis bahan tambah makanan bagi asid askorbik?
What are the types of food additives for ascorbic acid?

A Pengawet
Preservatives

B Pengantioksida
Antioxidants

C Penstabil
Stabilisers

[Pahang JUJ Set 2 2023-12] Pada kebiasaannya, asid askorbik ditambah ke dalam roti dan jem. Antara berikut, yang manakah merupakan fungsi utamanya?
Ascorbic acid is usually added to bread and jams. Which of the following is its main function?

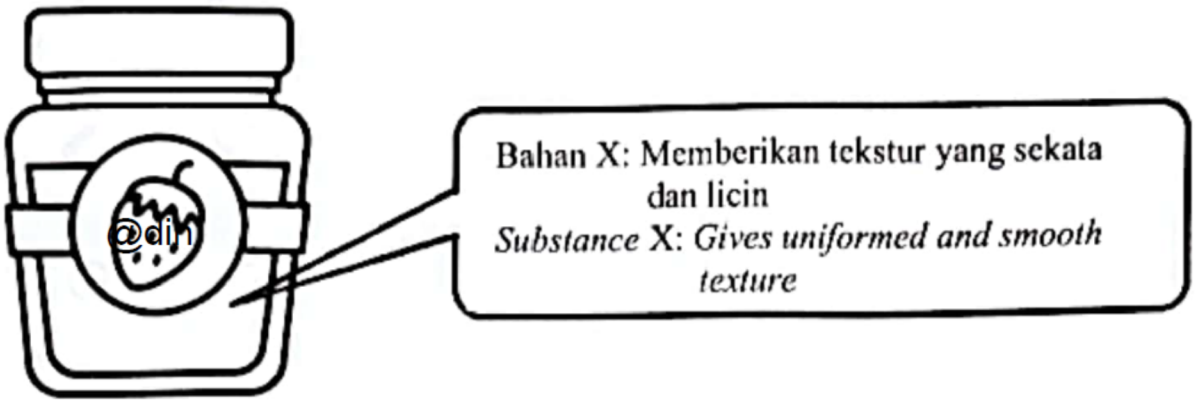
A Menambahkan rasa makanan
Enhances the taste of the food

B Bertindak sebagai bahan penstabil
Acts as a stabiliser

C Bertindak sebagai bahan antioksida
Acts as an antioxidant

D Memberi warna yang menarik kepada makanan
Gives a nice colour to the food

[Johor Bahru 2023-23]Rajah 4 menunjukkan bahan X yang ditambah dalam pembuatan jem.
Diagram 4 shows substance X that is added in the making of jam.



Apakah X? / *What is X?*

A Pektin
Pectin

C Gelatin
Gelatine

B Gula
Sugar

D Monogliserida
Monoglycerides

5.4 Ubat-ubatan dan bahan kosmetik

[Selangaor2023 Set 01-25] Antara berikut, yang manakah penggunaan yang betul ginseng (Panax ginseng) dalam perubatan tradisional?
Which of the following are the correct usages of ginseng (Panax ginseng) in traditional medicine?

I Mencegah selesema
Prevents flu

II Membantu memanaskan badan
Helps keep the body warm

III Membina pertahanan badan terhadap jangkitan
Builds immunity against infections

IV Merendahkan tekanan darah dan paras kolesterol
Lowers blood pressure and cholesterol levels

A I dan II
I and 11

C III dan IV
III and IV

B II dan III
II and III

D I dan IV
I and IV

[Kedah2023-09] Rajah di bawah merupakan sejenis tumbuhan yang digunakan dalam perubatan tradisional.
Diagram below is a type of plant used in traditional medicine.

Antara berikut yang manakah kegunaan tumbuhan tersebut?
Which of the following is the use of the plant?

