Koleksi Soalan Kemahiran Mengeksperimen Dalam Kimia Ting 4 & 5

Disusun oleh:
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To Excel in Chemistry is to Love Chemistry

Chapter 4 : The Periodic Table of Elements
Bab 4 : Jadual Berkala Unsur

1. [SPM 2008]

The three statements below describe the observation made when three elements react with water.
The elements are in Group 1 of the Periodic Table of Elements.
Tiga penyataan bawah menghuraikan pemerhatian yang dibuat apabila tiga unsure bertindak balas dengan air. Unsur-unsur itu adalah dalam kumpulan 1 Jadual Berkala Unsur.

Statement 1
Lithium, Li, moves slowly at random on the surface of the water with a little fizzing. The water then turns red litmus paper to blue.
Penyataan 1
Lithium, Li, bergerak perlahan-lahan secara rawak di atas permukaan air dengan menghasilkan desiran. Air itu kemudian menukarkan kertas litmus merah kepada biru.

Statement 2
Sodium, Na, moves rapidly at random on the surface of the water with a 'hissing' sound. The water then turns red litmus paper to blue.
Penyataan 2
Natrium, Na, bergerak pantas secara rawak di atas permukaan air dengan menghasilkan bunyi 'hiss'. Air itu kemudian menukarkan kertas litmus merah kepada biru.

Statement 3
Potassium, K, moves very rapidly at random on the surface of the water. It ignites with a lilac flame with a 'pop' and a 'hissing' sound. The water then turns red litmus paper to blue.
Penyataan 3
Kalium, K, bergerak sangat pantas secara rawak di atas permukaan air. Ia menyala dengan nyalaan ungu muda serta menghasilkan bunyi 'pop' dan 'hiss'. Air itu kemudiaan menukarkan kertas litmus merah kepada biru.

Plan a laboratory experiment to investigate the reactivity of lithium, sodium and potassium with water.
Rancang satu eksperimen makmal untuk mengkaji kereaktifan litium, natrium dan kalium dengan air.

Your planning should include the following aspects :
Perancangan anda hendaklah mengandungi aspek aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujian* :
To compare the reactivity of Group 1 elements with water.
Untuk membandingkan kereaktifan unsur-unsur Kumpulan 1 apabila bertindak balas dengan air.

Problem statement / *Pernyataan masalah*:
How does reactivity of alkali metals change when react with water?
Bagaimanakah kereaktifan logam alkali berubah apabila bertindak balas dengan air?

Variables / *Pemboleh ubah* :

Manipulated: Elements of Group 1// Li, Na, K
Dimanipulasi : Unsur-unsur Kumpulan 1 / Li, Na, K

Responding: Reactivity of alkali metals
Bergerakbalas :Kereaktifan logam alkali

Constant: Temperature/ Size of alkali metals / Volume of water
Dimalarkan: Suhu/ Saiz logam / Isi padu air

Hypothesis / *Hipotesis* :
The lower the position of metal in Group 1, the more reactive is the metal in reaction with water.
Semakin rendah kedudukan logam dalam Kumpulan 1, semakin reaktif logam itu dalam bertindak balas dengan air.

Materials / *Bahan* :
lithium, sodium, potassium, water
litium, natrium, kalium, air

Apparatus / *Radas* :
knife, forceps, water trough, filter paper
pisau, forseps, besen, kertas turas

Procedure:/ *Prosedur*:
1. Fill the water trough with water
   Isikan besen dengan air.
2. Cut a small piece of lithium using knife and forceps.
   Potong secebis kecil litium dengan menggunakan pisau dan forsep.
3. Dry the lithium using filter paper.
   Keringkan litium menggunakan kertas turas.
4. Place the lithium on the surface of the water.
   Letakkan litium di atas permukaan air.
5. Record all the changes/ observations.
   Rekod semua perubahan/ pemerhatian.
6. Repeat steps 1 -5 using sodium and potassium.
   Ulang langkah 1-5 menggunakan natrium dan kalium.

Tabulation of data / *Penjadualan Data* :

Elements *Unsur*	Observations *Pemerhatian*
Lithium	
Sodium	
Potassium	

2. Table 1 shows the observation when three elements of Group 1 react with oxygen gas.
Jadual 1 menunjukkan pemerhatian apabila tiga unsur-unsur Kumpulan 1 bertindakbalas dengan gas oksigen.

Element ***Unsur***	**Observation** ***Pemerhatian***
Li	Lithium burns slowly with a red flame. A white solid produced. *Litium terbakar dengan perlahan-lahan dengan nyalaan merah.* *Pepejal putih terhasil.*
Na	Sodium burns quickly with a yellow flame. A white solid produced. *Natrium terbakar dengan cepat dengan nyalaan kuning.* *Pepejal putih terhasil.*
K	Potassium burn very vigorously with a purple flame. A white solid produced. *Kalium terbakar dengan sangat cergas dengan nyalaan ungu.* *Pepejal putih terhasil.*

Table 1/*Jadual 1*

Plan a laboratory experiment to investigate the reactivity of lithium, sodium and potassium with oxygen.
Rancang satu eksperimen dalam makmal untuk mengkaji kereaktifan litium, natrium dan kalium dengan oksigen.

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

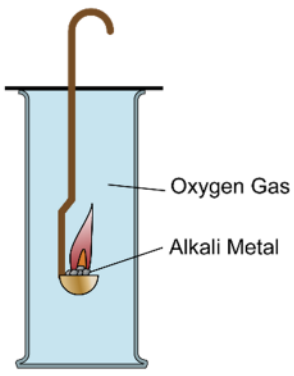
(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]



Aim / *Tujuan* :
To compare the reactivity of Group 1 elements with oxygen.
Untuk membandingkan kereaktifan unsur-unsur Kumpulan 1 apabila bertindak balas dengan oksigen.

Problem statement / *Penyataan masalah*:
How does reactivity of alkali metals change when whwn they react with oxygen?
Bagaimanakah kereaktifan logam alkali berubah apabila bertindak balas dengan oksigen?

Variables / *Pemboleh ubah* :

Manipulated: Elements of Group 1// Li, Na, K
Dimanipulasi : Unsur-unsur Kumpulan 1 / Li, Na, K

Responding: Reactivity of alkali metals // The brightness of flame when metal react with oxygen.
Bergerak balas : Kereaktifan logam alkakli // Kecerahan nyalaan apabila logam bertindak balas dengan oksigen

Constant: Size of metals //Volume of oxygen
Dimalarkan : Saiz logam // Isi padu oksigen

Hypothesis / *Hipotesis* :
The lower the position of metal in Group 1, the more reactive is the metal in reaction with oxygen.
Semakin rendah kedudukan logam dalam Kumpulan 1, semakin reaktif logam itu dalam bertindak balas dengan oksigen.

Materials / *Bahan* :
lithium, sodium, potassium, oxygen gas
litium, natrium, kalium, gas oksigen

Apparatus / *Radas* :
small knife, forceps, gas jar, gas jar spoon, filter paper
pisau kecil, forseps, balang gas, sudu balang gas, kertas turas

Procedure:
1. Cut a small piece of lithium using a knife and forceps.
2. Dry the oil on the surface of the lithium with filter paper.
3. Place the lithium in a gas jar spoon using forceps.
4. Heat the lithium until it starts to burn.
5. Put the burning lithium quickly into a gas jar filled with oxygen.
6. Record the observations.
7. Repeat the experiment using sodium and potassium

***Prosedur*:**
1. *Potong secebis kecil litium dengan menggunakan pisau dan forseps.*
2. *Keringkan minyak pada permukaan litium menggunakan kertas turas.*
3. *Letakkan litium itu pada sudu balang balang gas dengan mengunakan forseps.*
4. *Panaskan litium itu sehingga terbakar.*
5. *Letakkan litium yang terbakar itu dengan cepat ke dalam balang gas yang berisi oksigen.*
6. *Rekodkan pemerhatian*
7. *Ulang ekperimen dengan menggunakan natrium dan kalium.*

Tabulation of data / *Penjadualan data*:

Elements ***Unsur***	**Observations** ***Pemerhatian***
Lithium / *Litium*	
Sodium / *Natrium*	
Potassium / *Kalium*	

Chapter 5 : Chemical Bonds
Bab 5 : Ikatan Kimia

1. Ionic compound dissolve in water but most covalent compound does not dissolve in water. Sodium chloride is an example of ionic compound and glucose solution is covalent compound that dissolve in water.
Sebatian ion melarut di dalam air tetapi kebanyakkan sebatian kovalen tidak larut di dalam air. Natrium klorida, NaCl ialah satu contoh sebatian ion dan larutan glukosa pula adalah satu contoh sebatian kovalen yang melarut di dalam air.

Diagram 1 shows a conversation between two students about the conductivity of an ionic compound and carbon compound in water.
Rajah 1 menunjukkan perbualan di antara dua orang pelajar mengenai kekonduksian sebatian ion dan sebatian kovalen di dalam air.

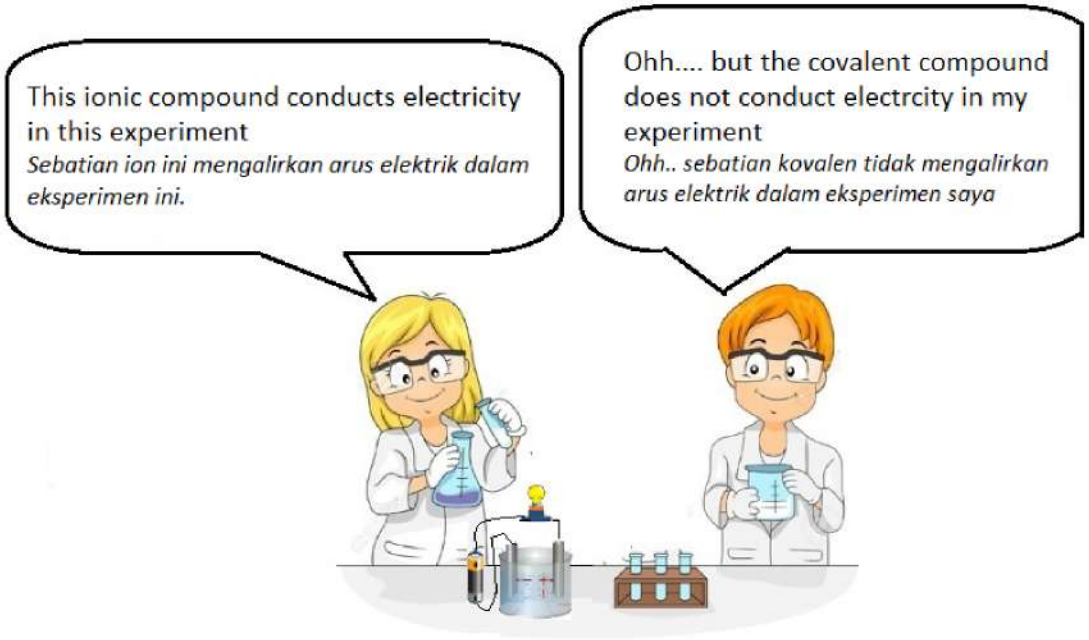


Diagram 1 / *Rajah 1*

Referring to the above conversation, plan a laboratory experiment to determine the conductivity of an ionic and covalent compound in water.
Merujuk kepada perbualan di atas, rancang satu eksperimen makmal untuk menentukan kekonduksian satu sebatian ion dan sebatian kovalen di dalam air

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

(a) Problem statement/ *Pernyataan masalah:*

Di antara sebatian ion atau sebatian kovalen, yang manakah mengalirkan arus elektrik di dalam air?

(b) All the variables/*Semua pembolehubah:*

Manipulasi : Jenis sebatian

Bergerak balas : kekonduksian elektrik

Dimalarkan : Jenis pelarut

(c) Hypothesis/*Hipotesis*

[Sebatian ion] mengalirkan arus elektrik manakala [sebatian kovalen] tidak mengalirkan arus elektrik

(d) List of materials and apparatus/ *Senarai bahan dan radas*

*Radas : Bateri, wayar penyambung, mentol / **galvanometer/mentol/ammeter**, elektrod karbon, bikar*

Bahan :larutan [glukosa], larutan [natrium klorida].

(e) Procedure /*Prosedur*

1. *Tuang larutan glukosa ke dalam sebuah bikar*
2. *Celupkan elektrod karbon ke dalam larutan*
3. *Sambungkan elektrod karbon kepada bateri dan **galvanometer / mentol / ammeter***
4. *Catatkan pemerhatian*
5. *Ulangi eksperimen dengan menggunakan larutan natrium klorida*

(f) Tabulation of data/*Penjadualan data*

Jenis larutan	Pemerhatian
Larutan glukosa	
Larutan natrium klorida	

Sodium chloride
Natrium klorida

Distilled water
Air suling

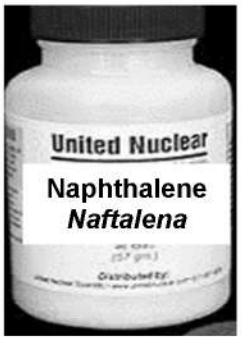


Diagram 2/*Rajah 2*

2. Based on the substances given in Diagram 2, plan one laboratory experiment to compare the property of ionic and covalent compounds in terms of its solubility.
Berdasarkan bahan-bahan yang diberikan dalam Rajah 2, rancang satu eksperimen makmal untuk membandingkan sifat sebatian ion dan sebatian kovalen dari segi keterlarutannya.

