BAHAGIAN PENGURUSAN SEKOLAH BERASRAMA PENUH
DAN SEKOLAH KECEMERLANGAN

CHEMISTRY 4541

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MODUL X A-PLUS SBP

2015

SEKOLAH BERASRAMA PENUH (SBP)

PANEL PENYEDIA I:	SEKOLAH
PN HJH WAN NOOR AFIFAH BT WAN YUSOFF	SBPI GOMBAK
TN HJ CHE MALEK B MAMAT	SBPI BATU RAKIT
PN HJH AISHAH PEONG BT ABDULLAH	SBPI TEMERLOH
EN JONG KAK YING	SMS KUCHING
PN NORINI BINTI JAAFAR	SMSP PEREMPUAN SEREMBAN

CHEMISTRY PERFECT SCORE & KANDUNGAN 2015
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Bil	Set	Topic	Page	Remark	Total
1	-	Guidelines & Anwering Techniques	3-8	-	-
2	Set 1	The structure of Atom, Periodic Table of Elements and Chemical Bonds	10-11	Essay section B=1 Essay section C=1 Total =2	5 questions
		Chemical Formulae and equations	11- 15	Essay section B=2 Essay section C=1 Total =3	
3	Set 2	Electrochemistry	16-20	Essay section B=1 Essay section C=2 Total =3	5 questions
		Oxidation and Reduction	21-25	Essay section B=1 Essay section C=1 Total =2	
4	Set 3	Acids and Bases	27-29	Essay section B=1 Essay section C=1 Total =2	12 questions
		Salts	30-35	Structure =2 Essay section B=1 Essay section C=1 Total =4	
		Rate of reaction	35-43	Structure = 2 Essay section B=1 Essay section C=1 Total =4	
		Thermochemistry	43-44	Essay section B=1 Essay section C=1 Total =2	
5	Set 4	Carbon compounds	46-47	Essay section B=1 Essay section C=1 Total =2	6 questions
		Manufactured Substance in Industry	48-50	Essay section B=1 Essay section C=1 Total =2	
		Chemicals for Consumers	50-52	Essay section B=1 Essay section C=1 Total =2	
6	Set 5	Guidelines for answering paper 3	54-55	-	2 sets
		Paper 3 set 1	56-60		
		Paper 3 set 2	61-65		

CHEMISTRY

PERFECT SCORE &

X – A PLUS MODULE

2015

GUIDELINES
&
ANSWERING TECHNIQUES

CHEMISTRY SPM

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1.0 FORMAT OF AN INSTRUMENT OF CHEMISTRY BEGINNING SPM 2003

No	Item	Paper 1 (4541/1)	Paper 2 (4541/2)	Paper 3 (4541/3)
1	Type of instrument	Objective test	Subjective test	Written Practical Test
2	Type of item	Objective it	Section A : Structured Item Section B : Essay restricted response Item Section C : Essay extended response Item	Subjective Item : Structured Item Extended Response Item: (Planning an experiment)
3	Number of question	50 (answers all)	Section A : 6 (answer all) Section B : 2 (choose one) Section C : 2 (choose one)	Structured Item : 1/2 items (answer all) Extended Response Item : 1 item
5	Duration of time	1 hour 15 minutes	2 hour 30 minutes	1 hour 30 minutes

2.0 CONSTRUCT REQUIREMENT

Construct	Paper 1	Paper 2	Paper 3
Knowledge	20 m (No 1- 20)	14	-
Understanding	15 m (No 21 – 35)	21	-
Application	15 m (No 36 – 50)	29	-
Analysis	-	21	-
Synthesizing	-	15	-
Science process	-	-	50
Total mark	50	100	50

3.0 TIPS TO SCORE " A " CHEMISTRY

3.1 Master the topics that contains the basic concepts of chemistry :

1. The structure of the atom
2. Chemical Formulae And Equations
3. Periodic Table
4. Chemical Bond

3.2 Familiarize with different types of questions as listed below and complete the previous SPM papers:

1. Objectives questions (MCQ) (Paper 1)
2. Structured questions (Paper 2 & 3)
3. Essays (Paper 2)
4. Planning an experiment (Paper 3)
5. Draw and label the diagram
6. Writing chemical equation(balanced equation, ionic equation, half equation)