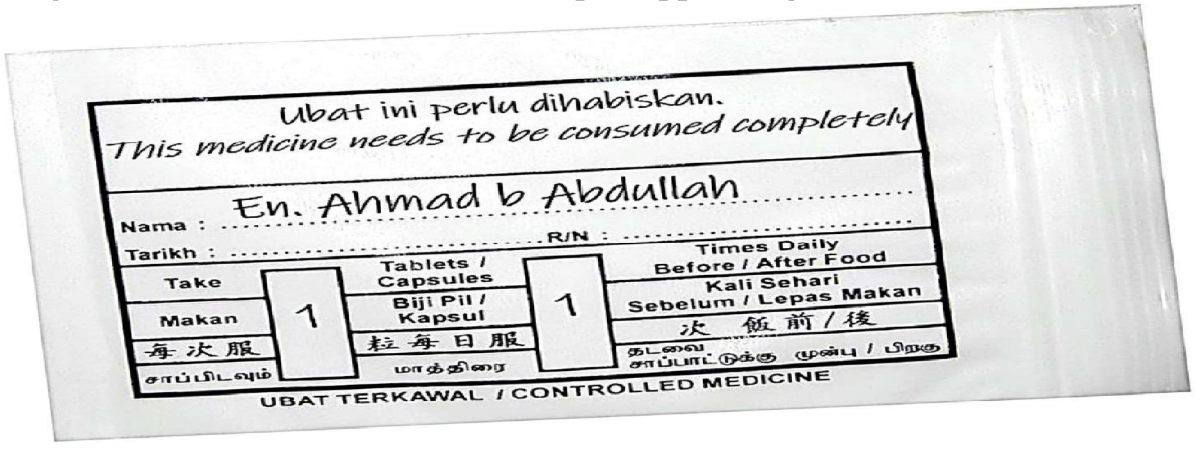
A Merawat kurap
Treat ringworm

C Menurunkan tekanan darah
Lower blood pressure

B Mencegah selesema
Prevents flu

D Melegakan luka akibat melecur
Relieves bums wound

[Kelantan 2023-07] Rajah 3 menunjukkan sampul ubat yang dibekalkan oleh doktor kepada En. Ahmad.
Diagram 3 shows the medicine envelope supplied by the doctor to Mr. Ahmad.



Berdasarkan arahan yang diberikan pada sampul ubat, apakah jenis ubat yang diberikan kepada En. Ahmad?
Based on the instruction given on the medicine envelope, what type of medicine was given to Mr. Ahmad?

A. Antimikrob
Antimicrobials

C. Analgesik
Analgesics

B. Antialergi
Anti allergies

D. Kortikosteroid
Corticosteroids

[Selangor2023 Set 1-25] Maklumat berikut adalah mengenai sejenis ubat.
The following information is about a type of drug.

• Melegakan sakit dalam keadaan sedar
Relieves pain in conscious state

• Bersifat asid/ *Acidic*

• Menyebabkan ulser perut pada kanak-kanak
Causes stomach ulcer on children

Antara berikut, yang manakah ubat yang dinyatakan?
Which of the following is the specified drug?

A Kodeina
Codeine

C Klozapin
Clozapine

B Antibiotik
Antibiotics

D Aspirin
Aspirin

[Melaka 2023-39] Rajah 11 menunjukkan satu situasi yang memerlukan penggunaan ubat moden.
Diagram 11 shows a situation that requires the use of modern medicine.

Antara yang berikut, ubat manakah yang sesuai untuk digunakan dalam situasi itu?
Which of the following medicine is suitable to use in that situation1?

A Streptomisin
Streptomysin

C Etanol
Ethanol

B Hidrogen peroksida
Hydrogen peroxide

D Klozapin
Chlozapine

[Pahang JUJ Set 1 2023-29] Rajah 14 menunjukkan perbualan dua rakan sekolah mengenai ubat yang diberi oleh doktor.
Diagram 14 shows a conversation between two schoolmates about the medicine given by the doctor.

Apakah nama ubat R dan ubat T?/ *What is the name of medicine R and T?*

	Ubat R/ *Medicine R*	Ubat T/ *Medicine T*
A	Parasetamol/ *Paracetamol*	Penisilin/ *Penicillin*
B	Penisilin/ *Penicillin*	Parasetamol/ *Paracetamol*
C	Parasetamol/ *Paracetamol*	Kodeina/ *Codeine*
D	Kodeina/ *Codeine*	Parasetamol/ *Paracetamol*

[MRSM2023-14] Rajah 6 menunjukkan seorang budak lelaki mengalami kegatalan kulit akibat alahan.
Diagram 6 shows a boy suffering skin rashes due to allergic reaction.