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

(a) Problem statement/ *Pernyataan masalah:*
Are ionic compound / covalent compound soluble in water?

(b) All the variables/*Semua pembolehubah:*
Manipulated : Ionic compound and covalent compound
Responding : Solubility in water
Fixed : Volume water

(c) Hypothesis/*Hipotesis*
Ionic compound soluble in water while covalent compound in soluble in water.

(d) List of materials and apparatus/ *Senarai bahan dan radas*
Materials : Sodium chloride, Naphthalene, Propanone, Water
Apparatus : Beaker// Test tube// Boiling tube, Spatula, Stirrer//Glass rod

(e) Procedure /*Prosedur*
1. *Pour 20 cm^3 of water into a beaker.*
2. *Put 2 g sodium chloride powder into the beaker.*
3. *Stir the mixture.*
4. *Record the observation*
5. *Repeat the steps 1 to 4 using naphthalene.*

(f) Tabulation of data/*Penjadualan data*

Substance	Observation
Sodium chloride	
Napthalene	

Chapter 6: Electrochemistry
Bab 6 : Elektrokimia

1. **[Trial Kelantan 2017]**
Rajah 1 menunjukkan perbualan antara seorang guru dengan muridnya.

Berdasarkan situasi tersebut, rancang satu eksperimen makmal untuk mengkaji kesan kepekatan elektrolit terhadap hasil elektrolisis pada elektrod anod. Perancangan anda hendaklah mengandungi aspek-aspek berikut;

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan* :
To investigate the effect of concentration of ions on the selective discharge of ions at the electrodes of aqueous hydrochloric acid.
Untuk mengkaji kesan kepekatan ion terhadap pemilihan ion untuk dinyahcas pada elektrod dalam asid hidroklorik akueus.

Problem statement / *Pernyataan masalah*:
How does the concentration of ions in hydrochloric acid affect the discharge of ions at the anode?
Bagaimanakah kepekatan ion dalam asid hidroklorik mempengaruhi pemilihan ion untuk dinyahcas pada anod?

Variables / *Pemboleh ubah*:
Concentration of chloride ions
Manipulated:……
Dimanipulasi
Ions discharged at the anode
Responding: ……
Bergerak balas
Type of electrolyte
Constant: ……..
Dimalarkan

Hypothesis / *Hipotesis*:
When the concentration of chloride ion is higher, then the chloride ion will be selectively discharged at the anode.

Materials / *Bahan* :
1.0 mol dm³ hydrochloric acid and 0.001 mol dm³ hydrochloric acid.

Apparatus / *Radas* :
Batteries, carbon electrodes, connecting wires with crocodile clips, ammeter, electrolytic cell, test tubes, blue litmus paper, wooden splinter, switch and matches.

Procedure/ *Prosedur* :
1. *An electrolytic cell is filled with 1.0 mol dm³ hydrochloric acid until it is half full.*
2. *The circuit is completed by connecting the electrodes to the switch, ammeter and batteries.*
3. *The switch is turned on.*
4. *Any observation is recorded.*
5. *The gases produced at the anode and the cathode are collected and tested with a moist blue litmus paper and a burning wooden splinter.*
6. *The experiment is repeated using 0.001 mol dm³ hydrochloric acid.*
7. *The gases produced at anode and cathode are collected and tested with a glowing wooden splinter and burning wooden splinter.*

Tabulation of data / *Penjadualan data* :

Electrolyte	*Anode*	*Cathode*
1.0 mol dm³ hydrochloric acid		
0.001 mol dm-³ hydrochloric acid		

2. Diagram 2 shows the conversation between two students about the electrolysis experiment.
Rajah 2 menunjukkan perbualan antara dua orang pelajar tentang eksperimen elektrolisis

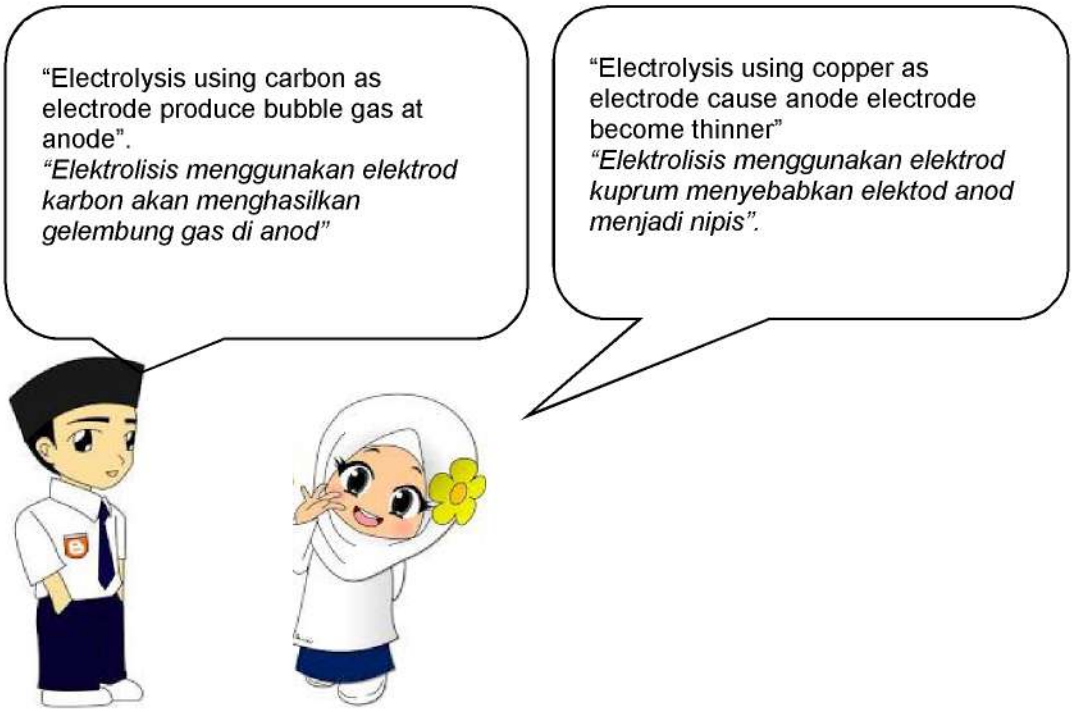


Diagram / *Rajah* 2

Referring to the conversation above, plan a laboratory experiment to investigate the effect of the type of electrode to the electrolysis of copper(II) sulphate solution.
Merujuk kepada perbualan di atas, rancang satu eksperimen makmal untuk mengkaji kesan jenis elektrod ke atas elektrolisis larutan kuprum(II) *sulfat.*

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan* :
To investigate the effect of the types of electrodes on the products of electrolysis of aqueous copper(II) sulphate solution.
Untuk mengkali kesan jenis elektrod terhadap hasil elektrolisis larutan akueus kuprum(II) sulfat.

Problem statement / *Pernyataan masalah*:
Does the type of electrode affect the type of products formed during the electrolysis?
Bagaimanakah jenis elektrod yang digunakan mempenpengaruhi hasil yang terbentuk semasa elektrolisis?

Variables / *Pemboleh ubah* :

Manipulated: Types of electrodes
Dimanipulasikan : Jenis elektrod

Responding: Product at the anode
Bergerak balas : Hasil pada anod

Constant: Type and concentration of elektrolit
Dimalarkan : Jenis dan kepekatan elektrolit
Hypothesis / *Hipotesis* :
When copper electrodes are used instead of carbon electrodes, then different products are formed at anode.
Apabila elektrod kuprum digunakan untuk mengantikan elektrod karbon, hasil yang terbentuk pada anod adalah berbeza.

Materials / *Bahan* :
0.1 mol dm³ copper(II) sulphate solution.

Apparatus / *Radas* :
Batteries, carbon electrodes, copper electrode, connecting wires with crocodile clips, ammeter, electrolytic cell, test tubes, beaker, wooden splinter, sandpaper, electronic balance, switch and matches.

Procedure/ *Prosedur* :
1. Two carbon electrodes are cleaned with sandpaper.
2. The copper(II) sulphate solution is poured into an electrolytic cell with carbon electrodes until it is half full.
3. The circuit is completed by connecting the electrodes to the ammeter, batteries and switch.
4. The switch is turned on for 15 minutes.
5. All observations at anode, cathode and electrolyte are recorded.
6. The gas produced at the anode is collected and tested with glowing wooden splinter.
7. The experiment is repeated using copper electrodes.

Tabulation of data / *penjaduala data* :

Electrode	Anode	Cathode	Electrolyte
Carbon			
Copper			

Electrochemical Series
Siri Elektrokimia

3. **[SPM 2007]**
Diagram 3 shows several electrochemicals cells with different voltages.
Rajah 3 menunjukkan beberapa jenis sel elektrokimia yang mempunyai voltan yang berlainan.

Diagram 3/ *Rajah 3*

Indentify the factor that influences the difference in the voltage.
Kenal pasti faktor yang mempengaruhi perbezaan voltan tersebut.

Plan a laboratory experiment to construct an electrochemical cell to determine one factor that influences in the voltage.
Rancang satu eksperimen dalam makmal untuk membina satu sel elektrokimia bagi menentukan satu faktor yang mempengaruhi perbezaan voltan.

Your planning should include the following :
Perancangan anda hendaklah mengandungi perkara-perkara berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan :*
To construct the electrochemical series based on potential differences between two metals.
Untuk membina siri elektrokimia berdasarkan beza keupayaan antara dua logam

***Problem statement / Pernyataan masalah* :**
How does the distance between two metals in the electrochmeical series affect the voltage?
Bagaimanakah jarak antara dua logam dalam siri elektrokimia mempengaruhi voltan?

Variables / *Pemboleh ubah*:

Manipulated : Pairs of metals.
Dimanipulasi : Pasangan logam

Responding : Voltage / Potential difference.
Bergerak balas : Nilai voltan / Beza keupayaan

Constant : Electrolyte // metal as the positive/ negative electrode
Dimalarkan : Elektrolit // logam sebagai elektrodl positive / negatif

Hypothesis / *Hipotesis :*
The further apart the two metals in the electrochemical series, the greater the voltage produced.
Semakin jauh jarak pasangan logam dalam siri elektrokimia, semakin besar nilai voltan dihasilkan

Materials / *Bahan* :
Dilute sulphuric acid, copper strip, lead strip, iron strip, zinc strip, aluminium strip, and sandpaper.
Asid sulfurik cair, jalur kuprum, jalur plumbum, jalur besi, jalur zink, jalur aluminium, dan kertas pasir

Apparatus / *Radas* :
Voltmeter, beaker and connecting wires with crocodile clips.
Voltmeter, bikar dan wayar penyambung dengan klip buaya

Procedure:
1. Pour the dilute sulphuric acid into a beaker until it is two-thirds full.
2. Clean the metal strips with sandpaper.
3. Dip the aluminium strip and copper strip into the dilute suplhuric acid.
4. Connect both metals to a voltmeter.
5. Record the voltmeter reading
6. Repeat the experiment by substituting aluminium strip with zinc strip, iron strip and lead strip.

Prosedur:
1. *Tuangkan asid sulfurik cair ke dalam bikar sehingga dua pertiga penuh.*
2. *Bersihkan jalur-jalur logam dengan kertas pasir.*
3. *Celupkan jalur aluminium dan jalur kuprum ke dalam asid sulfurik cair.*
4. *Sambungkan kedua-dua logam kepada voltmeter.*
5. *Catatkan bacaan voltmeter.*
6. *Ulang eksperimen dengan menggantikan jalur aluminium dengan jalur zink, jalur besi dan jalur plumbum*

Tabulation of data / *Penjadualan data*:

Pair of metals	*Potential different*	*Negative terminal*
Magnesium and copper		
Aluminium and copper		
Zinc and copper		
Iron and copper		
Lead and copper		

4. **[SPM 2016]**
Diagram 4 shows the apparatus set-up for the reaction between copper strip and silver nitrate solution.
Rajah 4 menunjukkan susunan radas bagi tindak balas antara jalur kuprum dan larutan argentum nitrat.

