

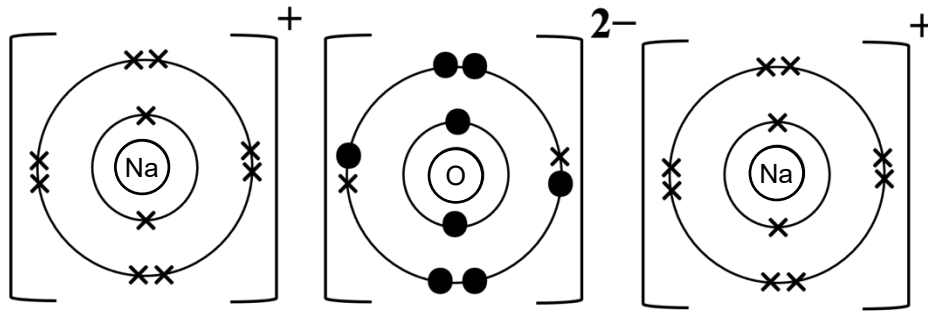
Bahagian A**Section A** aDin

Jawab semua soalan dalam bahagian ini

Answer all questions in this section.

- 1 Rajah 1 menunjukkan gambar rajah susunan elektron bagi sebatian yang terbentuk antara ion natrium, Na^+ dan ion oksida, O^{2-} .

Diagram 1 shows the electron arrangement for the compound formed between sodium ion, Na^+ and oxide ion, O^{2-} .



Rajah 1/ Diagram 1

- (a) Berdasarkan Rajah 1, nyatakan jenis ikatan bagi sebatian yang terbentuk .
Based on Diagram 1, state the type of bond for the compound formed.

.....
[1 markah/ mark]

- (b) Tuliskan formula kimia bagi sebatian tersebut.
Write the chemical formula for the compound.

.....
[1 markah/ mark]

- (c) Nyatakan daya tarikan yang wujud antara ion natrium, Na^+ dan ion oksida, O^{2-} .
State force of attraction that exists between sodium ion, Na^+ and oxide ion, O^{2-} .

.....
[1 markah/ mark]

- (d) Terangkan secara ringkas bagaimana sebatian dalam Rajah 1 terbentuk.
Explain briefly how the compound in Diagram 1 is formed.

.....
.....
.....
[2 markah/ marks]

2. Rajah 2 menunjukkan piala yang dimenangi oleh Azrul dalam Pertandingan Catur Peringkat Kebangsaan. Piala ini diperbuat daripada aloi X dengan komposisi utamanya ialah kuprum.

Diagram 2 shows the trophy won by Azrul in the National Chess Competition. This trophy is made of alloy X with the main composition is copper.



Rajah 2 / Diagram 2

- (a) (i) Nyatakan jenis aloi X.
State the type of alloy X.

.....
[1 markah/ mark]

- (ii) Lukis dan label susunan atom dalam aloi yang dinyatakan di a(i).
Draw and label the arrangement of atoms in the alloy stated in a(i).



[2 markah / marks]

- (b) Bumper kereta ialah salah satu bahan komposit yang bersifat ringan dan mempunyai kekuatan regangan yang tinggi.
Nyatakan bahan matriks dan bahan pengukuhan bagi bahan komposit tersebut.

Car bumpers are one of the composite materials that are lightweight and have high tensile strength.

State the matrix substance and strengthening substance for the composite substance.

Bahan matriks :

Matrix substance

Bahan pengukuhan :

Strengthening substance

[2 markah / marks]

- 3 Jadual 1 menunjukkan tiga bahan dan formula kimianya.
Table 1 shows three substances and their chemical formulae.

Bahan Substance	Formula kimia Chemical formula
Natrium <i>Sodium</i>	Na
Klorin <i>Chlorine</i>	Cl ₂
X	

Jadual 1/ *Table 1*

Berdasarkan Jadual 1:

Based on Table 1:

- (a) (i) Tandakan ✓ bagi jenis zarah yang terdapat dalam natrium.
Mark ✓ for the type of particles found in sodium.

Jenis zarah Type of particle	
Atom <i>Atom</i>	
Molekul <i>Molecule</i>	
Ion <i>Ion</i>	

[1 markah/ *mark*]

- (ii) Takat lebur klorin dan takat didih klorin masing-masing ialah -101.0°C dan -34.0°C . Apakah keadaan fizik klorin pada 27.0°C ?
Melting point and boiling point of chlorine are -101.0°C and -34.0°C respectively. What is the physical state of chlorine at 27.0°C ?

.....