3.3 Try to get :-

- ✓ 45 marks above for paper 1
- ✓ 90 marks above for paper 2
- ✓ 45 marks above for paper 3 (Total= 180/2 = 90 , **A+** in SPM)

4.0 GUIDELINE FOR ANSWERING PAPER 1

4.1 Paper 1 questions test students on

1. Knowledge (Number 1 – 20)
2. Understanding (Number 21 – 35)
3. Application (Number 36 – 50)

4.2 Score in paper 1 Indicates student's level of understanding in chemistry:

Less than 20 – very weak
20 – 25 - weak
26 – 30 - average
31 – 39 - good
40 – 45 - very good
46 – 50 - excellent.

4.3 Answer all SPM objective questions . Objective questions for each year contain all topics. If your score in paper 1 is 45 and above, you will able to answer questions in paper 2 & 3 easily.

5.0 GUIDELINE FOR ANSWERING PAPER 2 (STRUCTURE AND ESSAY)

5.1 Paper 2 questions test student on

1. knowledge
2. understanding
3. application
4. analyzing
5. synthesizing

5.2 Steps taken are:

1. Underline the **command word** and **marks** allocated for each question.
2. **Match** the **command word to the mark** allocated for each question. 1 point is awarded 1 mark.
3. Follow the needs of the question (Refer to the command words, page …….)
4. Unnecessary repetition of the statement in the question is not required.

5.3 Three types of questions which involve experiments in paper 2:

I. Type 1

Describe an experiment on……Include a labeled diagram in your answer

1. Diagram
2. Procedure
3. Observation/example/data/calculation/equation/sketch of graph/conclusion

II. Type 2

Describe an experiment……(The diagram will support your answer.)

1. No mark is allocated for a diagram
2. Procedures
3. Observation/example/calculation/equation/sketch of graph/conclusion

III. Type 3

Describe a chemical/confirmatory test for …….

1. Procedure
2. Observation
3. Conclusion

6.0 THE COMMON COMMAND WORDS IN PAPER 2 & PAPER 3 CHEMISTRY

- The question normally starts with a command word.
- Students must know the meaning of the command word to make sure that the **answer given is according to the question's requirement.**
- Match the command word to the mark allocated for each question.

Command word	Explanation/example
Name/State the name (paper 2 & 3)	Give the name , not the formula. Example: Name the main element added to copper to form bronze. Wrong answer :Sn. Correct answer : Tin
State (paper 2 & 3)	Give brief answer only. Explanation is not required. Example : State one substance which can conduct electricity in solid state. Answer : Copper
State the observation (Paper 2 & 3)	Write what is observed physically. ***Example 1*** : State one observation when magnesium powder is added to hydrochloric acid. [1 *mark*] ***Wrong answer*** : Hydrogen gas is released. ***Correct answer*** : Gas bubbles are released
	Indicate the change of colour , give the initial and final colour of the substance/chemical. ***Example 2***: What is the colour change of copper(II) suphate solution. [2 *marks*] ***Wrong answer***: The solution becomes colourless ***Correct answer*** : The blue colour of the solution becomes colourless
Explain (Paper 2 & 3)	Give the answer with reasons to explain certain statement / fact / observation/ principal. ***Example 1*** : Explain why bronze is harder than pure copper [4 *marks*] ***Correct answer*** : - Copper atoms in pure copper are all of the same size and .....1 - they are arranged in layers that can slide easily when force is applied .....1 - The presence of tin atoms in bronze that are different in size disturb the orderly arrangement of atoms in bronze. .....1 - This reduces the layer of atoms from sliding. 1
What is meant by.. (Definition) (Paper 2 & 3)	Give the exact meaning ***Example:*** What is meant by hydrocarbon. ***Wrong answer:*** A compound that contains carbon and hydrogen ***Correct answer***: A compound that contains carbon hydrogen only
Describe chemical test (Paper 2 & 3)	State the**method** to conduct the test , **observation** and **conclusion.** ***Example*** : Describe how to identify the ion present in the solution . [3 *marks*] ***Answer*** : - Pour in 2 cm^3 of the solution in a test tube. Add a few drops of sodium hydroxide *solution* and the test tube is shake the test tube .....1 - A reddish brown precipitate formed. .....1 - Fe^{3+} ions present 1
Describe gas test. (Paper 2 & 3)	State the method to conduct the test observation and conclusion**.** Example: Describe the confirmatory test for gas released at the anode(oxygen). [3 *marks*] ***Wrong answer***: Test with a glowing wooden splinter. ***Correct answer:***- Place a glowing wooden splinter to the mouth of the test tube .....1 - The glowing wooden splinter is lighted up .....1 - Oxygen gas is released 1