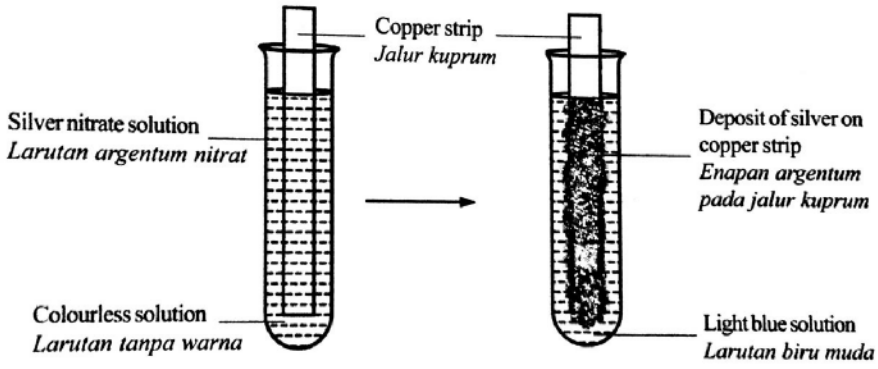


Diagram 4/*Rajah 4*

To construct an electrochemical series, the student needs to repeat the experiment by using a few different metals and suitable salt solutions.
Untuk membina satu siri elektrokimia, murid perlu mengulangi eksperimen itu dengan menggunakan beberapa jenis logam yang berbeza dan larutan garam yang sesuai.

Based on situation in Diagram 4, plan a laboratory experiment to construct the electrochemical series by using four named different metals and suitable salt solutions.
Berdasarkan situasi dalam Rajah 4, rancang satu eksperimen makmal untuk membina siri elektrokimia dengan menggunakan empat logam berbeza yang dinamakan dan larutan garam yang sesuai.

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan* :
To construct the electrochemical series based on the ability of a metal to displace another metal from its salt solution.
Untuk membina siri elektrokimia berdasarkan keupayaan logam menyesar logam lain daripada larutan garamnya.

Problem statement / *Pernyataan masalah* :
How can the electrchemical series of metals be constructed based on the displacement of metals?
Baigaimanakah siri elektrokimia logam dapat dibina berdasarkan tindak balas penyesaran logam?

Variables / *Pemboleh ubah* :
Manipulated: Type of metal
Dimanipulasi : Jenis logam

Responding: Deposition of metal
Bergerak balas : enapan logam

Fixed: Concentration of salt solution
Dimalarkan : Kepekatan larutan garam

Hypothesis / *Hipotesis*:
A more electropositive metal can displace a less electropositive metal from its salt solution
Logam yang lebih elektropositif dapat menyesarkan logam yang kurang elektropositif dari larutan garamnya

Materials / *Bahan*:
[0.1 -0.5] mol dm^3 copper(II) nitrate solution , [0.1 -0.5] mol dm^3 lead(II) nitrate solution, [0.1 -0.5] mol dm^3 iron(II) nitrate solution, [0.1 -0.5] mol dm^3 zinc nitrate solution, [0.1 -0.5] mol dm^3 magnesium nitrate solution, copper strip, lead strip, iron strip, zinc strip, magnesium ribbon,.
Larutan kuprum (II) nitrat [0.1 -0.5] mol dm^3, larutan plumbum(II) nitat [0.1 -0.5] mol dm^3, larutan ferum (II) nitat [0.1 -0.5] mol dm^3, larutan zink nitrat [0.1 -0.5] mol dm^3, larutan magnesium nitrat [0.1 -0.5] mol dm^3, jalur kuprum, jalur plumbum, jalur ferum, jalur zink dan pita magnesium

Apparatus / *Radas*:
Test tubes, sandpaper, test tubes rack
Tabung uji, kertas pasir,rak tabung uji

Procedure:
1. Filled the five test tubes with copper(II) nitrate solution respectively until they are half full.
2. Clean allmetalstrips with sandpaper.
3. Place copper strip, lead strip, iron strip, zinc strip, magnesium ribbon into each test tube
4. Record the observations
5. Repeat the experiment using lead(II) nitrate solution, iron(II) nitrate solution, zinc nitrate solution and magnesium nitrate solution to replace copper (II) nitrate solution

Prosedur:
1. *Tuangkan larutan kuprum (II) nitrat ke dalam 5 tabung uji berasigan sehingga separuh penuh.*
2. *Bersihkan semua jalur logam dengan kertas pasir.*
3. *Masukkan jalur kurprum, jalur plumbum, jalur ferum, jalur zink dan pita magnesium ke dalam setiap tabung uji.*
4. *Rekodkan pemerhatian.*
5. *Ulang ekpseriment dengan menggunakan larutan plum(II) nitrat, larutan ferum (II) nitrat, larutan zink nitrat dan larutan magnesium nitrat menggantikan larutan kurprum(II) nitrat*

Tabulation of data / *Penjadualan data*:

Metal strip	Magnesium nitrate	Zinc nitatre	Lead(II) nitrate	Copper(II) nitrate
Magnesium				
Zinc				
Lead				
Copper				

Chapter 7: Acid and Bases
Bab 7 : Asid dan Bes

1. **[SPM 2012]**
Diagram 1 shows a conversation between a teacher and her student.
Rajah 1 menunjukkan perbualan antara seorang guru dengan muridnya.

Diagram 1/*Rajah 1*

Based on the situation, plan a laboratory experiment to study the presence of water in showing the property of an alkali. Your planning should include the following aspects:
Berdasarkan situasi tersebut, rancangkan satu eksperimen makmal untuk mengkaji kehadiran air bagi menunjukkan sifat alkali. Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan* :
To investigate the role of water in showing the properties of alkalis.
Untuk mengkaji peranan air untuk menunjukkan sifat alkali.

Problem statement / *Pernyataan masalah:*
Does the presence of water show the properties of an alkali?
Adakah kehadiran air dapat sesuatu alkali menunjukkan sifatnya?

Variables / *Pemboleh ubah* :
Manipulated : Presence of water.
Dimanipulasi: Kehadiran air

Responding : Change in colour of litmus paper.
Bergerak balas : Perubahan warna kertas litmus merah

Fixed : Litmus paper.
Dimalarkan : kertas litmus

Hypothesis / *Hipotesis* :
The presence of water show an alkaline properties and absence of water does not show alkaline properties.
Kehadiran air menunjukkan sifat aklaki dan tanpa kehadiran air sifat alkali tidak ditunjukkan

Materials / *Bahan* :
Calcium hydroxide, water, red litmus paper
Kalsium hidroksida, air, kertas litmus merah

Apparatus / *Radas* :
Test tubes, spatula
Tabung uji , spatula

Procedure:
1. Put calcium hydroxide into different test tubes.
2. Pour water into one of the test tubes.
3. Shake the mixture
4. Put litmus paper into each test tubes.
5. Record the observation

Prosedur:
1. *Masukkan kalsium hidroksida ke dalam tabung uji yang berbeza.*
2. *Tuangkan air ke dalam satu daripada tabung uji.*
3. *Goncangkan campuran*
4. *Masukkan kertas litmus ke dalam setiap tabung uji.*
5. *Rekodkan pemerhatian*

Tabulation of data / *Penjadualan data*:

Alkali	Observation / *Pemerhatian*
$Ca(OH)_2$	
$Ca(OH)_2$ in water *$Ca(OH)_2$ dalam air*	

2. Diagram 2 shows two different beakers containing glacial ethanoic acid in solvent X and glacial ethanoic acid in solvent Y.
Rajah 2 menunjukkan dua bikar berbeza yang mengandungi asid etanoik glasial dalam pelarut X dan asid etanoik glasial dalam pelarut Y

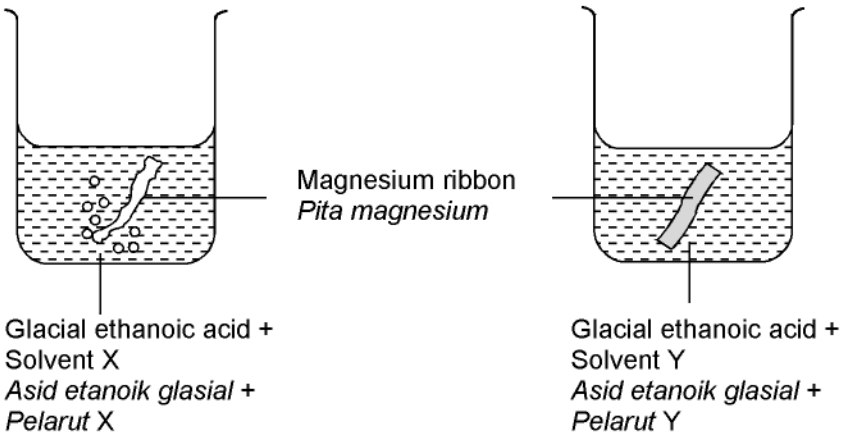


Diagram 2/*Rajah 2*

Based on Diagram 2, plan a laboratory experiment to investigate the role of water in showing the properties of acid by using a named Solvent X and a named Solvent Y.
Berdasarkan Rajah 2, rancang satu eksperimen makmal untuk mengkaji peranan air dalam menunjukkan sifat asid dengan menggunakan satu Pelarut X yang dinamakan dan satu Pelarut Y yang dinamakan.

Your planning should include the following items:
Perancangan anda hendaklah mengandungi perkara-perkara berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan* :
To investigate the role of water in showing the properties of acids.
Unutk mengkaji peranan air dalam menunjukkan sifat asid.

Problem statement / *Pernyataan masalah* :
Does an acid need water to show its acidic properties?
Adakah air diperlukan untuk membolehkan asid menunjukkan sifatnya?

Variables / *Pemboleh ubah*:
Presence of water
Manipulated:……
Dimanipulasi
Change in colour of lime water
Responding: ……
Bergerak balas
Litmus paper
Constant: ……
Dimalarkan

Hypothesis / *Hipotesis*:
The presence of water shows an acidic properties and absence of water does not show acidic properties.

Materials / *Bahan* :
Glacial ethanoic acid, zinc, X: distilled water, Y: methylbenzene, lime water

Apparatus / *Radas* :
Test tubes, stopper, delivery tubes

Procedure/ *Prosedur* :
1. *Pour 1 cm^3 glacial ethanoic acid into test tube.*
2. *Add 2 cm^3 of distilled water into the test tube. Shake the test tube.*
3. *Add zinc strip into the test tubes.*
4. *Record the observation.*
5. *Repeat step 1-5 by using methylbenzene.*

Tabulation of data / *Penjadualan data* :

Test tubes	Observation / *Pemerhatian*
Glacial ethanoic acid+ distilled water	
Glacial ethanoic acid+ methylbenzene	

3. **[SPM 2009]**
Diagram 3 shows four reagent bottles containing nitric acid, HNO_3 with different concentrations.
Rajah 3 menunjukkan empat botol reagen yang mengandungi asid nitric, HNO_3 dengan kepekatan yang berbeza.

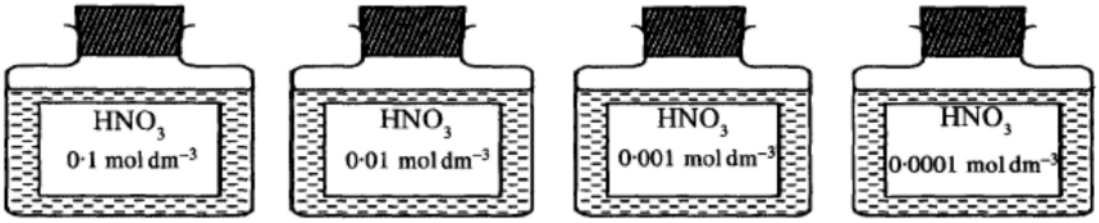


Diagram 3/*Rajah 3*

Using the acid given, plan a laboratory experiment to determine the relationship between the concentration of nitric acid and pH value.
Menggunakan asid yang diberikan, rancang satu eksperimen makmal untuk menentukan hubungan antara kepekatan asid nitrik dengan nilai pH.

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan*:
To investigate the relationship between pH values with molarity of acid / concentration.
Untuk mengkaji hubungan antara nilai pH dengan kemolaran asid / kepekatan

Problem statement / *Pernyataan masalah*:
What is the relationship between concentration of acid and pH values?
Apakah hubungan antara kepekatan asid dan nilai pH?

Variables / *Pemboleh ubah* :
Manipulated : Concentration of acid.
Dimanipulasikan : Kepekatan asid

Responding : pH value.
Bergerak balas : nilai pH

Fixed : Type of acid
Dimalarkan : Jenis asid

Hypothesis / *Hipotesis*:
The higher the concentration of an acid, the lower the pH value.
Lebih tinggi kepekatan asid, lebih rendah nilai pH

Materials / *Bahan* :
0.1 mol dm^{-3},0.01 mol dm^{-3},0.001 mol dm^{-3}, 0.0001 mol dm^{-3} nitric acid
0.1 mol dm^{-3},0.01 mol dm^{-3},0.001 mol dm^{-3}, 0.0001 mol dm^{-3} asid nitrik

Apparatus / *Radas:*
pH meter, beaker.
Meter pH, bikar

Procedure:
1. Pour 0.1 mol dm^{-3} nitric acid into a beaker.
2. Immersed a pH meter into the acid.
3. Record the pH value
4. Repeat the experiment using 0.01 mol dm^{-3},0.001 mol dm^{-3}, 0.0001 mol dm^{-3} nitric acid.