[1 markah/ *mark*]

- (b) (i) Sebatian X terbentuk apabila natrium bertindak balas dengan klorin.
 Tuliskan persamaan kimia bagi tindak balas tersebut.
Compound X is formed when sodium reacts with chlorine.
Write a chemical equation for the reaction.

.....

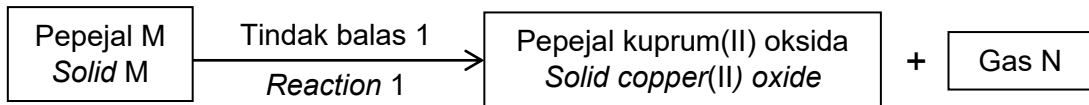
[2 markah/ *marks*]

- (ii) Hitungkan jisim natrium yang diperlukan untuk bertindak balas dengan lengkap dengan 2 mol klorin.
[Jisim molar X = 58 g mol⁻¹]
Calculate the mass of sodium needed to completely reacts with 2 mol of chlorine.
[Molar mass X = 58 g mol⁻¹]

[2 markah/ marks]

5. Rajah 4 menunjukkan penguraian pepejal M kepada pepejal kuprum(II) oksida dan gas N.

Diagram 4 shows the decomposition of solid M to solid copper(II) oxide and gas N.



Rajah 4 / Diagram 4

- (a) (i) Nyatakan warna kuprum(II) oksida.
State the colour of copper(II) oxide.

.....
[1 markah/ mark]

- (ii) Kenal pasti Pepejal M.
Identify Solid M.

.....
[1 markah/ mark]

- (b) (i) Bagaimanakah Tindak balas 1 dilakukan?
How Reaction 1 is carried out?

.....
[1 markah/ mark]

- (ii) Tuliskan persamaan kimia yang seimbang bagi tindak balas ini.
Write a balanced chemical equation for this reaction.

.....
[1 markah/ mark]

- (iii) Lukis gambar rajah berlabel bagi Tindak balas 1.
Draw a labelled diagram for Reaction 1.

- (c) Huraikan secara ringkas ujian pengesahan bagi gas N.
Describe briefly confirmatory test for gas N.

.....

.....

[2 markah/ *marks*]

- 6 Jadual 2 menunjukkan maklumat bagi dua set eksperimen yang telah dijalankan untuk mengkaji faktor yang mempengaruhi kadar tindak balas.

Table 2 shows the information on two sets of experiments that were conducted to study the factor that affects the rate of reaction.

Eksperimen <i>Experiment</i>	Bahan tindak balas <i>Reactants</i>	Masa untuk tanda 'X' hilang dari penglihatan (s) <i>Time taken for the mark 'X' to disappear from the sight (s)</i>
I	100 cm ³ larutan natrium tiosulfat 0.5 mol dm ⁻³ + asid nitrik 1.0 mol dm ⁻³ berlebihan pada 40 °C. 100 cm ³ of 0.5 mol dm ⁻³ <i>sodium thiosulphate solution</i> + 1.0 mol dm ⁻³ <i>excess nitric acid at 40 °C.</i>	50
II	100 cm ³ larutan natrium tiosulfat 0.5 mol dm ⁻³ + asid nitrik 1.0 mol dm ⁻³ berlebihan pada 60 °C. 100 cm ³ of 0.5 mol dm ⁻³ <i>sodium thiosulphate solution</i> + 1.0 mol dm ⁻³ <i>excess nitric acid at 60 °C.</i>	30

Jadual 2 / Table 2

- (a) Apakah maksud kadar tindak balas?

What is meant by rate of reaction?

.....

[1 markah/ mark]

- (b) Mengapakah hasil campuran tindak balas ini bertukar menjadi keruh?

Why does the product of the mixture in this reaction turns cloudy?

.....

[1 markah/ mark]

- (c) (i) Hitungkan kadar tindak balas bagi Eksperimen I:

Calculate the rate of reaction for Experiment I

.....

[1 markah/ mark]

- (ii) Tuliskan persamaan ion bagi tindak balas dalam eksperimen tersebut.
Write a balanced ionic equation for the reaction in the experiment.

.....
[2 markah/ marks]

- (b) (i) Ramalkan masa yang diambil untuk tanda 'X' hilang dari penglihatan sekiranya larutan natrium tiosulfat berkepekatan 1.0 mol dm^{-3} digunakan dalam Eksperimen II tanpa mengubah suhu dan isipadu yang sama.
Predict the time taken for mark 'X' to disappear from sight if sodium thiosulphate with concentration 1.0 mol dm^{-3} solution in Experiment II is used without changing the temperature and volume.

.....
[1 markah/ mark]

- (ii) Terangkan jawapan anda di b(i) menggunakan teori pelanggaran.
Explain your answer in b(i) using collision theory.