Describe an experiment (8 - 10 marks) (Paper 2)	- No mark is awarded for the diagram. The diagram can help students write the steps taken in the procedure. - List of materials 1m } *Can be obtained from the diagram* - List of apparatus 1m - Procedure (5 – 8 m) - Observation/tabulation of data/ calculation/sketch of the graph/ chemical equation /ionic equation /conclusion …… etc. - Any additional details relevant derived from the question.
Plan an experiment (17 marks) (Paper 3)	Answer the question according the requirement : – Problem statement/Aim of experiment – Hyphotesis – Variables – List of substances and apparatus – Procedure – Tabulation of data Note: For question 3, unlike PEKA report students only need to answer according to what is stated in the question. - No mark for the diagram. Diagram can help student writing the steps taken in the procedure.
Describe the process … **Describe** the structure …. **Describeand write** equation… **Describe how** … (Paper 2 & 3)	Give relevant details derived from the question.
Predict (Paper 2 & 3)	Make a prediction for something that might happen based on facts *Example*: Experiment 1 is repeated using a larger beaker.Predict the increase in temperature Answer : The increase in temperature is lower than experiment 1.
Compare (Paper 2)	Give the **similarities and differences** between two items/ situations
Differentiate (Paper 2)	**Give differences** between two items/situations Example : State three differences between ionic and covalent compound. Answer : State three properties of ionic compound and three properties covalent compound
Draw a labeled diagram of the apparatus (Paper 2)	Draw a complete set up of apparatus (i) Functional set up of apparatus (ii) Complete label (iii) Shade solid, liquid and gas correctly. (iv) Draw an arrow and label ' heat' if the experiment involves heating.
Draw a diagram to show the bonding formed in the compound (Paper 2)	(i) Ionic compound – The number of electrons in each shell is correct, 2 electrons in the first shell and 8 electrons in the second and third shell. – Show the charge of each particle. – Write the symbol of each element at the centre of the ion. (ii) Covalent compound – The number of electrons in each shell is correct, 2 electrons in the first shell and 8 electrons in the second and third shell. – The number of atoms sharing pair of electrons is correct. – Write the symbol of each element at the center of each atom in the molecule.

Draw graph (Paper 3)	Draw graph as follows : – Label the two axis with the correct unit – Choose suitable scale, the size of the graph should be at least ¾ of the size of the graph paper. – Plot all the points correctly – Smooth graph (curve or straight line) – For the determination of the rate of reaction (i) Draw a tangent at the curve. (ii) Draw a triangle at the tangent Calculate the gradient of the tangent
Draw the energy level diagram (Paper 2)	– Draw an arrow for the vertical axis only and label with energy. – Draw two horizontal lines for the reactants and products
Draw the arrangement of particles in solid, liquid and gas. (Paper 2)	– Solid: Draw at least three layers of particles closely packed in orderly manner and they are not overlap. – Liquid : The particles packed closely but not in orderly manner – Gas : The particles are very far apart from each other
Draw the direction of electron flow (Paper 2 /3)	Draw the direction for the flow of electrons on the circuit, not through the solution.
Write chemical equation (Paper 2 & 3)	– Write the balanced chemical equation – Differentiate : (i) Balanced chemical equation (ii) Ionic equation (iii) Half equation for oxidation (iv) Half equation for reduction
Calculate (Paper 2 & 3)	– Show all the steps taken – Give final answer with unit. –
Classify (Paper 3)	– Draw table to represent the classification.

SET ①

1. **The Structure of Atom, Periodic Table of Elements and Chemical Bonds**
2. **Chemical Formulae and Equations**

SET 1 : THE STRUCTURE OF ATOM, PERIODIC TABLE OF ELEMENTS AND CHEMICAL BONDS (SECTION B)

1. Table 1 shows the melting point and boiling point of substances X, Y and Z.
Jadual 1 *menunjukkan takat lebur dan takat didih bagi bahan* X, Y *dan* Z.