Antara ubat berikut, manakah yang sesuai untuk merawat alahan tersebut?
Which of the following medicine is suitable to treat the allergic reaction?

A Kodeina
Codeine

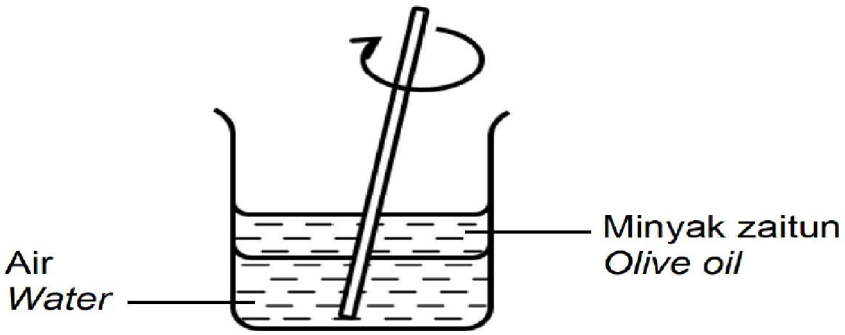
B Haloperidol
Haloperidol

C Antihistamin
Antihistamine

D Parasetamol
Paracetamol

Kosmetik

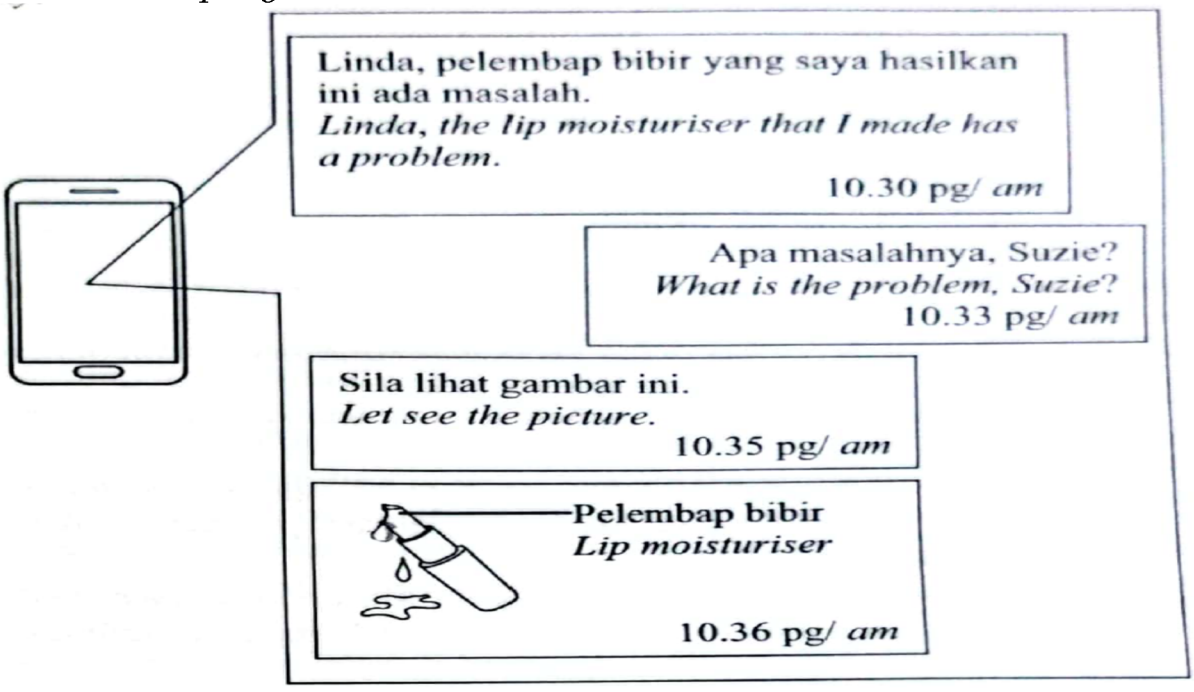
[Kelantan 2023-23] Ain cuba mencampurkan minyak zaitun dengan air sebagai bahan asas penyediaan kosmetik menggunakan bahan semula jadi. Rajah 8 menunjukkan air dan minyak zaitun tidak bercampur dengan sebati.
Ain tried to mix olive oil with water as a basic ingredient in the preparation of cosmetics using natural ingredients. Diagram 8 shows that water and olive oil do not mix well.