.....
.....
.....
[3 markah/ marks]

- 7 (a) Rajah 5 menunjukkan kesan tindakan pencucian agen pencuci A dan B ke atas pakaian yang kotor akibat terkena kuah kari.

Diagram 5 shows the effect of cleaning agents A and B on clothes stained by curry sauce.

Set Set	Susunan radas Apparatus set-up	Pemerhatian Observation
I	 Air laut + agen pencuci A Sea water + cleaning agent A Kuah kari Curry sauce	
II	 Air laut + agen pencuci B Sea water + cleaning agent B Kuah kari Curry sauce	

aDin

Rajah 5 / Diagram 5

- (i) Pembentukan kekat berlaku apabila air laut bertindak balas dengan agen pencuci A.

Nyatakan nama **dua** ion di dalam air laut yang menyebabkan pembentukan kekat.

The formation of scum occurs when sea water reacts with cleaning agent A.

*State the name of **two** ions in sea water that cause scum formation.*

.....
[1 markah /mark]

- (ii) Berdasarkan rajah 5, nyatakan jenis agen pencuci B.

Based on diagram 5, state the type of cleaning agent B.

.....
[1 markah/ mark]

- (b) Jadual 3 menunjukkan keputusan apabila larutan X dan larutan Y ditambah ke dalam lateks selepas ditinggalkan selama 15 minit.

Table 3 shows the results when solution X and solution Y were added to the latex after leaving it for 15 minutes.

Set Set	Keputusan Result
Lateks + larutan X <i>Latex + solution X</i>	Lateks menggumpal <i>Latex coagulate</i>
Lateks + larutan Y <i>Latex + solution X</i>	Lateks tidak menggumpal <i>Latex not coagulate</i>

Jadual 3 / Table 3

Cadangkan larutan X dan larutan Y. Terangkan perbezaan bagi kedua-dua set.

Suggest solution X and solution Y. Explain the differences between the two sets.

.....

.....

.....

[3 markah/ marks]

- (c) Jadual 4 menunjukkan tiga jenis kosmetik beserta kegunaannya.

Table 4 shows three types of cosmetics along with their uses.

Jenis kosmetik Types of cosmetics	Kegunaan Uses
R	Untuk memberikan haruman <i>To give fragrance</i>
Kosmetik rias <i>Makeup cosmetics</i>	S
T	Untuk merawat badan <i>To treat the body</i>

Jadual 4 / Table 4

Berdasarkan Jadual 4, tuliskan jawapan bagi R, S dan T.

Based on Table 4, write the answers for R, S and T.

R :

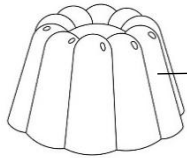
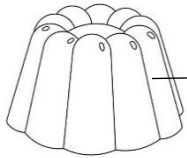
S :

T :

[3 markah/ marks]

- (d) Puan T bercadang ingin membeli puding bagi majlis sambutan hari jadi anaknya. Rajah 6 menunjukkan jenis pewarna yang digunakan bagi puding yang dijual di dua buah kedai.

Mrs. T plans to buy pudding for her son's birthday party. Diagram 6 shows the types of coloring used for pudding sold in two shops.

 Pewarna hijau Green dye	 Jus daun pandan Pandan leaf juice
Kedai A Shop A	Kedai B Shop B

Rajah 6 / Diagram 6

Wajarkan pilihan yang boleh dibuat oleh Puan T. Berikan sebab.

Justify the choices that Mrs. T can make. Give a reason.

.....

.....

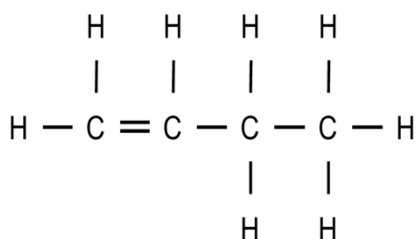
.....

[2 markah/ marks]

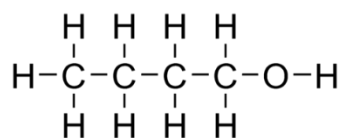


8. Rajah 7 menunjukkan formula struktur bagi tiga sebatian karbon, sebatian A, sebatian B dan sebatian C.

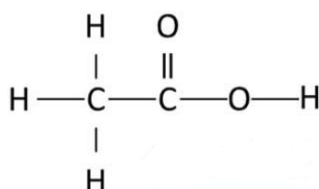
Diagram 7 shows the structural formula for three carbon compounds, compounds A, B and C.



Sebatian A
Compound A



Sebatian B
Compound B



Sebatian C
Compound C

Rajah 7/ Diagram 7

- (a) Apakah yang dimaksudkan dengan sebatian karbon?
What is meant by carbon compound?