Substance / *Bahan*	**Melting point / *Takat lebur* (°C)**	**Boiling point / *Takat didih* (°C)**
X	65	110
Y	−8	54
Z	200	450

Table 1 / *Jadual* 1

(a) Eplain why the melting point substance X is lower than Z.
Terangkan mengapa takat lebur X *lebih rendah dari* Z.

[2 marks]

(b) Identify the state of matter of substance X, Y and Z at room condition. Explain your answer
Kenal pasti keadaan jirim bahan X, Y *dan* Z pada keadaan bilik*. Terangkan jawapan anda*.

[6 marks]

(c) Substance Y is heated from room temperature to 90 ^{O}C.
Bahan Y *dipanaskan daripada suhu bilik ke 90* ^{O}*C*

(i) Sketch a graph of temperature against time for the heating of substance Y.
Lakar graf suhu melawan masa bagi pemanasan bahan Y.

[2 marks]

(ii) Describe the graph in terms of state of matter, particle arrangements and changes in kinetic energy.
Huraikan graf itu dari segi keadaan jirim, susunan zarah dan perubahan tenaga kinetik.

[10 marks]

SET 1 : THE STRUCTURE OF ATOM, PERIODIC TABLE OF ELEMENTS AND CHEMICAL BONDS (SECTION C)

2. Diagram 1 shows parts of the Periodic Table of Elements. L, Q, R and T are not the actual symbols of the elements.
Rajah 1 *menunjukkan sebahagian unsur dalam Jadual Berkala Unsur.* L, Q, R *dan* T *bukan simbol sebenar unsur.*

Diagram 1 /*Rajah* 1

(a) Compare element R and T in terms of /*Bandingkan unsur R dan T dari segi*

- Atomic size/*Saiz atom*
- Electronegativity/*Keelektronegatifan*

Explain your answer.
Terangkan jawapan anda

[6marks]

(b) Element T is added into swimming pool water to clean the pool and to kill germs. The product formed for the reactions between T and water are acidic solution of HT and acidic solution HOT that bleach.
Calculate mass T that needs to be dissolved in 500 dm^3 of swimming pool water to produce 0.0001$moldm^{-3}$ HOT solution
[Relative atomic mass : H=1; O=16; T= 35.5]
Unsur T *dimasukkan ke dalam air kolam renang untuk membersihkan kolam dan membunuh kuman. Hasil tindak balas* T *dengan air ialah larutan* HT *yang bersifat asid dan larutan berasid* HOT *yang bersifat peluntur.*
Hitung jisim T *yang perlu dilarutkan dalam* 500 dm^3 *air kolam mandi untuk menghasilkan larutan* HOT 0.0001$moldm^{-3}$
[*Jisim atom relatif* : H=1; O=16; T= 35.5]

[4 marks]

(c) Using the element in Diagram 1, explain how two compounds can be formed from these elements. The two compounds should have different bond types.
Dengan menggunakan unsur dalam Rajah 1*, terangkan bagaimana dua sebatian boleh terbentuk dari unsur-unsur itu. Dua sebatian itu hendaklah mempunyai jenis ikatan yang berlainan.*

[10 marks]

SET 1 : CHEMICAL FORMULAE AND EQUATIONS (SECTION B)

3. A housewife wants to boil water in an electric kettle that was purchased a year ago. She found that the time taken to boil the water is longer than the time she first bought the kettle.
Seorang suri rumah ingin memasak air di dalam cerek elektrik yang telah dibeli setahun lalu. Dia mendapati masa yang diambil untuk memasak air tersebut lebih lama berbanding pada masa mula-mula dia membeli cerek tersebut.
Diagram 1.1 shows the kettle used by the housewife.
Rajah 1.1 *menunjukkan cerek yang digunakan oleh suri rumah*.

ı / Rajah 1.1

Scale is a white solid that accumulated in kettle consists of calcium carbonate. A simple way to remove the scales is by dissolving it with an acid X.
Kerak adalah pepejal putih yang terkumpul dalam cerek yang mengandungi kalsium karbonat. Cara yang mudah untuk menyingkirkan kerak ialah dengan melarutkannya dengan asid X.