Prosedur:
1. *Tuangkan asid nitrik 0.1 mol dm^{-3} ke dalam bikar.*
2. *Celupkan meter pH ke dalam asid.*
3. *Rekodkan nilai pH.*
4. *Ulang ekspermen dengan menggunakan asid nitrik 0.01 mol dm^{-3}, 0.001 mol dm^{-3}, 0.0001 mol dm^{-3}*

Tabulation of data / *Penjadualan data*:

Concentration of acid (mol dm^{-3}) *Kepekatan asid (mol dm^{-3})*	pH value
0.0001	
0.001	
0.01	
0.1	

4 Diagram 4 shows two reagent bottles containing two colourless solutions, P and Q respectively.
Rajah 4 menunjukkan dua botol reagen yang mengandungi dua larutan tidak berwarna P dan Q masing-masing.

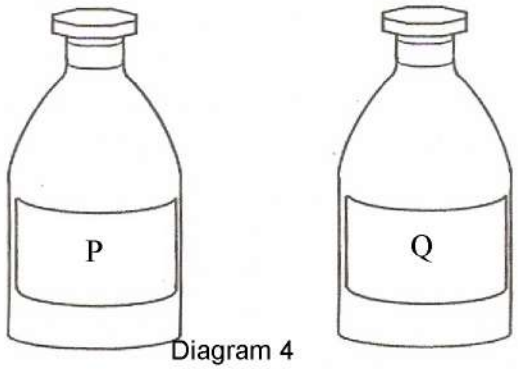


Diagram 4
Rajah 4

These two liquids are hydrochloric acid and sodium hydroxide. The labels on the two reagent bottles are missing. Thus, the identity of the liquids in the bottles is not known.
Kedua-dua cecair ini merupakan asid hidroklorik dan natrium hidroksida. Label yang terdapat pada kedua-dua botol reagen ini telah hilang. Oleh itu, identiti cecair dalam botol ini tidak diketahui.

Using a **chemical test [don't use litmus paper]**, plan a laboratory experiment to differentiate the liquids. Your planning must include the following items :
*Rancang satu eksperimen **ujian kimia [jangan guna kertas litmus]** untuk membezakan larutan tersebut. Laporan anda mestilah mengandungi perkara-perkara berikut :*

(a) Statement of the problem
Pernyataan masalah

(b) Variables
Pembolehubah

(c) Hypothesis
Hipotesis

(d) Lists of materials and apparatus
Senarai bahan serta radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan*:
To determine and identify acid and alkaline using Mg ribbon/ $CaCO_3$ powder.

Problem statement / *Pernyataan masalah*:
How to determine and identify acid and alkaline using Mg ribbon/ $CaCO_3$ powder?

Variables / *Pemboleh ubah* :

Manipulated variable: Liquid P and Q // acid and alkaline

Responding variable: Gas bubbles produces

Fixed variable: volume of acid and alkaline

Hypothesis / *Hipotesis*:
If the reaction of solution P and the Mg ribbon produce bubbles, solution P is acid.

Materials / *Bahan* :
Liquid P, Liquid Q, Mg ribbon// $CaCO_3$ powder,

Apparatus / *Radas:*
Test tube, sand paper, spatula

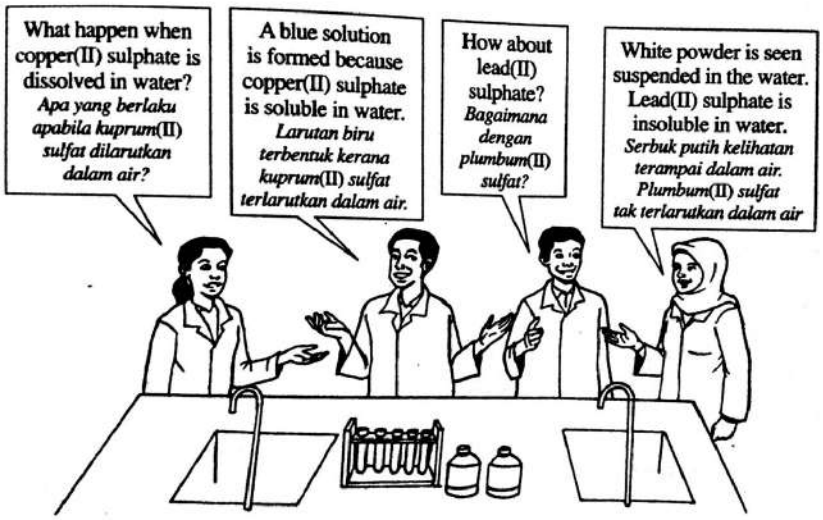
Procedure:
1. The Mg ribbon is cleaned using a piece of sand paper
2. [3-5] cm^3 solution P are poured in a test tubes.
3. Put the Mg ribbon in test tube
4. Observe the observation
5. Record the observation
6. Repeat step 1-5 using solution Q.

Tabulation of data / *Penjadualan data*:

Liquid	Observation
Liquid P	
Liquid Q	

Chapter 8: Salt
Bab 8 : Garam

1. **[SPM 2013]**



Referring to the above conversation, plan a laboratory experiment to study the solubility of sulphate slats in water. You are required to use two examples of soluble sulphate salts and two examples of insoluble sulphate salts.
Merujuk kepada perbualan di atas, rancang satu eksperimen makmal untuk mengkaji kelarutan garam sulfat dalam air. Anda dikehendaki menggunakan dua contoh garam sulfat terlarutkan dan dua contoh garam sulfat tak terlarutkan.

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan:*
To determine the solubility of sulphate salts in water.
Untuk menentukan keterlarutan garam sulfat dalam air.

Problem statement / *Pernyataan masalah*:
Are sulphate salts soluble in water?
Adakah garam sulfat larut dalam air?

Variables / *Pemboleh ubah* :
Manipulated : Sulphate salts
Dimanipulaskani : Garam sulfat

Responding : Solubility in water.
Bergerak balas : Kerterlarutan air

Fixed : Volume of water.
Dimalarkan : isi padu air

Hypothesis / *Hipotesis* :
Some sulphate salts are soluble in water.
Setengah garam sulfat larut dalam air

Materials / *Bahan*:
Copper(II) sulphate, magnesium sulphate, lead(II) sulphate, calcium sulphate, water.
Kuprum (II) sulfat, magnesium sulfat. Plumbum (II) sulfat, kalsium sulfat air

Apparatus / *Radas* :
Beaker, Spatula, glass rod
Bikar,spatula, rod kaca

Procedure:
1. Pour 20 cm^3 of water into the beaker.
2. Put 5 g of copper(II) sulphate into the beaker.
3. Stir the mixture
4. Record the observations.
5. Repeat the experiment using magnesium sulphate, calcium sulphate and lead(II) sulphate.

Prosedur:
1. *Tuangkan 20 cm^3 air ke dalam bikar*
2. *Masukkan 5 g kuprum(II) sulfat ke bikar*
3. *Kacau campuran.*
4. *Rekodkan pemerhatian.*
5. *Ulang eksperimen menggunakan magnesium sulfat, kalsium sulfat dan plumbum(II) sulfat*

Tabulation of data / *Penjadualan data*:

Salt *Garam*	Observation *Pemerhatian*
Copper(II) sulphate *Kuprum (II) sulfat*	
Magnesium sulphate *Magnesium sulfat*	
Calcium sulphate *Kalsium sulfat*	
Lead(II) sulphate *Plumbum (II) sulfat*	

2. **[SPM 2011]**
Diagram 2 shows eight tubes containing lead(II) iodide precipitate which is formed when lead(II) nitrate solution reacts with potassium iodide solution.
Lead(II) iodide is an insoluble salt. The ionic equation for this reaction is:

$$Pb^{2+}_{(aq)} + 2I^{-}_{(aq)} \rightarrow PbI_{2(s)}$$

Rajah 2 menunjukkan lapan tabung uji yang mengandungi mendakan plumbum(II) iodida yang terbentuk apabila larutan plumbum(II) nitrat bertindak balas dengan larutan kalium iodida. Plumbum(II) iodida adalah garam tak terlarut. Persamaan ion untuk tindak balas ini ialah:

$$Pb^{2+}_{(ak)} + 2I^{-}_{(ak)} \rightarrow PbI_{2(s)}$$

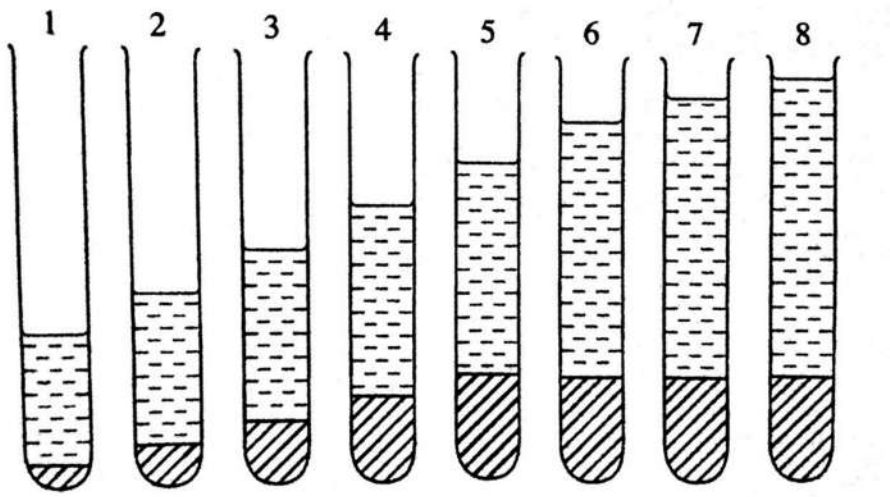


Diagram 2/*Rajah 2*

Based on Diagram 2, plan **one** laboratory experiment to construct the ionic equation for the formation of lead(II) iodide as given in the above ionic equation.
*Berdasarkan Rajah 2, rancang **satu** eksperimen makmal untuk membina persamaan ion bagi pembentukan plumbum(II) iodida seperti yang diberi dalam persamaan ion di atas.*

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan*:
To construct the ionic equation for the formation of lead(II) iodide.
Untuk membina persamaan ion bagi pembentukan plumbum(II) iodida.

Problem statement/ *Pernyataan masalah:*
How to construct an ionic equation for the formation of lead(II) iodide?
Bagaimanakah membina persamaan ion bagi pembentukan plumbum(II) iodide

Variables / *Pemboleh ubah*:
Manipulated : Volume of potassium iodide
Dimanipulasikan : Isi padu kalium iodida

Responding : Height of the precipitate formed
Bergerak balas : Tinggi mendakan yang terbentuk

Fixed : Size of the test tubes// Temperature // Volume and concentaration of lead (II) nitrate
Dimalarkan : Saiz tabung uji / /suhu // Isi padu dan kepekatan larutan plumbum (I) nitrate

Hypothesis / *Hipotesis :*
When the volume of potassium iodide solution increases, the height of the precipitate increases until its achieves maximum height.
Apa bila isi padu larutan kalium iodida bertambah, ketinggian mendakan bertambah sehingga mencapai ketinggian maksimum.

Materials / *Bahan*:
[0.1 – 2.0] mol dm^{-3} lead(II) nitrate solution and [0.1 – 2.0] mol dm^{-3} potassium iodide solution.
[0.1 – 2.0] mol dm^{-3} larutan plumbum(II) nitrate dan [0.1 – 2.0] mol dm^{-3} larutan kalium iodid

Apparatus/ Radas:
Ruler, test tubes, test tube rack, glass rod, burette
Pembaris, tabung uji , rak tabung uji,rod kaca, buret

Procedure:
1. Label all the test tubes and put test tubes in the rack.
2. Pour 5 cm^3 of lead(II) nitrate solution into test tubes.
3. Pour 1 cm^3 of potassium iodide solution into the first test tube, 2 cm^3 of potassium iodide into second test tube until the last test tube with 7 cm^3 of potassium iodide solution.
4. Stir the mixture
5. Leave the test tube.
6. Measure and record the heights of precipitate.

Prosedur:
1. *Label kesemua tabung uji dan letakkan ke dalam rak tabung uji.*
2. *Masukkan 5 cm^3 larutan plumbum (II) nitrat ke dalam tabung uji*
3. *Masukkan 1cm^3 larutan kalium(II) iodida ke dalam tabung uji pertama, 2 cm^3 larutan kalium iodidda ke dalam tabung uji kedua sehingga tabung uji yang terakhir dengan 7 cm^3 larutan kalium iodida.*
4. *Kacau campuran.*
5. *Biarkan tabung uji seketika.*
6. *Ukur dan rekod ketinggian mendakan*

Tabulation of data/ Penjadualan data:

Volume of potassium iodide solution (cm^3) *Isi padu larutan kalium iodida (cm^3)*	1.00	2.00	3.00	4.00	5.00	6.00	7.00
Height of precipitate (cm) *Ketinggian mendakan (cm)*							

Chapter 9: Manufactured Substances in Industry
Bab 9: Bahan Buatan dalam Industri

1. **[SPM 2005]**
The copper wire in an electric cable can be easily bent by hand, A one-cent coin made of an alloy of copper with tin and zinc cannot be bent easily.
Dawai kuprum terdapat dalam kabel electric boleh dibengkokkan dengan mudah menggunakan tangan. Duit syiling satu sen yang diperbuat daripada aloi kuprum dengan stanum dan zink tidak boleh dibengkokkan dengan mudah.