.....
[1 markah/ mark]

- (b) Nyatakan kumpulan berfungsi bagi sebatian A.
State the functional group for compound A.

.....
[1 markah/ mark]

- (c) Sebatian A boleh ditukarkan kepada sebatian B melalui proses I.
Compound A can be converted to compound B through process I.

- (i) Nyatakan nama bagi proses I.
State the name for process I.

.....
[1 markah/ mark]

- (ii) Nyatakan satu keadaan yang perlu digunakan untuk menjalankan proses I.

State one condition that must be used to carry out process I.

.....

[1 markah/ mark]

- (iii) Lukiskan formula struktur bagi satu isomer sebatian A.

Draw the structural formula for one isomer of compound A.

[1 markah/ mark]

- (d) Sebatian B terbakar dengan nyalaan biru.

Compound B burns with a blue flame.

- (i) Tuliskan persamaan kimia bagi pembakaran sebatian itu.

Write the chemical equation for the combustion.

.....

[2 markah/ mark]

- (ii) Sebatian B dan sebatian C boleh bertindak balas untuk menghasilkan satu sebatian karbon lain yang kurang tumpat daripada air.

Compounds B and C can be reacted to form a carbon compound that is less dense than water.

Huraikan secara ringkas bagaimana tindak balas itu dapat dijalankan di dalam makmal.

Describe briefly how the reaction can be carried out in the laboratory.

.....

.....

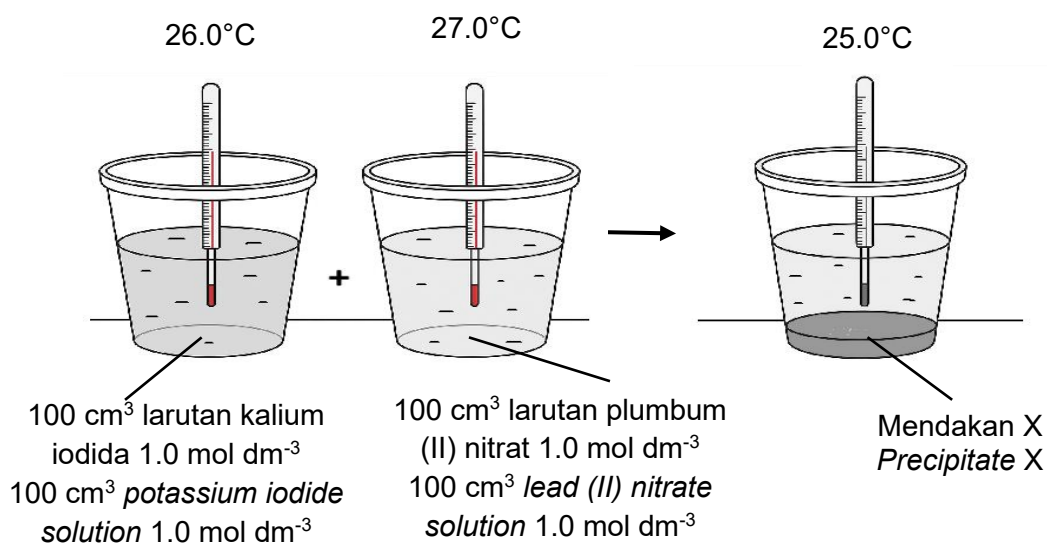
.....

[3 markah/ marks]

Bahagian B
Section B
 [20 markah]

Jawab **satu** soalan sahaja dari bahagian ini.
*Answer only **one** question from this section.*

- 9 Rajah 8 menunjukkan suatu set eksperimen yang dijalankan oleh pelajar untuk menentukan haba pemendakan bagi mendakan X.
Diagram 8 shows a set of experiments carried out by students to determine the heat of precipitation for precipitate X.



Rajah 8 / *Diagram 8*

Berdasarkan Rajah 8,
Based on Diagram 8,

- (a) (i) Apakah yang dimaksudkan dengan haba pemendakan? Tuliskan formula kimia bagi kalium iodida.
What is meant by heat of precipitation? Write the chemical formula of potassium iodide.
- [2 markah/ marks]
- (ii) Nyatakan jenis tindak balas di atas. Apakah warna mendakan X?
State the type of the reaction. What is the color of precipitate X?
- [2 markah/ marks]

- (b) Tuliskan persamaan ion bagi tindak balas tersebut. Hitung haba pemendakan bagi mendakan X dalam eksperimen itu.

[Diberi muatan haba tentu bagi larutan ialah $C = 4.2 \text{ Jg}^{-1} \text{ }^{\circ}\text{C}^{-1}$; ketumpatan larutan = 1 g cm^{-3}]

Write the ionic equation for the reaction. Calculate the heat of precipitation for precipitate X in the experiment.