Apakah bahan yang sesuai digunakan oleh Ain untuk memastikan kedua-dua bahan asas tersebut bercampur sebati.
What is the appropriate material used by Ain to ensure that the two basic ingredients are mixed well.

A. Lesitin/*Lecithin*
B. Gliserin/ *Glycerin*
C. Paraben/*Parabens*
D. Formaldehid/ *Formaldehyde*

[SBP2023-30] Rajah 8 menunjukkan tangkap layar mesej perbualan dua orang rakan sekerja di sebuah syarikat kosmetik.
Diagram 8 shows a screenshot chat messages between two collegues in a cosmetic company.



Antara yang berikut, apakah bahan yang perlu ditambah pada pelembap bibir untuk mengatasi masalah itu?
Which of the following substances need to be added to the lip moisturiser to overcome the problem?
A Formaldehid untuk mendapatkan campuran yang sekata antara bahan-bahan
Formaldehyde to obtain homogeneous mixture of the ingredients

B Asid stearik untuk mengelakkannya daripada kerosakan
Stearic acid to prevent it from spoilage

C Natrium laktat untuk mengekalkan kelembapannya
Sodium lactate to retain its moisture

D Gliserin untuk mengentalkan strukturnya
Glycerin to thicken its structure

[Kedah2023-40] Rania ingin menghasilkan satu produk kecantikan. Berikut merupakan beberapa ciri-ciri produk yang ingin dihasilkan.
Rania wants to produce a beauty product. The following arr somr of the features of the product to be produced.

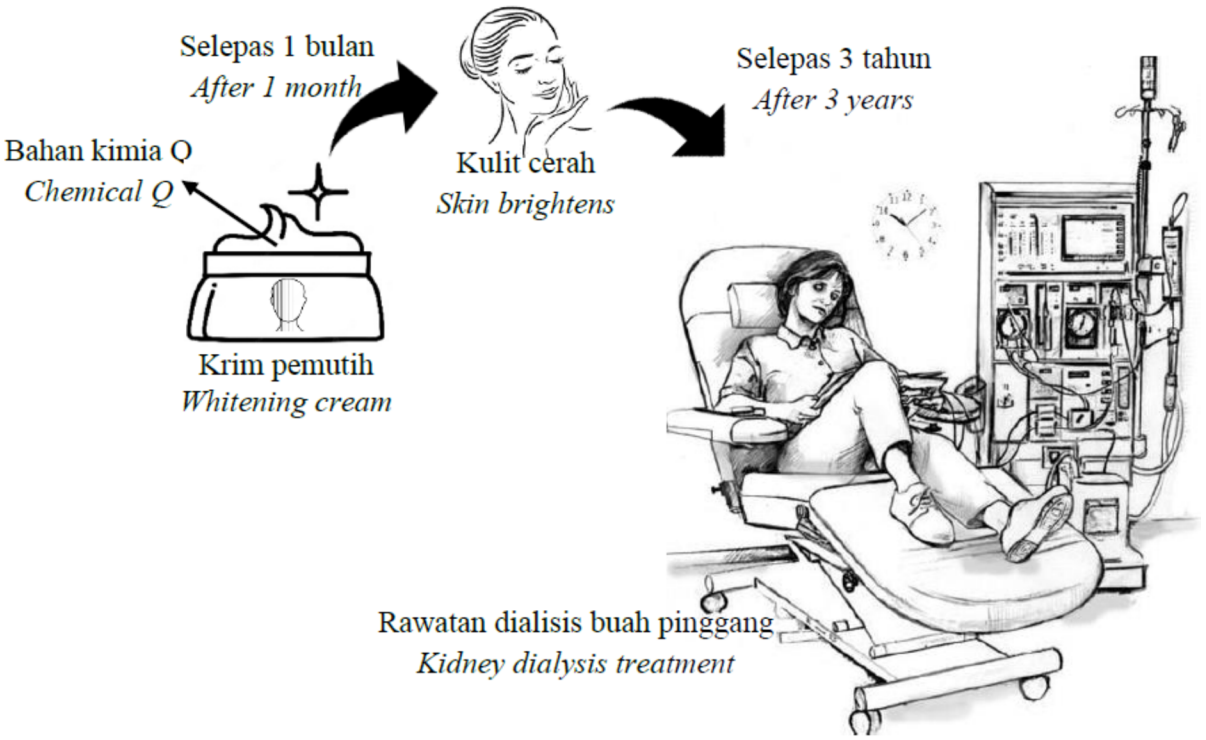
Berdasarkan ciri-ciri di atas, yang manakah bahan asas kosmetik yang terlibat dalam penghasilan produk tersebut?
Based on the characteristic above, which are the basic cosmetic ingredients involved in the production of the product?
A Pelembab, pewarna, pemekat dan air
Moisturizer, dye, thickener and water