Referring to the situation above, plan a laboratory experiment to investigate the effect of alloy formation on the hardness of a metal.
Merujuk kepada situasi diatas, rancangkan satu eksperimen dalam makmal untuk mengkaji kesan pengaloian terhadap kekerangan logam.

Perancangan anda hendaklah mengandungi perkara-perkara berikut:
Your planning must include the following items:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan* :
To compare the hardness of a pure metal and its alloy.
Untuk membandingkan kekerasan logam tulen dengan aloinya

Problem statement/ *Pernyataan masalah :*
Are alloys harder than pure metals?
Adakah aloi lebih keras daripada logam tulennya?

Variables / *Pemboleh ubah* :
Manipulated : Copper and bronze // types of block
Dimanipulasikan : Kuprum dan gangsa

Responding : Diameter of dent
Bergerak balas : Diamater lekuk

Fixed : Mass of weight//Height of weight
Dimalarkan : Jisim pemberat // Ketinggian pemberat

Hypothesis/ *Hipotesis:*
Bronze (alloy) is harder than copper(pure metals).
Gangsa (aloi) lebih keras daripada kuprum (logam tulen)

Materials / *Bahan* :
Copper block, bronze block, cellophane tape
Bongkah kuprum, bongkah gangsa, pita selofan

Apparatus / *Radas*:
Retord stand with clamps,meter rule,thread,1 kg weight,stainless steel ball bearing
Kaki retort dan pengapit, pembaris meter, benang, pemberat 1 kg, bebola keluli

Procedure:
1. Stick the stainless ball bearing on the bronze block with cellophane tape.
2. Hang the 1 kg weight at a height 50 cm above the bronze block.
3. Release the weight.
4. Measure and record the diamter of the dent.
5. Repeat the experiment twice on other parts of the blok.
6. Repeat the experiment using bronze block

Prosedur:
1. *Lekatkan bebola keluli pada permukaan bongkah gangsa dengan pita selofan*
2. *Gantungkan pemberat 1 kg setinggi 50 cm di atas bongkah gangsa.*
3. *Jatuhkan pemberat*
4. *Ukur dan rekod diameter lekuk*
5. *Ulang eksperimen dua kali pada permukaan yang lain*
6. *Ulang eksperimen dengan menggunakan blok kuprum*

Tabulation of data / *Penjadualan data*:

Type of block *Jenis blok*	Diameter of dent (cm) *Diameter lekuk (cm)*			Average (cm) *Purata (cm)*
	1	2	3	
Bronze *Gangsa*				
Copper *Kuprum*				

CHAPTER 10 : RATE OF REACTION
BAB 10 : KADAR TINDAK BALAS

A. TOTAL SURFACE AREA
JUMLAH LUAS PERMUKAAN

1.

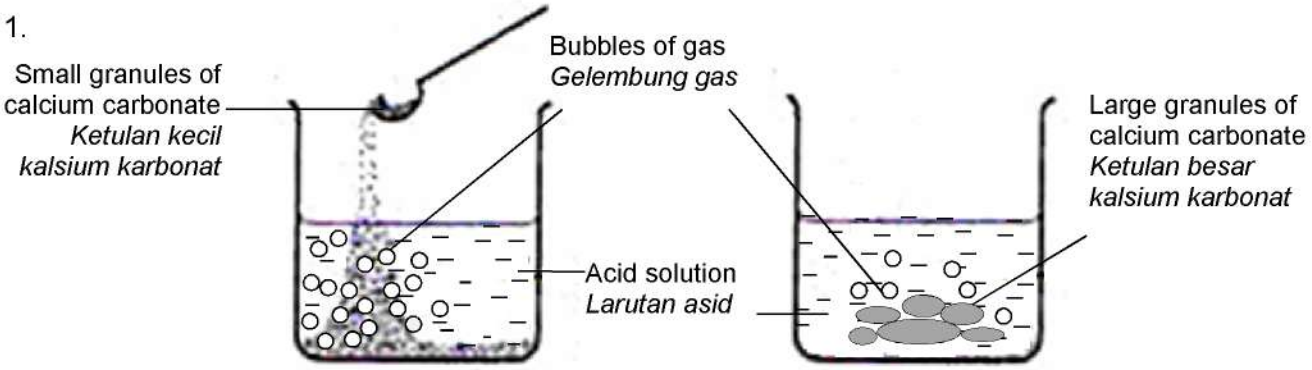


Diagram 1/*Rajah* 1

Referring to the observation in Diagram 1, plan a laboratory experiment to investigate the effect of the size of reactant on the rate of reaction.
Merujuk kepada pemerhatian di dalam Rajah 1*, rancang satu eksperimen dalam makmal untuk mengkaji kesan saiz bahan tindak balas ke atas kadar tindak balas.*

Your planning must include the following items:
Perancangan anda hendaklah mengandungi perkara-perkara berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan*:
To investigate the effect of size (total surface area) of reactant on the rate of reaction.
Untuk mengkaji kesan saiz (jumlah luas permukaan) bahan tindak balas terhadap kadar tindak balas

Problem statement / *Pernyataan masalah*:
How does the size of marble chips affect the rate of reaction?
Bagaimanakah saiz ketulan marmar mempengaruhi kadar tindak balas?

Variables / *Pemboleh ubah*:

Manipulated: *Size of calcium carbonate /reactant*
Dimanipulasi

Responding: *Rate of reaction*
Bergerak balas

Fixed: *Mass of calcium carbonate/Volume and concentration of HCl/acid*
Dimalarkan

Hypothesis / *Hipotesis* :

When the size of calcium carbonate increases/decreased the rate of reaction decreases/increases//
When the total surface area of calcium carbonate increases/decreases the rate of reaction increases/decreases

Materials / *Bahan* :
[0.2 -1.0] mol dm^{-3} hydrochloric acid/any acid, small and large calcium carbonate, water

Apparatus / *Radas* :
[100 -250]cm^3 conical flask, basin/container, burette, delivery tube, retort stand with clamp, stop watch, measuring cylinder

Procedure :
1. Fill a burette with water and invert it over a basin containing water.
2. Record the initial burette reading.
3. Place 3 g of small marble chips in a conical flask.
4. Add [20-50 cm^3] of hydrochloric acid into the conical flask.
5. Fit the conical flask with a delivery tube and start the stopwatch.
6. Record the burette reading at 30 seconds intervals.
7. Repeat the experiment by using large marble chips.

Prosedur:
1. *Isikan sebuag buret dengan air dan telangkupkan ke dalam besen berisi air.*
2. *Rekodkan bacaan awal buret.*
3. *Letakkan 3 g ketulan kecil marmar ke dalam kelalang kon.*
4. *Tambahkan [20-50 cm^3] asid hidroklorik ke dalam kelalang kon.*
5. *Pasangkan salur penghantar kepada kelalang kon dan mulakan jam randik.*
6. *Rekodkan bacaan buret pada sela 30 saat.*
7. *Ulang eksperimen dengan menggunakan ketulan besar marmar.*

Tabulation of data/ *Penjadualan data* :

Time(s) *Masa (s)*	0	30	60	90	120
Total volume of gas (cm^3) using small marble chips *Jumlah isi padu gas (cm^3) menggunakan ketulan kecil marmar*					
Total volume of gas (cm^3) using large marble chips *Jumlah isi padu gas (cm^3) menggunakan ketulan besar marmar*					

B. TEMPERATURE
SUHU

2. Diagram 2 shows a spoon of sugar is added into hot coffee and stirred by Amira. She found out that the sugar is easy to dissolve in hot coffee compared to cold coffee.
Rajah 2 menunjukkan satu sudu gula ditambah ke dalam kopi panas dan dikacau oleh Amira. Dia mendapati gula mudah larut dalam air kopi panas berbanding air kopi sejuk.

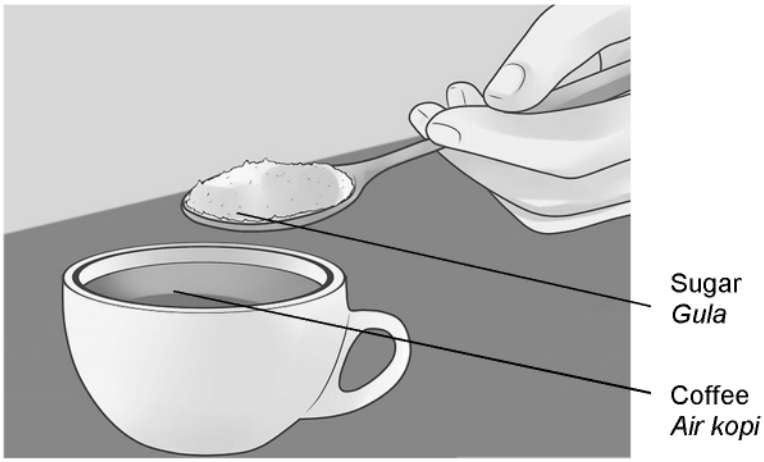


Diagram / *Rajah* 2

Referring to the above situation, plan a laboratory experiment to investigate the effect of the temperature of reactant on the rate of reaction.
Merujuk kepada situasi di atas, rancang satu eksperimen dalam makmal untuk mengkaji kesan suhu bahan tindak balas terhadap kadar tindak balas.

Your planning must include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan* :
To investigate the effect of temperature on the rate of reaction.
Untuk mengkaji kesan suhu terhadap kadar tindak balas.

Problem statement / *Pernyataan masalah*:
Does the increase in the temperature increase the rate of reaction

Variables / *Pemboleh ubah*:

Manipulated: *Temperature of sodium thiosulphate solution*
Dimanipulasi

Responding: *Rate of reaction*
Bergerak balas

Fixed: *Volume and concentration of H_2SO_4/acid*
Dimalarkan

Hypothesis / *Hipotesis* :
The higher the temperature of sodium thiosulphate solution, the higher the rate of reaction

Materials / *Bahan* :
Sodium thisulphate solution, Sulphuric acid

Apparatus / *Radas* :
White paper mark 'X', stopwatch, thermometer, conical flask, Bunsen burner

Procedure:
1. Pour 45 cm^3 of 0.2 mol dm^{-3} sodium thisulphate solution into a conical flask.
2. Place a thermometer into the conical flask and heat the sodium thiosulpahte solution until the temperature is 30^0C.
3. Place the conical flask on top of a piece of white paper with a mark 'X'
4. Measure 5 cm^3 of 1.0 mol dm^{-3} sulphuric acid.
5. Pour the sulphuric acid quickly and carefully into the conical flask and start the stopwatch immediately.
6. Swirl the mixture a few times.
7. Stop the stopwatch as soon as the mark 'X' dissappears from sight.
8. Record the time taken.
9. Repeat the experiment by heating the sodium thiosuphate solution at different temperaures.

Prosedur:
1. *Tuangkan 45 cm^3 larutan natrium sulfat 0.2 mol dm^{-3} ke dalam kelalang kon.*
2. *Letakkan termometer ke dalam kelalng kon dan panaskan larutan natrium tiosufat sehingga suhu 30^0C.*
3. *Letakkan kelalang kon di atas sekeping kertas putih yang mempunyai tanda 'X'*
4. *Sukat 5 cm^3 asid sulfurik 1.0 mol dm^{-3}.*
5. *Dengan cepat dan cermat, tuangkan asid sulfurik ke dalam kelalang kon dan pada masa yang sama mulakan jam randik.*
6. *Goncangkan campuran perlahan-lahan.*
7. *Hentikan jam randik sebaik sahaja tanda 'X' hilang daripada penglihatan.*
8. *Catatkan masa yang diambil.*
9. *Ulang eksperimen dengan memanaskan larutan natrium tiosulfat pada suhu yang berbeza.*

Tabulation of data / *Penjadualan data* :

Temperature sodium thiosulphate solution, ^{0}C	*Time, s*
30.0	
40.0	
50.0	
60.0	

C. CONCENTRATION
KEPEKATAN

2. **[SPM2005]**
Bulidings in industrial areas are more corroded than those in housing areas. This is because the concentration of acid in rain water is higher in industrial areas
Refering to the situation above, plan a laboratory experiment to investigate **the effect of concentraton on the rate of reaction between a named acid and a named metal.**
Bangunan di kawasan perindustrian lebih mudah terkakis berbanding dengan bangunan di kawasan perumahan. Ini adalah kerana keepekatan asid dalam air hujan di kawasan perindustrian adalah lebih tingi,
Merujuk kepada situasi di atas, rancangan satu eksperimen dalam makmal untuk mengkaji ***kesan kepekatan terhadap kadar tindak balas antara suatu asid yang dinamakan dengan satu logam yang dinamakan.***

Your planning must include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan*:
To investigate the effect of concentration on the rate of reaction
Untuk mengkaji kesan kepekatan terhadap kadar tindak balas.