[Given the specific heat capacity of solution is $C = 4.2 \text{ Jg}^{-1} \text{ }^{\circ}\text{C}^{-1}$; density of solution = 1 g cm^{-3}]

[6 markah/ marks]

- (c) Jadual 5 menunjukkan maklumat tentang tiga jenis bahan api yang boleh digunakan untuk pemanasan domestik semasa aktiviti perkhemahan.

Table 5 shows information about three types of fuel that can be used for domestic heating during camping activities.

Bahan <i>Substance</i>	Formula kimia Chemical formula	Haba pembakaran (kJ mol^{-1}) Heat of combustion (kJ mol^{-1})
Butana / <i>Butane</i>	C_4H_{10}	2877
Kerosin / <i>Kerosene</i>	$\text{C}_{12}\text{H}_{26}$	6100
Gasolin / <i>Gasoline</i>	C_8H_{18}	5460

Jadual 5/ *Table 5*

Berdasarkan Jadual 5, pilih bahan yang terbaik untuk digunakan dari segi nilai bahan api dan terangkan jawapan anda. Tunjukkan langkah pengiraan untuk menyokong pilihan itu. Tuliskan persamaan kimia bagi pembakaran bahan tersebut.

Based on Table 5, choose the best substance to use in terms of fuel value and explain your answer. Show the calculation steps to support your choice. Write the chemical equation for the combustion of the substance.

[Jisim atom relatif/ *Relative atomic mass*, C=12, H=1]

[10 markah/ marks]

- 10 (a) Rajah 9.1 menunjukkan perbualan antara seorang ibu dan anaknya.
Diagram 9.1 shows a conversation between a mother and her daughter.



Rajah 9.1/Diagram 9.1

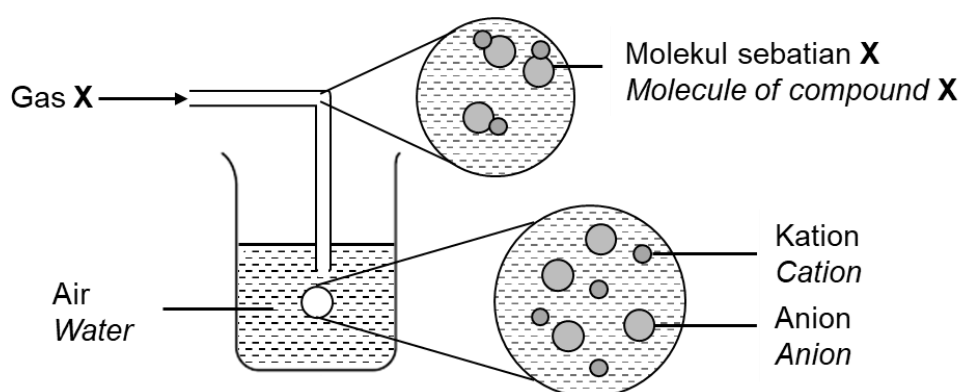
Berdasarkan Rajah 9.1 nyatakan maksud alkali. Nyatakan ion yang menyebabkan sifat alkali bagi sabun.

Based on Diagram 9.1, state the meaning of alkali. State the ion that causes the alkaline properties of soap.

[2 markah/ marks]

- (b) Rajah 9.2 menunjukkan gambar rajah pengionan asid X dalam air yang terbentuk daripada gas X.

Diagram 9.2 shows the ionisation of acid X in water, formed from gas X.



Rajah 9.2/Diagram 9.2

- (i) Kenal pasti asid X. Nyatakan kation dan anion bagi asid itu.
Identify acid X. State the cation and anion for the acid.

[2 markah/ marks]

- (ii) Jika kepekatan asid X ialah 0.1 mol dm^{-3} , hitungkan nilai pH bagi asid X.
If the concentration of acid X is 0.1 mol dm^{-3} , calculate the pH value of acid X.

[2 markah/ marks]

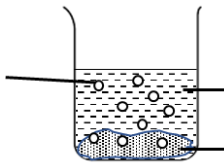
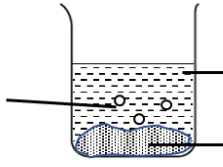
- (c) Sengatan obor-obor adalah beralkali dan menyebabkan kesakitan. Cadangkan satu bahan yang boleh disapu pada kulit tanpa menyebabkan kecederaan seterusnya. Terangkan jawapan anda.

The sting of a jelly-fish is alkaline and causes pain. Suggest one substance that can be applied to the skin without causing further injury. Explain your answer.