B Pelembab, pengawet, pengemulsi dan air
Moisturizer, preservative, emulsifier and water

C Pelembab, pemekat, pengemulsi, pewangi
Moisturizer, thickener, emulsifier and fragrance

D Pelembab, pewangi, pengawet, pengemulsi
Moisturizer, fragrance, preservative and emulsifier

[Pahang 2023-29] Rajah 9 menunjukkan kesan buruk utama akibat penggunaan bahan kimia terlarang Q dalam produk kecantikan seperti krim pemutih.
Diagram 9 shows the main adverse effects of using harmful chemical Q in beauty products such as whitening cream.



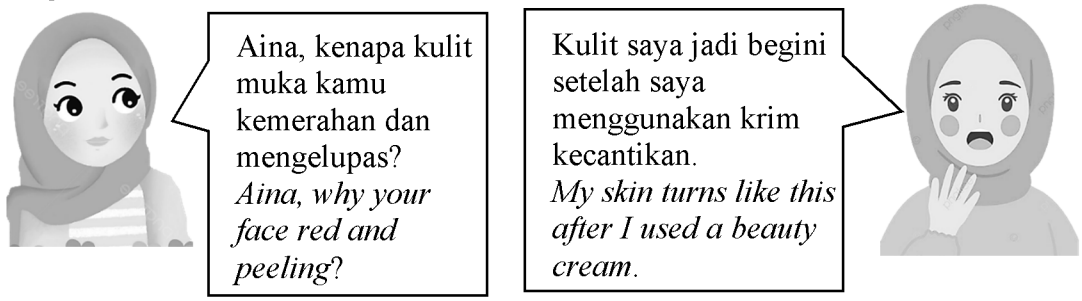
Apakah bahan kimia Q yang terdapat dalam krim pemutih tersebut?
What is the chemical Q found in the whitening cream?

A Merkuri
Mercury

B Hidrokuinon
Hydroquinone

C Betamethasone valerate
Betamethasone valerate

[Putrajaya2023-15] Rajah 4 menunjukkan perbualan antara Mira dan Aina
Diagram 4 shows a conversation between Mira and Aina.



Apakah bahan kimia terlarang yang terkandung di dalam krim kecantikan yang digunakan oleh Aina?
What is the harmful chemicals contained in the beauty cream used by Aina?