Problem statement / *Pernyataan masalah*:
Does the increase in the acid concentration increase the rate of reaction

Variables / *Pemboleh ubah* :
Manipulated : Concentration of hydrochloric acid
Dimanipulasi : Kepekatan asid hidroklorik

Responding : Rate of reaction
Bergerak balas : Kadar tindak balas

Fixed : Volume of hydrochloric asid // mass of zinc
Dimalarkan : Isi padu asid hidroklorik // jisim zink

Hypothesis / *Hipotesis* :
The higher the concentration of acid, the higher the rate of reaction

Materials / *Bahan* :
[0.2 -1.0] mol dm^{-3} hydrochloric acid/any acid, zinc

Apparatus / *Radas* :
Stopwatch, beaker ,measuring cylinder

Procedure:
1. Pour [10 – 50 cm^3] 1.0 mol dm^{-3} hydrochloric acid into a beaker
2. Put [0.5 – 5 g] zinc into the beaker.
3. Start the stop watch immediately
4. Stir the mixture.
5. Record the time taken for the metal to completely dissolve.
6. Reperat the experiment using different concentration of hydrochloric acid.

Prosedur:
1. *Tuangkan [10 -50 cm^3] asid hidroklorik 1.0 mol dm^{-3} ke dalam bikar.*
2. *Masukkan [0.5 – 5 g] zink ke dalam bikar itu.*
3. *Dengan serta merta mulakan jam randik.*
4. *Kacau campuran.*
5. *Catatkan masa apabila semua logam melarut.*
6. *Ulang eksperimen dengan menggunakan kepekatan asid hidroklorik yang berbeza.*

Tabulation of data / *Penjadualan data*:

Concentration acid, mol dm^{-3}	*Time,s*
1.0	
0.8	
0.6	
0.4	
0.2	

E. CATALYST

3. **[SPM2010]**
Diagram 3 shows the productions of fuel during the launching of a space shuttle by using a catalyst.
Rajah 3 menunjukkan pengeluaran bahan api semasa pelancaran sebuah kapal angkasa dengan menggunakan mangkin.

The catalyst is used to speed up the production of fuel. Based on this idea, plan one laboratory experiment to investigate the effect of a catalyst on the rate of reaction between metal and acid. Use copper(II) sulphate solution as the catalyst.
Mangkin itu digunakan untuk mempercepatkan pengeluaran bahan api. Berdasarkan idea ini, rancang satu eksperimen makmal untuk menyiasat kesan mangkin ke atas kadar tindak balas antara logam dengan asid. Guna larutan kuprum(II) sulfat sebagai mangkin.

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan* :
To investigate the effect of catalyst on the rate of reaction between metal and acid.
Untuk menyiasat kesan mangkin ke atas kadar tindak balas antara logam dan asid.

Problem statement / *Pernyataan masalah* :
Does the presence of a catalyst affect the rate of reaction between metal and acid?
Adakah kehadiran mangkin akan mempengaruhi kadar tindak balas antara logam dan asid?

Variables / *Pemboleh ubah* :
Manipulated : The presence of catalyst.
Dimanipulasikan : Kehadiran mangkin

Responding : Rate of reaction.
Bergerak balas : Kadar tindak balas

Constant: Temperature// mass of metal// volume and concentration of acid
Dimalarkan : Suhu // jisim logam // isi padu dan kepekatan asid

Hypothesis / *Hipotesis* :
The presence of a catalyst increases the rate of reaction
Kehadiran mangkin akan meningkatkan kadar tindak balas

Materials/ *Bahan* :
[0.1- 2.0 mol dm^{-3}] hydrochloric acid, magnesium, copper(II) sulphate, water
[0.1- 2.0 mol dm^{-3}] asid hidroklorik , magnesium , kuprum (II) sulfat, air

Apparatus / *Radas* :
Stopwatch, conical flask, measuring cylinder, delivery tube, burette, retort stand, basin
Jam randik, kelalang kon, silinder penyukat, salur penghantar, buret, kaki retot, besen

Procedure :
1. Fill a burette with water and invert it over a basin containing water.
2. Record the initial burette reading.
3. Place magnesium in a conical flask.
4. Add [20-50 cm^3] of hydrochloric acid into the conical flask.
5. Fit the conical flask with a delivery tube and start the stopwatch.
6. Record the burette reading at 30 seconds intervals.
7. Repeat the experiment by adding copper(II) sulphate solution into the conical flask.

Prosedur:
1. *Isikan sebuah buret dengan air dan telangkupkan ke dalam besen berisi air.*
2. *Rekodkan bacaan awal buret.*
3. *Letakkan magnesium ke dalam kelalang kon.*
4. *Tambahkan [20-50 cm^3] asid hidroklorik ke dalam kelalang kon.*
5. *Pasangkan salur penghantar kepada kelalang kon dan mulakan jam randik.*
6. *Rekodkan bacaan buret pada sela 30 saat.*
7. *Ulang eksperimen dengan menambahkan larutan kuprum (II) sulfat ke dalam kelalang kon.*

Tabulation of data / *Penjadualan data* :

Time (s) *Masa (s)*	0	30	60	90	120
Burette reading (cm^3) *Bacaan buret (cm^3)*					
Volume of hydrogen gas (cm^3) *Isi padu gas hidrogen (cm^3)*					

CHAPTER 11 : CARBON COMPOUND
BAB 11: SEBATIAN KARBON

PROPERTIES ALKANES AND ALKENES
SIFAT ALKANA DAN ALKENA

1. [SPM2014]

Diagram 1 shows the structural formulae of Hydrocarbon X and Hydrocarbon Y.
Both hydrocarbons have different chemical properties.
Rajah 1 menunjukkan formula struktur bagi Hidrokarbon X dan Hidrokarbon Y.
Kedua-dua hidrokarbon mempunyai sifat kimia yang berbeza.

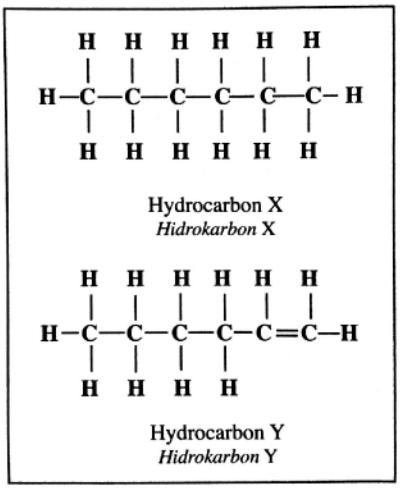


Diagram 1 /*Rajah 1*

By using bromine water as reagent, plan a laboratory experiment to differentiate both hydrocarbons.
Dengan menggunakan air bromin sebagai reagen, rancang satu eksperimen makmal untuk membezakan kedua-dua hidrokarbon.

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan*:
To investigate either alkane or alkene decolourise bromine water.
Untuk mengkaji sama ada alkana atau alkena menyahwarnakan air bromin.

Problem statement / *Pernyataan masalah*:
Does alkane and alkene docolourise bromine water?
Adakah alkana dan alkena menyahwarnakan air bromin?

Variables / *Pemboleh ubah* :
Manipulated : Hexane, hexene
Dimanipulasikan; Heksana, heksena

Responding : Colour change of bromine
Bergear balas : Perubahan warna bromin

Fixed : Bromine water
Dimalarkan : Air bromin

Hypothesis / *Hipotesis* :
Hexene decolourises the colour of bromine water while hexane does not.
Heksena menyahwarna air bromin manakala heksana tidak

Materials/ *Bahan*
Hexane, hexene, bromine water,
Heksana, heksena, air bromin

Apparatus / *Radas* :
Test tube, dropper, stopper
Tabung uji, penitis, penyumbat

Procedure:
1. Pour 3 cm^3 hexane into a test tube.
2. Add 5 drops of bromine water.
3. Shake.the mixture
4. Record the observation.
5. Repeat the experiment by replacing hexane with hexene.

Prosedur:
1. *Tuangkan 5 cm^3 heksana ke dalam tabung uji.*
2. *Tambahkan 5 titik air bromin.*
3. *Goncangkan campuran.*
4. *Catatkan pemerhatian.*
5. *Ulangkan eksperimen dengan menggantikan heksana dengan heksena.*

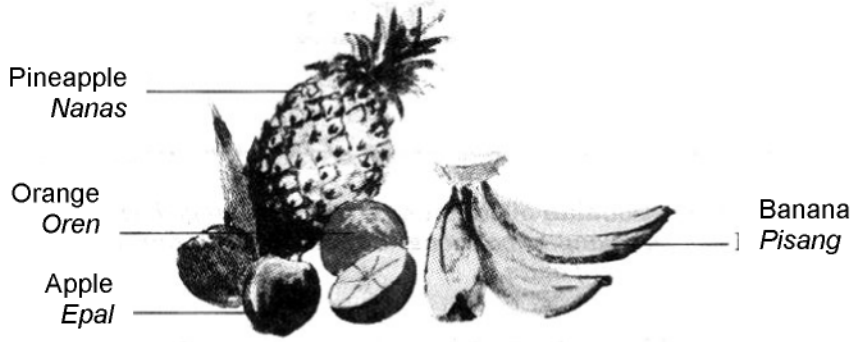
Tabulation of data / *Penjadualan data* :

Hydrocarbon *Hidrokarbon*	Observation *Pemerhatian*
Hexane *Heksana*	
Hexene *Heksena*	

PREPARE ESTER
PENYEDIAAN ESTER

2. [SPM2004]

The fruits in Figure 2.1 produce natural esters which have tastes and scents.
Buah-buahan dalam Rajah 2.1 menghasilkan ester semulajadi yang mempunyai pelbagai rasa dan bau.



Esters can be produced in the laboratory whwn an alcohol reacts with a carboxylic acid.
Ester boleh dihasilkan di dalam makmal apabila satu alcohol bertindak balas dengan satu asid karboksilik.

Table 2.2 shows types of alcohol and carboxylic acid used to produce various esters.
These esters have a similar scent to the esters in fruits.
Jadual 2.2 menunjukkan jenis-jenis alcohol dan asid karboksilik yang digunakan untuk menghasilkan pelbagai ester yang sama seperti ester dalam buah-buahan.

Alcohol *Alkohol*	Carboxylic acid *Asid karboksilik*	Ester *Ester*	Fruit *Buah-buahan*
Ethanol *Etanol*	Butanoic acid *Asid butanoik*	Ethyl butanoate *Etil butanoat*	Pineapple *Nanas*
Methanol *Metanol*	Butanoic acid *Asid butanoik*	Methyl butanoate *Metil butanoat*	Apple *Epal*
Octanol *Oktanol*	Ethanoic acid *Asid etanoik*	Octyl ethanoate *Oktil etanoat*	Orange *Oren*
Pentanol *Pentanol*	Ethanoic acid *Asid etanoik*	Pentyl ethanoate *Pentil etanoat*	Banana *Pisang*

Table 2.2/ *Jadual 2.2*

You are required to prepare two different types of ester using the same carboxylic acid with different alcohols.
The two esters must be chosen from those shown in Table 2.2.
Anda dikehendaki menyediakan dua jenis ester yang berbeza dengan menggunakan asid karboksilik yang sama dan alcohol yang berlainan. Kedua-dua ester itu hendaklah dipilih daripada Jadual 2.2.

Use the information in Table 2.2 to plan a laboratory experiment to prepare the esters and describe their scents.
Gunakan maklumat dalam Jadual 2.2 untuk merancang satu eksperimen bagi menyediakan ester-ester itu dan perihalkan bau ester yang terhasil.