[4 markah/ marks]

- (d) Rajah 9.3 menunjukkan pemerhatian bagi tindak balas antara dua jenis asid dan serbuk magnesium dalam dua eksperimen.

Diagram 9.3 shows the observations on reaction between two types of acids and magnesium powder in two experiments.

Eksperimen <i>Experiment</i>	Pemerhatian <i>Observation</i>
I	Gelembung gas <i>Gas bubble</i>  Asid hidroklorik <i>Hydrochloric acid</i> Serbuk magnesium <i>Magnesium powder</i>
II	Gelembung gas <i>Gas bubble</i>  Asid P <i>Acid P</i> Serbuk magnesium <i>Magnesium powder</i>

Rajah 9.3/*Diagram 9.3*

Berdasarkan maklumat dalam Rajah 9.3, cadangkan asid P dan kenal pasti gas yang terhasil. Terangkan perbezaan pemerhatian antara Eksperimen I dan Eksperimen II.

Based on the information in Diagram 9.3, suggest acid P and identify the gas produced. Explain the difference in observations between Experiment I and II.

[5 markah/ marks]

- (e) Jadual 6 menunjukkan nilai pH bagi dua asid dengan kepekatan yang sama.
Table 6 shows the pH value of two acids with the same concentration.

Asid Acid	Kekuatan asid Strength of acid	Nilai pH pH value
Y	Asid kuat <i>Strong acid</i>	2.0
Z	Asid kuat <i>Strong acid</i>	1.0

Jadual 6/*Table 6*

Dengan menggunakan satu contoh yang dinamakan bagi setiap asid, terangkan perbezaan nilai pH antara asid Y dan asid Z.

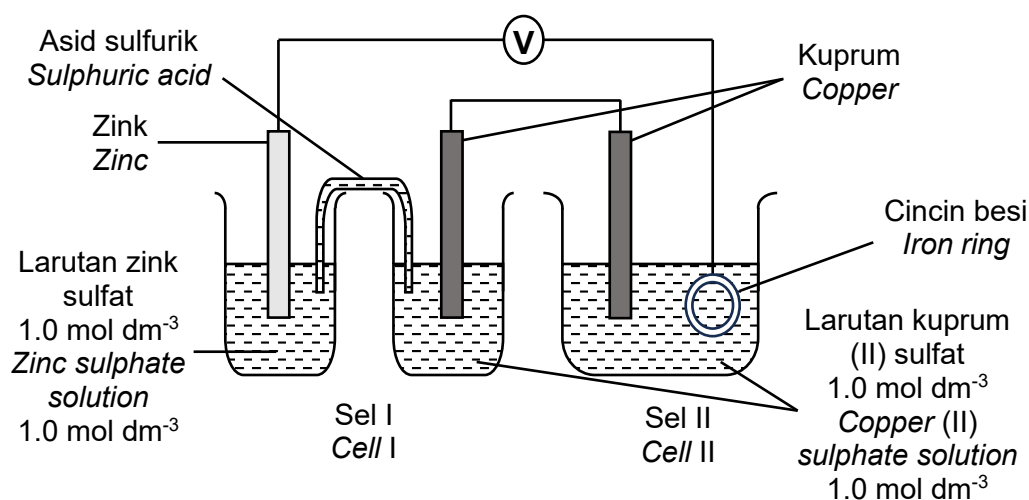
Using one named example for each acid, explain the difference in pH value between acid Y and acid Z.

[5 markah/ *marks*]

Bahagian C Section C

Jawab semua soalan dibahagian ini
Answer all questions in this section

11. (a) Rajah 10.1 menunjukkan satu susunan radas yang digunakan untuk menyadurkan sebuah cincin besi yang telah berkarat.
Diagram 10.1 shows an apparatus setup used to electroplate a rusted iron ring.



Rajah 10.1/ Diagram 10.1

Jadual 7 menunjukkan nilai keupayaan elektrod piawai bagi beberapa jenis ion
Table 7 shows part of the standard electrode potential value for a few ions.

Tindak balas sel setengah Reaction of half-cell	E^0 (V) (298K)
$\text{Zn}^{2+} + 2\text{e}^- \rightleftharpoons \text{Zn}$	-0.76
$2\text{H}^+ + 2\text{e}^- \rightleftharpoons \text{H}_2$	0.00
$\text{Cu}^{2+} + 2\text{e}^- \rightleftharpoons \text{Cu}$	+ 0.34
$\text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^- \rightleftharpoons 4\text{OH}^-$	+ 0.40
$\text{S}_2\text{O}_8^{2-} + 2\text{e}^- \rightleftharpoons 2\text{SO}_4^{2-}$	+ 2.01

Jadual 7/ Table 7

Berdasarkan Sel I,
Based on Sel I,

- (i) Nyatakan fungsi bagi larutan asid sulfurik cair. Tentukan terminal negatif sel I dan berikan satu sebab bagi jawapan anda.