(a) The information below is regarding acid X.
Maklumat di bawah mengenai asid X.

- Carbon 39.9%/*Karbon* 39.9%
- Hydrogen 6.7%/*Hidrogen* 6.7%
- Oxygen 53.4%/*Oksigen* 53.4%
- Relative molecular mass = 60/*Jisim molekul relatif* = 60
- Relative atomic mass of C = 12, H=1 and O=16/*Jisim atom relatif* C = 12, H=1 *dan* O=16

Based on the information of acid X, calculate:
Berdasarkan maklumat bagi asid X*, hitungkan :*

(i) the empirical formula of acid X./*formula empirik bagi asid* X

(ii) the molecular formula of acid X/*formula molekul bagi asid* X

(iii) State the name of acid X/*Nyatakan nama asid* X

[6 *marks*]

(b) Based on your answer in (a)(i) dan (a)(ii), compare and contrast empirical formula with molecular formula for acid X.
Berdasarkan kepada jawapan anda di (a)(i) dan (a)(ii), *banding dan bezakan formula empirik dan formula molekul bagi asid* X.

[4 *marks*]

(c) (i) State the name of products when acid X is added to solid calcium carbonate.
Nyatakan nama bagi hasil-hasil tindak balas apabila asid X ditambahkan kepada pepejal kalsium karbonat.

(ii)Write the chemical equation for the reaction.
Tuliskan persamaan kimia bagi tindak balas bagi tindak balas.

[5 *marks*]

(d) Diagram 1.2 shows a farmer is spreading fertilisers to her crops.
Rajah 1.2 *menunjukkan seorang petani sedang menabur baja ke atas tanaman-tanamannya.*

Diagram /Rajah 1.2

Fertiliser plays important role for the growth of plants. There are a few types of fertilisers in market.
By using your knowledge in chemistry, help the farmer to determine the best fertiliser among the following :
Baja memainkan peranan penting untuk pertumbuhan tanaman-tanaman. Terdapat beberapa jenis baja di pasaran.Dengan menggunakan pengetahuan anda dalam kimia, bantu petani tersebut untuk menentukan baja yang terbaik di antara yang berikut :

- Urea , $(NH_2)_2CO$/*Urea*
- Ammonium sulphate, $(NH_4)_2SO_4$*Ammonium sulfat*
- Ammonium nitrate. NH_4NO_3*Ammonium nitrat*

[Given that the relative atomic mass of H = 1, C = 12, N = 14, O = 16, S = 32]
[*Diberi jisim atom relatif bagi* H = 1, C = 12, N = 14, O = 16, S = 32]

[5 *marks*]

4 (a) Table 4 shows the incomplete observation for two experiments to construct balanced chemical equation.
Jadual 2 *menunjukkan pemerhatian yang tidak lengkap bagi dua eksperimen untuk membina persamaan kimia yang seimbang*.

Experiment ***Eksperimen***	**Procedure** ***Prosedur***	**Observation** ***Pemerhatian***
I	Copper(II) carbonate is heated and the gas produced is passed through lime water./*Kuprum(*II*) karbonat dipanaskan dan gas yang terhasil dialirkan melalui air kapur*.	Green solid turns black. The lime water turns milky. *Pepejal hijau menjadi hitam*. *Air kapur menjadi keruh*.
II	Potassium iodide solution is added to lead(II) nitrate solution./*Larutan kalium iodida ditambah kepada larutan plumbum(*II*) nitrat*.	....

TABLE / *JADUAL* 4

(i) Based on the observation, state the name of the products in Experiment **I** and write the chemical equation for the reaction.
Berdasarkan pemerhatian, nyatakan nama bagi hasil-hasil tindak balas dalam Eksperimen **I** *dan tuliskan persamaan kimia bagi tindak balas itu*.

[4 *marks*]

(ii) State **one** observation in Experiment **II** and state the type of the reaction.
Write the chemical equation for the reaction.
Nyatakan ***satu*** *pemerhatian dalam Eksperimen* **II** *dan nyatakan jenis tindak balas itu.*
Tuliskan persamaan kimia bagi tindak balas itu.