Your explanation should include all the followings:
Penerangan anda haruslah mengandungi perkara-perkara berikut:

(a) Aim of the experiment
Tujuan eksperimen

(b) Hypothesis
Hipotesis

(c) List of materials and apparatus
Senarai bahan dan radas

(d) Procedure
Prosedur

(e) Tabulation of data
Penjadualan data

[17 marks]

(a) Aim / *Tujuan:*
Dapat menghasilkan dua ester dengan menggunakan asid karboksilik yang sama dan dapat memperihalkan bau.
……

……

(b) Hypothesis/*Hipotesis*
Tindak balas antara asid butanoik/etanoik dengan jenis alcohol berlainan menghasilkan bau ester yang berlainan
……

……

(c) List of materials and apparatus/ *Senarai bahan dan radas*
Bahan : Asdi butanoic/ etanoik, methanol, etanol, asid sulfuric pekat dan air
……
Radas : Tabung uji/bikar, penitis, penunu Bunsen, penyepit/ pemegang tabung uji.
……

(d) Procedure /*Prosedur*
1. *Metanol ditambahkan ke dalam asid butanoik.*
……
2. *Campuran digoncangkan.*
……
3. *Beberapara titis asid sulfurik di masukkan ke dalam campuran dengan menggunakan penitis.*
……
4. *Campuran dihangatkan selama beberapa minit.*
……
5. *Hasil tindak balas dituangkan ke dalam bekas/ bikar.*
……
6. *Bau yang terhasil dihidu.*
……
7. *Ulangi langkah 1 -6 dengan menggantikan methanol dengan etanol.*
……

……

……

(e) Tabulation of data/*Penjadualan data*

Alkohol	*Asid karboksilik*	*Bau*
Metanol	*Asid butanoic/ asid etanoik*	
Etanol	*Asid butanoic/ asid etanoik*	

[17 *marks*]

COAGULATION OF LATEX
PENGGUMPALAN GETAH

3. Diagram 3 shows how fresh latex produced from rubber tree and a coagulated latex transform into rubber sheets.
Rajah 3 menunjukkan bagaiman susu getah diperolehi dari pokok getah dan latek yang telah dibekukan ditukarkan menjadi getah keping.

Referring to the diagram, plan a laboratory experiment to investigate the effect of acids and alkali on the coagulation of latex.
Merujuk kepada rajah di atas, rancang satu eksperimen makmal untuk mengkaji kesan asid dan alkali ke atas pengumpalan lateks.

Your planning must include the following items:
Perancangan anda hendaklah mengandungi perkara-perkara berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

(a) Problem statement/ *Pernyataan masalah:*

How does acids and alkalis affect on the coagulation of latex?

……

……

(b) All the variables/*Semua pembolehubah:*

MV: Type of acids and alkalis // ammonia solution and ethanoic acid

……

RV: Coagulation of latex//coagulate or not

……

CV: Volume of latex / acid / (ammonia solution) / alkali // latex / temperature

……

(c) Hypothesis/*Hipotesis*

The presence of ethanoic acid, latex coagulate and the presence of ammonia, latex does not coagulate

……

……

(d) List of materials and apparatus/ *Senarai bahan dan radas*

Materials: Latex, ethanoic acid, ammonia solution

……

Apparatus : Beaker, glass rod

……

(e) Procedure /*Prosedur*

1. Latex is poured is into a beaker.
2. Ethanoic acid is added into the beaker
3. The mixture is stirred with a glass rod.
4. The changes occurred are observed and recorded.
5. The step 1 to 4 are repeated by replacing ethanoic acid with ammonia solution.

(f) Tabulation of data/*Penjadualan data*

Mixture//substance added to latex	Observation//coagulate or not
Latex + ethanoic acid//ethanoic acid	
Latex + ammonia solution//ammonia	

VULCANISED RUBBER AND UNVULCANISED RUBBER
GETAH TERVULKAN DAN GETAH TAK TERVULKAN

4. [SPM2006]
Diagram 4 shows the stretching phases of a vulcanised rubber and an unvulcanised rubber strands.
Rajah 4 menunjukkan fasa regangan bagi jalur getah tervulkan dan jalur getah tak tervulkan.

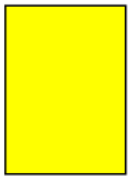
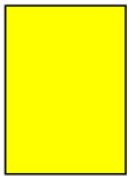
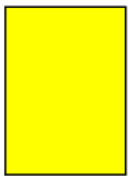
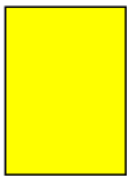
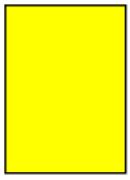
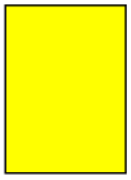
Stretching phases *Fasa regangan*	Length of vulcanised rubber *Panjang jalur getah tervulkan*	Length of unvulcanised rubber *Panjang jalur getah tak tervulkan*
Before *Sebelum*	 45 mm	 45 mm
During *Semasa*	 59 mm	 60 mm
After *Selepas*	 45 mm	 50 mm

Diagram 4/ *Rajah 4*

Plan an experiment to compare one characteristic shown in Diagram 4 for both types of rubber.
Rancang satu eksperimen untuk membandingkan satu sifat yang ditunjukkan dalam Rajah 4 bagi kedua-dua jenis getah.

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi perkara-perkara berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan* :
To compare the elasticity of vulcanised rubber and unvulcanised rubber.
Untuk membandingkan kekenyalan getah tervulkan dengan getah tak tervulkan.

Problem statement / *Pernyataan masalah*:
Is vulcanized rubber more elastic than unvulcanised rubber?
Adakah getah tervulkan lebih kenyal daripada getah tan tervulkan?

Variables / *Pemboleh ubah*:

Manipulated: *Vulcanized rubber and unvulcanised rubber*
Dimanipulasi

Responding: *The change in the length of the rubber strand*
Bergerak balas

Fixed: *Type of rubber, initial length of the rubber strand*
Dimalarkan

Hypothesis / *Hipotesis* :
Vulcanized rubber is more elastic than unvulcanized rubber

Materials / *Bahan* :
10 cm of vulcanized rubber, 10 cm of unvulcanized rubber

Apparatus / *Radas* :
Clip, Weight, Retort stand, Ruler

Prosedure / *Prosedur* :
1. *Hang the vulcanized and unvulcanized rubber strans on two different retort stand.*
2. *Measure the original/initial length of both rubber strands.*
3. *Hang a weight on each rubber strand and measure the length.*
4. *Take off the weight and measure the length of the rubber strands again.*
5. *Record the observations.*

Tabulation of data / *Penjadualan data*:

Type of rubber	*Initial length, cm*	*Length of the rubber while the weight is hung, cm*	*Length of the rubber when the weight is taken off, cm*
Vulcanized			
Unvulcanized			

BAB 12 : OXIDATION REDUCTION
BAB 12 : PENGOKSIDAAN DAN PENURUNAN

1. [SPM2015]

The main component of the body of ship is made up of iron. A few blocks of zinc metal are sticked at the bottom of the body of the ship to prevent iron form rusting as shown in Diagram 1.
Komponen utama badan sebuah kapal diperbuat daripada besi. Beberapa blok logam zink dilekatkan di bahagian bawah badan kapal untuk mengelakkan besi daripada berkarat, seperti yang ditunjukkan dalam Rajah 1.

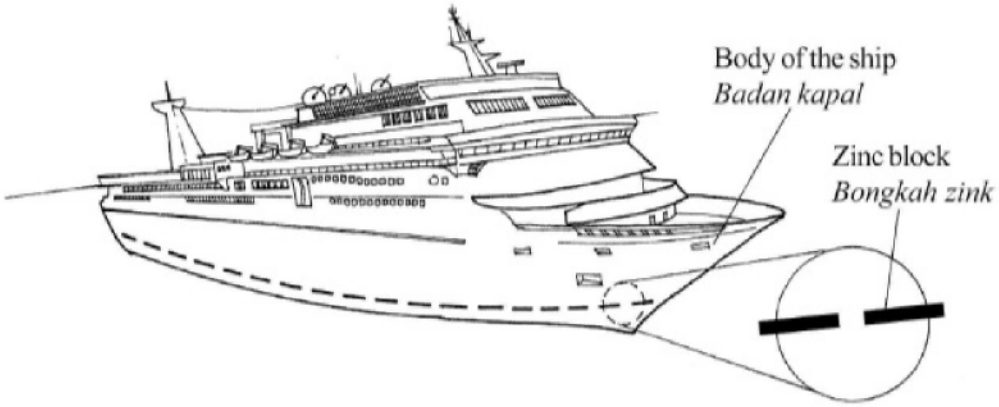


Diagram 1/*Rajah 1*

Referring to above situation, plan a laboratory experiment to compare the effect of a named metal causes rusting and a named metal to prevent rusting.
Merujuk situasi di atas, rancang satu eksperimen makmal untuk membandingkan kesan satu logam yang dinamakan yang menyebabkan pengaratan dan satu logam yang dinamakan untuk menggelakkan pengaratan.

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut :

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / Tujuan :
To investigate the effect of other metals on the rusting of iron.
Untuk mengkaji kesan logam lan terhadap pengaratan besi

Problem statemen / *Pernyataan masalah*:
How do different types of metals in contact with iron affect rusting?
Apakah kesan sentuhan logam lain terhadap pengaratan besi?

Variables / *Pemboleh ubah*
Manipulated : Different types of metals.
Dimanipulasikan : Jenis logam

Responding : Rusting // The presence of blue colour
Bergerak balas : Pengaratan besi / /kehadiran warna biru

Fixed : Iron nails
Dimalarkan : paku besi

Hypothesis / *Hipotesis :*
When a more electropositive metal in contact with iron, rusting does not occur whereas when a less electropositive metal in contact with iron, rusting occurs.
Apabila logam yang lebih elektropositif bersentuhan dengan besi, pengaratan tidak berlaku manakala jika logam yang kurang elektropositif bersentuhan dengan besi, pengaratan akan berlaku.

Materials/ *Bahan* :
Iron nails, magnesium, copper, hot jelly solution, potassium hexacyanoferrate (III) solution, phenolphthalein indicator, sandpaper.
Paku besi, magnesium, kuprum, larutan agar-agar panas, larutan kalium heksasianoferat (III), penunjuk fenolftalein, kertas pasir

Apparatus / *Radas* :
Test tube and test tube rack.
Tabung uji dan rak tabung uji

Procedure:
1. Clean iron nail, magnesium and copper with sandpaper.
2. Coil iron nail with magnesium and another iron nail with copper.
3. Place the iron nail in separate test tube.
4. Pour jelly containing potassium hexacyanoferrate(III) solution and phenolphthalein indicator into each test tube.
5. Leave the test tubes for one day.
6. Record the observation

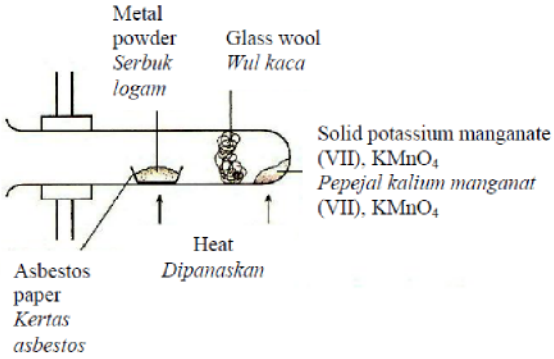
Prosedur:
1. *Bersihkan paku besi, magnesium dan kuprum dengan kertas pasir.*
2. *Lilitkan satu paku besi dengan magnsium dan satu lagi dengan kuprum.*
3. *Masukkan paku besi itu dalam tabung uji yang berasingan,*
4. *Tuang larutan agar-agar yang mengandungi larutan kalium heksasianoferat (III) dan penunjuk fenolftalein ke dalam setiap tabung uji.*
5. *Biarkan tabung uji selama sehari.*
6. *Catatkan pemerhatian.*

Tabulation of data / *Penjadualan data*:

Metal *Logam*	Observation *Pemerhatian*
Magnesium *Magnesium*	
Copper *Kuprum*	

REACTIVITY SERIES (SPM 2004)
SIRI KEREAKTIFAN

2. Method to store metal depends on reactivity of metal towards oxygen. For example, sodium is kept in paraffin oil, calcium is put in a vacuumed desicator and zinc is wrapped with paper. The reactivity of the metals is compared by observing the brightness of flame or glow when the metal burns in oxygen.
Kaedah penyimpanan logam bergantung kepada kereaktifan logam itu terhadap oksigen. Sebagai contoh, natrium disimpan dalam minyak parafin, kalsium disimpan dalam desikator yang kedap udara dan zink dibalut dengan kertas. Kereaktifan logam dibandingkan dengan memerhatikan kecerahan nyalaan atau baraan semasa logam terbakar dalam oksigen.
Diagram 2.1 shows the set-up of apparatus for an experiment to determine the order of metals in the Reactivity Series.
Rajah 2.1 menunjukkan susunan radas bagi eksperimen untuk menentukan susunan logamlogam dalam Siri Kereaktifan Logam



Referring to above situation, plan a laboratory experiment to arrange metals in terms of their reactivity with oxygen. You are required to use **four** different metals.
*Merujuk situasi di atas, rancang satu eksperimen makmal untuk menyusun logam-logam berdasarkan kereaktifan logam berkenaan bertindak balas dengan oksigen. Anda dikehendaki menggunakan **empat** jenis logam yang berlainan.*

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi perkara-perkara berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan* :
To investigate the reactivity of magnesium, copper, zinc and lead with oxygen
Untuk mengkaji kereaktifan logam magnesium, kuprum, zink dan plumbum dengan oksigen

Problem statement / *Pernyataan masalah*:
How do different types of metals react with oxygen?
Bagaimanakah pelbagai jenis logam bertindak balas dengan oksigen?