State the function of dilute sulphuric acid. Determine the negative terminal of Sel I and give a reason for your answer.

[3 markah/ marks]

- (ii) Tuliskan notasi sel bagi sel itu dan hitungkan nilai E^0_{sel} yang terhasil.

Write the cell notation for the cell and calculate the E^0_{cell} produced.

[4 markah/ marks]

(iii) Berdasarkan Sel II dan Jadual 7, terangkan tindak balas yang berlaku di katod dari segi:

- Ion-ion yang tertarik
- Ion yang dipilih untuk diturunkan dan sebab
- Pemerhatian
- Setengah persamaan

Based on Cell II and Table 7, explain the reactions that occurred at cathode based on:

- *Ions attracted*
- *Ion chosen to be reduced and reasons*
- *Observation*
- *Half equation*

[5 markah/ marks]

(b) Rajah 10.2 menunjukkan perbualan antara dua orang pelajar mengenai satu tindak balas kimia yang berlaku pada sebuah kapal.

Diagram 10.2 shows the conversation between two students about chemical reaction that occurred to a ship.



Rajah 10.2/ Diagram 10.2

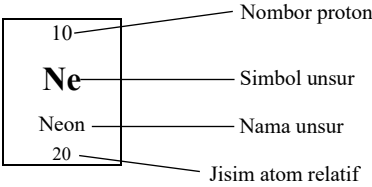
Berdasarkan Rajah 10.2, huraikan satu kaedah yang boleh dijalankan dalam makmal, dengan menggunakan radas dan bahan yang sesuai untuk membuktikan pernyataan di atas.

Based on Diagram 10.2, describe a method that can be carried out in the laboratory, using suitable apparatus and materials, to prove the statement given.

[8 markah/ marks]

JADUAL BERKALA UNSUR

1 H Hidrogen 1																	2 He Helium 4
3 Li Litium 7	4 Be Berilium 9											5 B Boron 11	6 C Karbon 12	7 N Nitrogen 14	8 O Oksigen 16	9 F Florin 19	10 Ne Neon 20
11 Na Natrium 23	12 Mg Magnesium 24											13 Al Aluminium 27	14 Si Silikon 28	15 P Fosforus 31	16 S Sulfur 32	17 Cl Klorin 35	18 Ar Argon 40
19 K Kalium 39	20 Ca Kalsium 40	21 Sc Skandium 45	22 Ti Titanium 48	23 V Vanadium 51	24 Cr Kromium 52	25 Mn Mangan 55	26 Fe Ferum 56	27 Co Kobalt 59	28 Ni Nikel 59	29 Cu Kuprum 64	30 Zn Zink 65	31 Ga Gallium 70	32 Ge Germanium 73	33 As Arsenic 75	34 Se Selenium 79	35 Br Bromin 80	36 Kr Krypton 84
37 Rb Rubidium 86	38 Sr Strontium 88	39 Y Itrium 89	40 Zr Zirkonium 91	41 Nb Niobium 93	42 Mb Molibdenum 96	43 Tc Teknetium 98	44 Ru Rutenium 101	45 Rh Rodium 103	46 Pd Palladium 106	47 Ag Argentum 108	48 Cd Kadmium 112	49 In Indium 115	50 Sn Stanum 119	51 Sb Antimoni 122	52 Te Telurium 128	53 I Iodin 127	54 Xe Xenon 131
55 Cs Sesium 133	56 Ba Barium 137	57 La Lantanum 139	72 Hf Hafnium 179	73 Ta Tantalum 181	74 W Tungsten 184	75 Re Renium 186	76 Os Osmium 190	77 Ir Iridium 192	78 Pt Platinum 195	79 Au Aurum 197	80 Hg Merkuri 201	81 Tl Taliun 204	82 Pb Plumbum 207	83 Bi Bismut 209	84 Po Polonium 210	85 At Astatin 210	86 Rn Radon 222
87 Fr Fransium 223	88 Ra Radium 226	89 Ac Actinium 227	104 Rf Rutherfordium 257	105 Db Dubium 262	106 Sg Siborgium 266	107 Bh Bohrium 264	108 Hs Hassium 269	109 Mt Meitnerium 278	110 Ds Darmstadtium 281	111 Rg Roengenium 280	112 Cn Kuprunisium 285	113 Nh Nihonium 286	114 Fl Flerovium 289	115 Mc Moskovium 289	116 Lv Livermorium 293	117 Ts Tenesin 294	118 Og Oganesson 294