[4 *marks*]

(b) The reaction between acid, HX and ionic compound, QY_2 can be represented by chemical equation below :
Tindak balas antara asid, HX *dan sebatian ion,* QY_2 *boleh diwakili oleh persamaan kimia di bawah* :

$$2HX(aq) + QY_2(aq) \rightarrow QX_2(s) + 2HY(aq)$$

State **three** statement to describe the chemical equation above.
Suggest an acid of HX and an ionic compound of QY_2.
Nyatakan ***tiga*** *pernyataan untuk menghuraikan persamaan kimia di atas*.
Cadangkan satu asid HX *dan satu sebatian ion* QY_2.

[5 *marks*]

(c) The information below is regarding substance Z./*Maklumat di bawah berkaitan dengan bahan* Z.

- Carbon / *Karbon* = 85.70 %
- Hydrogen / *Hidrogen* = 14.30 %
- Relative molecular mass = 56
  Jisim molekul relatif

(i) Determine the empirical formula of substance Z.
Tentukan formula empirik bagi sebatian Z.
[Relative atomic mass / J*isim atom relatif* : C = 12 , H = 1]

(ii) Determine the molecular formula of substance Z.
Tentukan formula molekul bagi bahan Z.

(iii) State the name of substance Z
Nyatakan nama bagi bahan Z

[7 *marks*]

5 a) Diagram 5 shows the set-up of apparatus in two experiments to determine the empirical formula of oxide of metal P and oxide of metal Q.
Rajah 5 menunjukkan susunan radas dalam dua eksperimen untuk menentukan formula empirik bagi oksida logam P *dan oksida logam* Q.

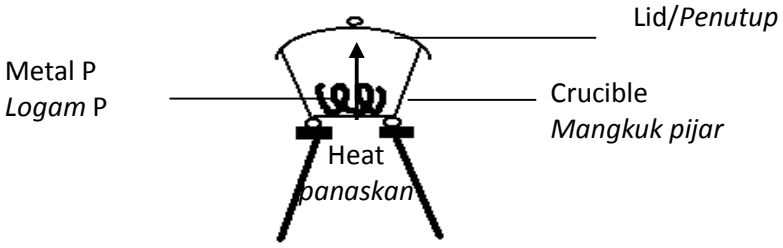
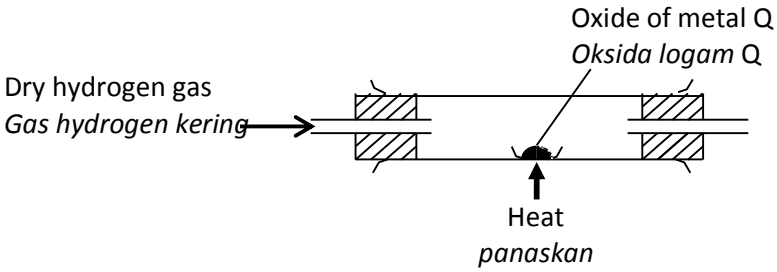
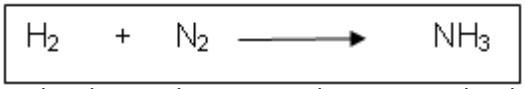
Experiment	Set-up of apparatus
I	
II	

Diagram / *Rajah 1*

Suggest one suitable metal P and one suitable metal Q.
Explain why method in Experiment I is suitable to determine the empirical formula of oxide of metal P and method in Experiment II is suitable to determine the empirical formula of oxide of metal Q.
Cadangkan satu logam yang sesuai untuk P *dan satu logam yang sesuai untuk* Q.
Terangkan mengapa kaedah dalam Eksperimen I *sesuai untuk menentukan formula empirik oksida logam* P *dan kaedah dalam Eksperimen* II *sesuai untuk menentukan formula empirik oksida logam* Q.
[4 *marks*]

(b) Diagram below shows the unbalance chemical equation for the reaction between hydrogen and nitrogen gas to produce ammonia.
Rajah di bawah menunjukkan persamaan kimia yang tidak seimbang bagi tindak balas antara gas hidrogen dan nitrogen untuk membentuk ammonia.