A Merkuri
Mercury

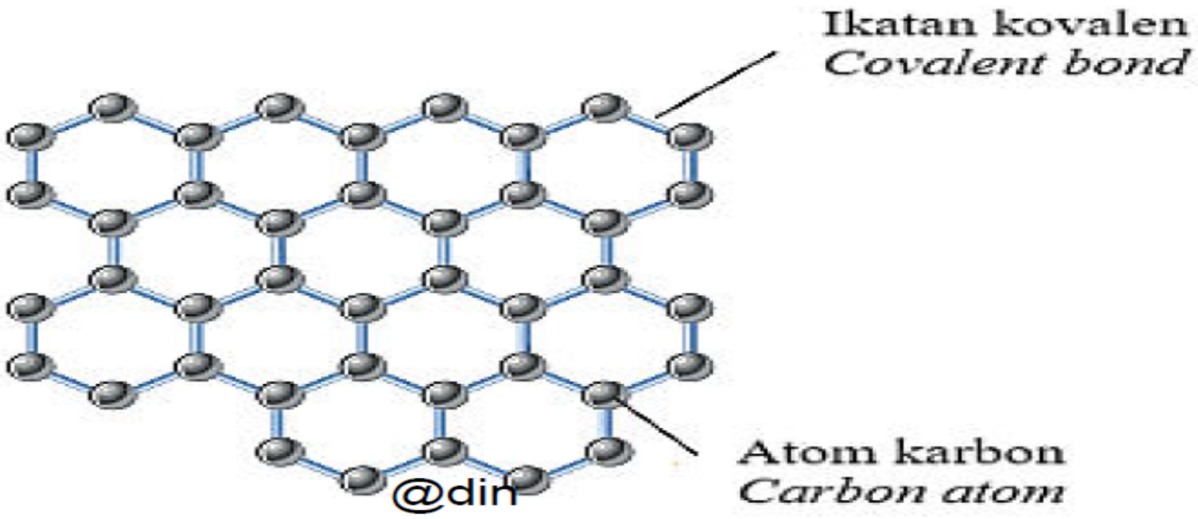
C Hidrokuinon
Hydroquinone

B Tretinoin
Tretinoin

D Betamethasone valerate
Betamethasone valerate

5.5 Aplikasi nanoteknologi dalam industri

[Johor PPD Tangkak 2023 29] Rajah 15 di bawah menunjukkan Helaian X. Saiznya yang sangat kecil menjadikannya bahan yang sangat penting dalam bidang nanoteknologi.
Diagram 15 below shows Sheet X. Its very small size makes it a very important material in the field of nanotechnology.



Rajah 15/ *Diagram 15*

Antara berikut , yang manakah ciri yang betul tentang X.
Which of the following is true about X.

A Tidak kenyal
Non elastic

B Lutsinar
Transparent

C Telap
Permeable

D Rintangan elektrik yang sangat tinggi
Very high electrical resistance

5.6 Aplikasi Teknologi Hijau dalam pengurusan sisa industry

[Negeri Sembilan 2023-20] Apakah definisi bagi nanoteknologi?
What is the meaning of nanotechnology?

A Pembangunan bahan atau peranti dengan memanfaatkan ciri-ciri zarah nano
Development of substances or gadgets using the properties of nanoparticles.

B Kajian pengolahan bahan-bahan pada skala nano iaitu antara 1 nanometer hingga 100 nanometer
Study on processing of substances at nanoscale that are between 1 nanometre to 100 nanometres