Variables / *Pemboleh ubah*:
Manipulated: *Magnesium, Copper, Zinc, Lead*
Dimanipulasi
Responding: *Reactivity of metal*
Bergerak balas
Fixed: *Potassium manganate(VII)*
Dimalarkan

Hypothesis / *Hipotesis* :
The more reactive the metal in Reactivity Series, the bigger the flame.

Materials / *Bahan* :
Magnesium powder, copper powder, zinc powder, lead powder, solid potassium managanate(VII)

Apparatus / *Radas* :
Combustion tube, retort stand with clamp, Bunsen burner, glass wool, asbestos paper.

Procedure:
1. Place one spatula of potassium manganate(VII) powder in a boiling tube.
2. Put some glass wool into the boiling tube and the tube is clamp horizontally.
3. Place one spatula of magnesium powder on an asbestos paper and put it in the boiling tube.
4. Heat the magnesium powder strongly until it glows, then heat strongly the potassium manganate(VII) powder to release oxygen gas.
5. Observe the brightness of the flame or glow and record the observation.
6. Repeat the experiment using zinc, lead and copper powder

Prosedur:
1. *Masukkan satu spatula serbuk kalium manganat (VII) ke dalam tabung didih.*
2. *Masukkan sedikit wul kaca ke dalam tabung didih itu dan apitkan secara mendatar.*
3. *Letakkan satu spatula serbuk magnesium pada kertas asbestos dan dimasukkan ke dalam tabung didih.*
4. *Panaskan serbuk magnesium dengan kuat sehingga membara dan kemudian panaskan pula serbuk kalium manganat(VII) untuk membebaskan gas oksigen.*
5. *Perhatikan kecerahan nyalaan atau baraan dan catatkan pemerhatian.*
6. *Ulang eksperimen dengan menggunakan serbuk zink, plumbum dan kuprum.*

Tabulation of data / *Penjadual data*:

Metals	*Observations*
Magnesium	
Zinc	
Copper	
Lead	

CHAPTER 13 :THERMOCHEMISTRY
BAB 13 : TERMOKIMIA

1. HEAT OF NEUTRALISATION (SPM 2006)
HABA PENEUTRALAN

Neutralisation is a reaction between an acid and an alkali to form salt and water.
Peneutralan ialah satu tindak balas antara asid dengan alkali untuk membentuk garam dan air.

Referring to the situation above, plan a laboratory experiment to compare the heat of neutralisation between **a named strong acid** with sodium hydroxide solution and heat of neutralisation between **a named weak acid** with sodium hydroxide solution.
*Merujuk kepada situasi di atas, rancangkan satu eksperimen dalam makmal untuk membandingkan haba peneutralan antara **suatu asid kuat** yang **dinamakan** dengan larutan natrium hidroksida dan haba peneutralan antara **suatu asid lemah** yang **dinamakan** dengan larutan natrium hidroksida.*

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan*:
To determine the heat of neutralization between strong acid and strong alkali and weak acid and strong alkali.
Untuk menentukan haba peneutralan antara acid kuat dengan alkali kuat dan asid lemah dan alkali kuat

Problem statement *Pernyataan masalah*:
Is the heat of neutralisation of strong acid and sodium hydroxide is higher than weak acid and sodium hydroxide?
Adakah haba peneutralan antara asid kuat dengan natrium hidroksida lebih tinggi daripada asid lemah dengan natrium hidroksida?

Variables / *Pemboleh ubah* :
Manipulated: Types of acids
Dimanipulasikan : Jenis asid

Responding: Heat of neutralisation
Bergerak balas : Haba peneutalan

Fixed: Type of alkali
Dimalarkan : Jenis alkali

Hypothesis / *Hipotesis:*
Reaction between strong acid and sodium hydroxide solution produces higher heat of neutralisation than the reaction between weak acid and sodium hydroxide solution.

Materials / *Bahan* :
[0.1 -2.0] mol dm3 sodium hydroxide solution, [0.1 -2.0] mol dm^3 [any strong acid], [0.1 -2.0] mol dm^3 [any weak acid]

Apparatus/ Radas:
Measuring cylinders, polystyrene cup with covers, thermometer

Procedure:
1. Measure 50 cm^3 of 1.0 mol dm^{-3} hydrochloric acid and pour into a plastic container.
2. Measure 50 cm^3 of 1.0 mol dm^{-3} sodium hydroxide solution and pour into another plastic container.
3. Record the initial temperature of both solutions.
4. Mix the two solutions together.
5. Stir the mixture.
6. Record the highest temperature.
7. Repeat the experiment using 1.0 mol dm^{-3} ethanoic acid.

Prosedur:
1. *Sukat 50 cm^3 asid hidroklorik 1.0 mol dm^{-3} dan tuangkan ke dalam bekas plastik.*
2. *Sukat 50 cm^3 larutan natrium hidroksida 1.0 mol dm^{-3} dan tuangkan ke dalam bekas plastik yang lain.*
3. *Catatkan suhu awal kedua-dua larutan.*
4. *Campurkan kedua-dua larutan.*
5. *Kacau campuran.*
6. *Catatkan suhu tertinggi.*
7. *Ulang ekpsriment dengan menggunakan asid etanoik 1.0 mol dm^{-3}*

Tabulation of data:/ *Penjadualan data*

Type of acid	*[any **strong** acid]*	*[any **weak** acid]*
Initial temperature of alkali, °C		
Initial temperature of acid, °C		
Highest temperature of the reaction mixture, °C		

2. HEAT OF COMBUSTION (SPM 2012)
HABA PEMBAKARAN

Brazil, the fifth largest country in the world imports no oil, since half its cars run on alcohol fuel made from sugarcane. Diagram 3 shows an alcohol fuel station in Brazil.
Brazil, negara yang kelima besar di dunia tidak mengimport petrol, separuh daripada kereta di negara itu menggunakan bahan api alkohol yang dibuat daripada air tebu.
Rajah 3 menunjukkan sebuah stesen bahan api alkohol di Brazil.

Diagram 3 /*Rajah* 3

Different types of alcohols produce different heat of combustions. The value of the heat of combustion is depended on the number of carbon atoms per alcohol molecule. Plan a laboratory experiment to compare the heat combustion of methanol, ethanol and propan-1-ol.
Jenis-jenis alkohol yang berlainan menghasilkan haba pembakaran yang berlainan. Nilai haba pembakaran adalah bergantung kepada bilangan atom karbon per molekul alkohol. Rancang satu eksperimen makmal untuk membandingkan haba pembakaran bagi metanol, etanol dan propan-1-ol.

Your planning should include the following aspects:
Perancangan anda haruslah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

Aim / *Tujuan*:
To determine the heat of combustion of various liquid alcohol.
Untuk menentukan haba pembakaran pelbagai jenis alkohol cecair.

Problem statement/ *Pernyataan masalah:*
Does the number of carbon atoms per molecule alcohol affect the heat of combustion?

Variables / *Pemboleh ubah:*
Manipulated: Type of alcohol
Dimanipulasikan: Jenis alkohol

Responding: Heat of combustion
Bergerak balas : Haba pembakaran

Fixed: Volume of water
Dimalarkan : Isi padu air

Hypothesis / *Hipotesis:*
The higher the number of carbon atoms per molecule of alcohol, the higher the heat of combustion.
Lebih banyak bilangan atom karbon per molekul alkohol, semakin tinggi haba pembakaran

Materials / *Bahan* :
Ethanol, Propanol, Butanol, Methanol, Water

Apparatus / *Radas* :
Copper can, Spirit lamp, thermometer, weighing balance, Wooden block, Tripod stand, Wind shield, Measuring cylinder.

Procedure / *Prosedur* :
1. *Measure 200 cm^3 of water using measuring cylinder and poured into a copper can.*
2. *Initial temperature of the water is recorded.*
3. *A spirit lamp is half filled with ethanol.*
4. *Initial mass of the spirit lamp is recorded.*
5. *Put the spirit lamp under the copper beaker and ignite the wick immediately.*
6. *Stir the water and the flame is put off after the temperature has increased by 30^0C.*
7. *The highest temperature of the water is recorded.*
8. *Immediately the final mass of the spirit lamp is recorded.*
9. *Repeat the experiment by replacing ethanol with propanol and butanol.*

Tabulation of data / *Penjadualan data :*

Types of alcohols	*Initial temperature,^0C*	*Highest temperature,^0C*	*Initial mass of spirit lamp, g*	*Final mass of spirit lamp, g*
Ethanol				
Methanol				
Propanol				
Butanol				

CHAPTER 5 : CHEMICAL FOR CONSUMERS
BAB 5: BAHAN KIMIA UNTUK PENGGUNA

[SPM2017]
Diagram 1 shows a group of scouts is setting up a tent by the beach.
Rajah 1 menunjukkan sekumpulan pengakap sedang mendirikan khemah.

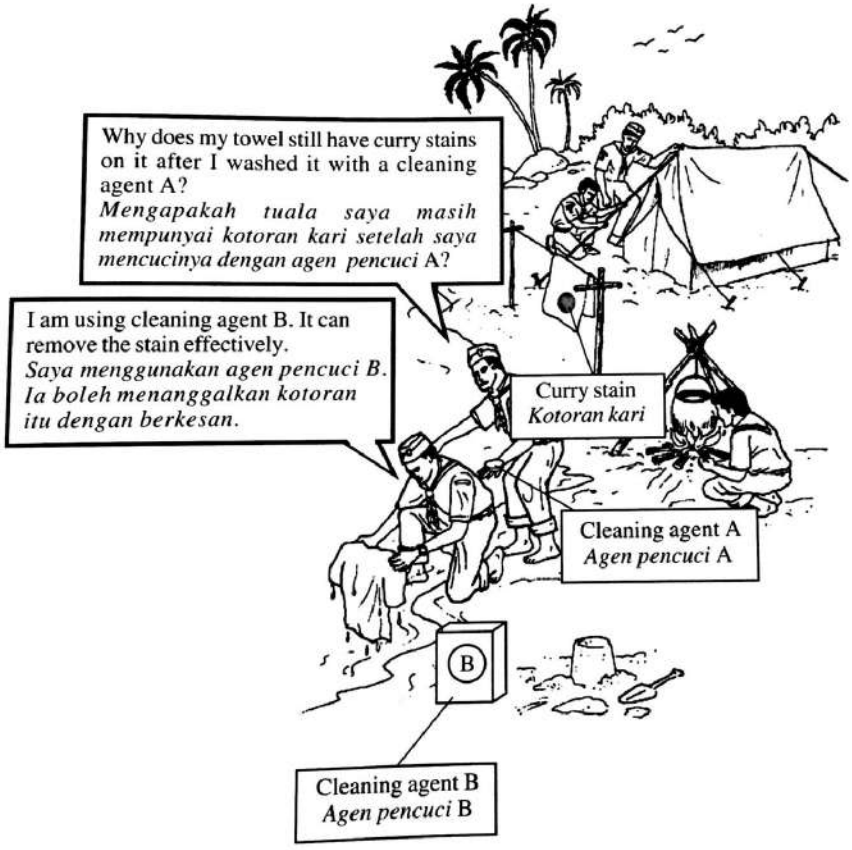


Diagram 1/*Rajah 1*

Based on conversation in Diagram 2, identify cleaning agent A and B.
Plan a laboratory experiment to study the effectiveness of the agents in hard water.
Berdasarkan perbualan pada Rajah 2, kenal pasti agen pencuci A dan agen pencuci B.
Rancang satu eksperimen makmal untuk mengkaji keberkesanan agen tersebut dalam air liat.

Your planning should include the following aspects:
Perancangan anda hendaklah mengandungi aspek-aspek berikut:

(a) Statement of the problem
Pernyataan masalah

(b) All the variables
Semua pembolehubah

(c) Hypothesis
Hipotesis

(d) List of materials and apparatus
Senarai bahan dan radas

(e) Procedure
Prosedur

(f) Tabulation of data
Penjadualan data

[17 marks]

(a) Problem statement/ *Pernyataan masalah:*
Is detergent/cleaning agent B more effective than soap/ cleaning agent A in hard water?

(b) All the variables/*Semua pembolehubah:*
MV: Type of cleaning agent// Soap and detergent
RV: Effectiveness of cleaning agents
CV: Hard water

(c) Hypothesis/*Hipotesis*
Detergent is more effective thab soap in hard water

(d) List of materials and apparatus/ *Senarai bahan dan radas*
Materials : Hard water, Detergent, Soap, Oil stained cloth
Apparatus : Beaker, Measuring cylinder, Spatula

(e) Procedure /*Prosedur*
1. *Pour 50 cm^3 of hard water into a beaker.*
2. *Pour 5 cm^3 of soap into the beaker.*
3. *Put a piece of oily stained cloth into the beaker.*
4. *Clean/ Scrub/ Brush/ Wash the cloth*
5. *Record the observation.*
6. *Repeat steps 1 to 5 using detergent.*

(f) Tabulation of data/*Penjadualan data*

Type of cleaning agent	*Observation*
Soap	
Detergent