Balance the chemical equation above. Describe the balance chemical equation in quantitative aspect.
In a reaction 1.7 g of ammonia gas is produced. Calculate the volume of hydrogen gas reacted.
[Relative atomic mass: H=1 ; N=14 ; Molar volume gas = 24 $dm^3\ mol^{-1}$]
Seimbangkan persamaan kimia diatas. Huraikan persamaan kimia yang telah seimbang dari aspek kuantitatif.
Dalam satu tindak balas 1.7 g *gas ammonia telah dihasilkan. Hitung isipadu gas hidrogen yang ditindakbalaskan.*
[*Jisim atom relatif* : H=1 ; N=14 ; *Isipadu molar gas* = 24 $dm^3\ mol^{-1}$]

[6 *marks*]

(c) Metal X is more reactive than hydrogen.
[Relative atomic mass: O = 16 ; X = 24 , ionic formula : X^{2+}]

Logam X *lebih reaktif daripada hidrogen.*
[*Jisim atom relatif*: O = 16 ; X = 24, *formula ion* : X^{2+}]

Describe a laboratory experiment to determine the empirical formula of oxide X.
Your answer should consist of the following:

- Procedure of the experiment
- Calculation involved

Huraikan satu eksperimen makmal untuk menentukan formula empirik bagi oksida X.
Jawapan anda hendaklah mengandungi perkara berikut :

- *Prosedur eksperimen*
- *Pengiraan yang terlibat*

[10 *marks*]

SET ②

1. Electrochemistry

2. Oxidation and Reduction

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1. (a)Table below shows the descriptions and observations for three experiments , I ,II and III.
Jadual dibawah menunjukkan penerangan dan pemerhatian bagi tiga eksperimen , I,II *dan* III.

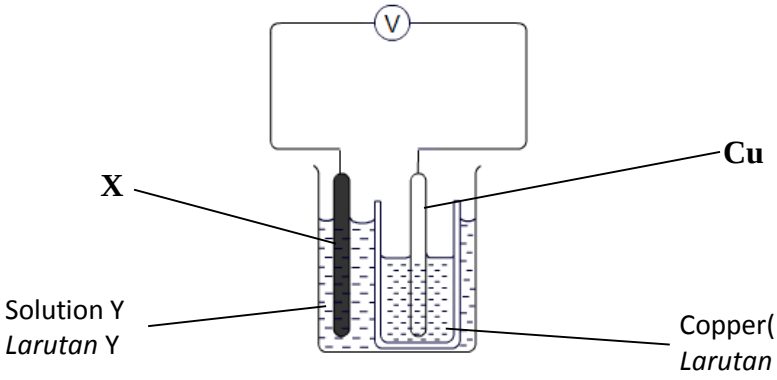
Experiment *Eksperimen*	Description *Penerangan*	Observation at anode *Pemerhatian dianod*
I	Electrolysis of 2 moldm^{-3} copper(II)chloride solution using carbon electrodes. *Elektrolisis larutan kuprum(II)klorida 2moldm^{-3} menggunakan elektrod karbon*	Greenish-yellow gas released. *Gas kuning kehijauan terbebas*
II	Electrolysis of 0.001 moldm^{-3} copper(II)chloride solution using carbon electrodes. *Elektrolisis larutan kuprum(II)klorida 0.001 moldm^{-3} menggunakan elektrod karbon*	Colourless gas released *Gas tanpa warna terbebas*.
III	Electrolysis of 2 moldm^{-3} copper(II)chloride solution using copper electrodes. Elektrolisis larutan kuprum(II)klorida 2 moldm^{-3} menggunakan elektrod kuprum	Anode become thinner. *Anod menipis*

(i) Compare the product of electrolysis at anode between experiment I , experiment II and experiment III.
In each case explain the difference in the products.
Bandingkan hasil elektrolisis di anod antara eksperimen I *eksperimen* II dan *eksperimen*III.
Bagi setiap kes terangkan perbezaan hasil itu.

(ii) Write half equation for the reaction at anode in experiment III.
Tulis setengah persamaan bagi tindak balas di anod dalam eksperimen III.

[10 *marks*]

(b)Diagram below shows a voltaic cell using copper, Cu and metal X. Copper is situated below metal X in the Electrochemical Series./*Rajah* di bawah *menunjukkan suatu sel kimia menggunakan kuprum,* Cu *dan logam* X. *Kuprum terletak di bawah logam* X *dalam Siri Elektrokimia*.



(i) Suggest a metal that is suitable as metal X and a solution that is suitable as solution Y.
Cadangkan logam yang sesuai sebagai logam X *dan larutan yang sesuai sebagai larutan* Y.