58 Ce Serium 140	59 Pr Praseo- dimium 141	60 Nd Neodimium 144	61 Pm Prometium 147	62 Sm Samarium 150	63 Eu Europium 152	64 Gd Gadolinium 157	65 Tb Terbium 159	66 Dy Disprosium 163	67 Ho Holmium 165	68 Er Erbium 167	69 Tm Tulium 169	70 Yb Iterbium 173	71 Lu Lutetium 175
90 Th Torium 232	91 Pa Proaktinium 231	92 U Uranium 238	93 Np Neptunium 237	94 Pu Plutonium 244	95 Am Amerisium 243	96 Cm Kurium 247	97 Bk Berkelium 247	98 Cf Kalifornium 249	99 Es Einsteinium 254	100 Fm Fermium 253	101 Md Mendeleeveium 256	102 No Nobelium 254	103 Lr Lawrensium 257

THE PERIODIC TABLE OF ELEMENTS

23

1 H Hydrogen 1																	2 He Helium 4
3 Li Lithium 7	4 Be Beryllium 9											5 B Boron 11	6 C Karbon 12	7 N Nitrogen 14	8 O Oxygen 16	9 F Fluorine 19	10 Ne Neon 20
11 Na Sodium 23	12 Mg Magnesium 24											13 Al Aluminium 27	14 Si Silicon 28	15 P Phosphorus 31	16 S Sulphur 32	17 Cl Chlorine 35	18 Ar Argon 40
19 K Potassium 39	20 Ca Calcium 40	21 Sc Scandium 45	22 Ti Titanium 48	23 V Vanadium 51	24 Cr Chromium 52	25 Mn Manganese 55	26 Fe Iron 56	27 Co Cobalt 59	28 Ni Nickel 59	29 Cu Copper 64	30 Zn Zink 65	31 Ga Gallium 70	32 Ge Germanium 73	33 As Arsenic 75	34 Se Selenium 79	35 Br Bromine 80	36 Kr Krypton 84
37 Rb Rubidium 86	38 Sr Strontium 88	39 Y Yttrium 89	40 Zr Zirconium 91	41 Nb Niobium 93	42 Mb Molybdenum 96	43 Tc Technetium 98	44 Ru Ruthenium 101	45 Rh Rhodium 103	46 Pd Palladium 106	47 Ag Argentum 108	48 Cd Cadmium 112	49 In Indium 115	50 Sn Tin 119	51 Sb Antimoni 122	52 Te Tellurium 128	53 I Iodin 127	54 Xe Xenon 131
55 Cs Caesium 133	56 Ba Barium 137	57 La Lanthanum 139	72 Hf Hafnium 179	73 Ta Tantalum 181	74 W Tungsten 184	75 Re Rhenium 186	76 Os Osmium 190	77 Ir Iridium 192	78 Pt Platinum 195	79 Au Gold 197	80 Hg Mercury 201	81 Tl Thalium 204	82 Pb Lead 207	83 Bi Bismuth 209	84 Po Polonium 210	85 At Astatine 210	86 Rn Radon 222
87 Fr Francium 223	88 Ra Radium 226	89 Ac Actinium 227	104 Rf Rutherfordium 257	105 Db Dubium 262	106 Sg Seaborgium 266	107 Bh Bohrium 264	108 Hs Hassium 269	109 Mt Meitnerium 278	110 Ds Darmstadtium 281	111 Rg Roentgenium 280	112 Cn Copernicium 285	113 Nh Nihonium 286	114 Fl Flerovium 289	115 Mc Moscovium 289	116 Lv Livermorium 293	117 Ts Tennessine 294	118 Og Oganesson 294

10

Ne

Neon

20

Proton number

Element's symbol

Element's name

Relative atomic mass

58 Ce Cerium 140	59 Pr Praseo- dimium 141	60 Nd Neodymium 144	61 Pm Promethium 147	62 Sm Samarium 150	63 Eu Europium 152	64 Gd Gadolinium 157	65 Tb Terbium 159	66 Dy Dysprosium 163	67 Ho Holmium 165	68 Er Erbium 167	69 Tm Thulium 169	70 Yb Ytterbium 173	71 Lu Lutetium 175
90 Th Thorium 232	91 Pa Protactinium 231	92 U Uranium 238	93 Np Neptunium 237	94 Pu Plutonium 244	95 Am Americium 243	96 Cm Curium 247	97 Bk Berkelium 247	98 Cf Californium 249	99 Es Einsteinium 254	100 Fm Fermium 253	101 Md Mendelevium 256	102 No Nobelium 254	103 Lr Lawrencium 257