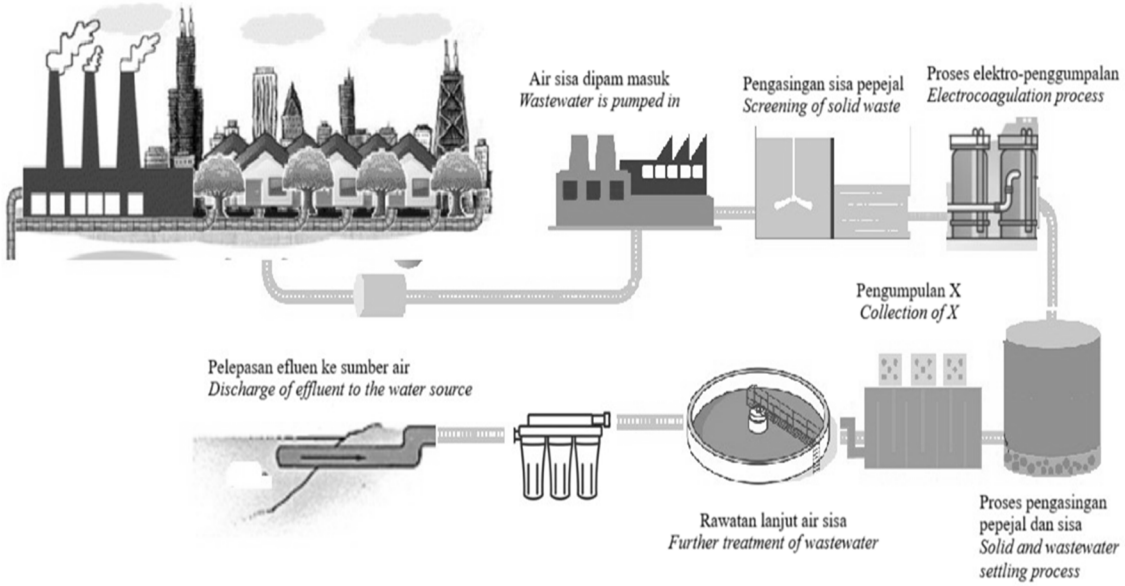
C Bidang kejuruteraan yang memfokuskan kajian, perkembangan dan penapisan bahan pada skala yang sangat kecil
The engineering field focused on the study, development and refinement of materials at a very small scale

[Kedah2023-14] Grafen merupakan alotrop bagi karbon selain berlian dan grafit. Grafen merupakan bahan yang penting dalam bidang nanosains dan nanoteknologi. Antara berikut kegunaan grafen manakah yang dipadankan dengan betul?
Graphene is an allotrope of carbon other than diamond and graphite. Graphene is an important material in the field of nanoscience and nanotechnology. Which of the following use of graphene is correctly matched?

	Bidang *Field*	Kegunaan dalam bidang nanoteknologi *Uses In the field of nanotechnology*
A	Elektronik *Electronics*	Sensor *Sensors*
B	Bioperubatan *Biomedicine*	Penurasan air *Water filtration*
C	Tenaga *Energy*	Superkapasitor *Supercapacitor*
D	Polimer dan komposit *Polymers and composites*	Konduktor yang unggul *Excellent conductor*

[Perlis 2023-28] Rajah 8 menunjukkan proses rawatan air sisa.

Diagram 8 shows wastewater treatment process.



Pilih pernyataan yang betul untuk menerangkan hasil X?
Choose the correct statement to explain the product of X?

A Air sisa mengandungi akrilonitril, toluena dan metilbenzena.
Wastewater consists of acrylonitrile, toluene and methylbenzene.

B Bahan enapcemar setelah dirawat dengan betul boleh digunakan sebagai baja dalam sektor pertanian.
After proper treatment, sludge can be used as fertilizers for the agriculture sector.

C Air sisa dapat digunakan untuk pengairan tanaman.
Wastewater that has been treated can be reused for crop irrigation.

D Air sisa disingkirkan sebagai efluen.
Wastewater can be discharged as effluent.

[SBP2023-26] Antara yang berikut, amalan manakah yang tidak menyokong konsep teknologi hijau untuk meminimakan kesan negatif kepada alam sekitar?
Which of the following practices does not support green technology concept to minimise the negative impact to environment?

A Penggunaan tenaga nuklear sebagai sumber alternatif
Usage of nuclear energy as alternative sources

B Penggunaan bekas makanan diperbuat daripada sabut kelapa
Usage of food container made from coconut husk

C Penggunaan sisa domestik sebagai baja air
Usage of domestic waste as water fertiliser

D Penggunaan kenderaan gas asli

Usage of natural gas vehicle

[Terengganu2023-22] Rajah 22 menunjukkan sejenis produk daripada sebuah kilang. *Diagram 22 shows a type of product from a factory.* 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