(ii) State the positive terminal and the negative terminal of this cell.
Nyatakan terminal positif dan terminal negatif bagi sel ini.

(iii) Write half equation at the positive terminal and negative terminal in (b) (ii).
Tuliskan setengah persamaan pada terminal positif dan terminal negatif dalam (b) (ii).

[6 *marks*]

(c) Diagram below shows the set up of the apparatus to arrange metals W, X, Y and Z based on the potential difference of the metals.
Rajah dibawah *menunjukkan susunan radas yang digunakan untuk menyusun logam-logam* W, X, Y *dan* Z *berdasarkan kepada perbezaan keupayaan logam-logam.*

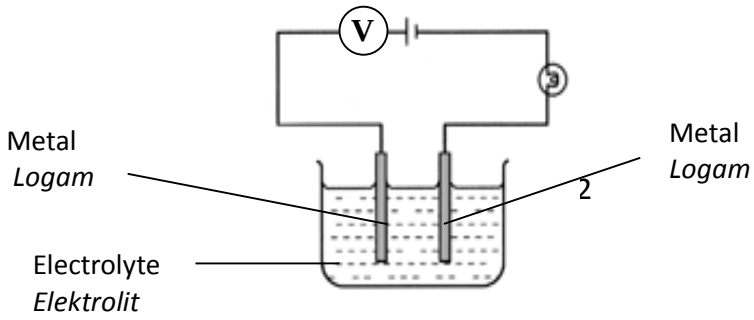


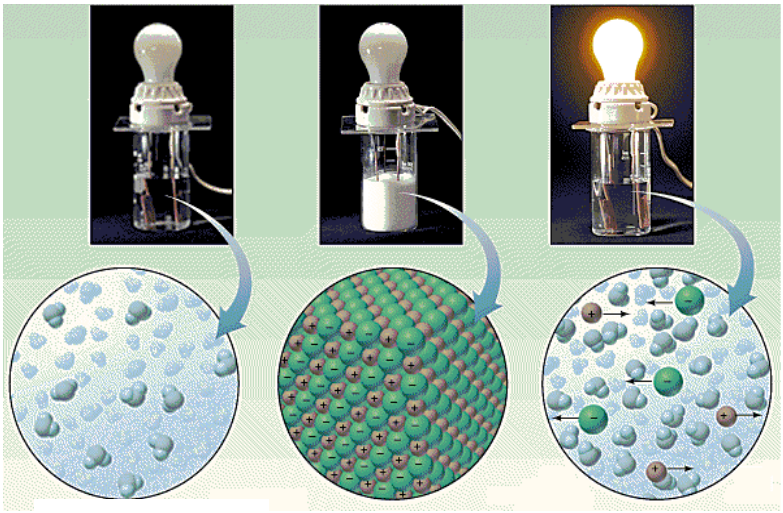
Table below shows the results of the experiment.
Jadual di bawah menunjukkan keputusan eksperimen yang dijalankan.

Pair of metals *Pasangan logam*	Potential difference (V) *Beza keupayaan*	Negative terminal *Terminal negatif*
W and X	0.50	X
X and Y	0.30	Y
W and Z	1.10	Z

(i) Arrange metals W, X, Y and Z in descending order in the Electrochemical Series.
Susunkan logam W, X, Y *dan* Z *dalam susunan menurun dalam Siri Elektrokimia.*
[1 *mark*]

(ii) Metals X and Z are used as electrodes in the voltaic cell.
State which metal acts as positive terminal.
Explain your answer and predict the voltage of the cell.
Logam X *dan* Z *digunakan sebagai elektrod dalam sel kimia.*
Nyatakan logam manakah yang menjadi terminal positif, terangkan jawapan anda dan ramalkan nilai voltan bagi sel itu.
[3 *marks*]

2. (a) A group of students were given a task by their teacher to carry out an experiment to determine the electrical conductivity of three substances X, Y and Z.
Sekumpulan pelajar telah diberikan tugasan oleh guru mereka untuk menjalankan eksperimen untuk menentukan kekonduksian elektrik bagi tiga bahan X, Y *dan* Z.
Results of the experiment are shown in Diagram 1.1
Keputusan eksperimen ditunjukkan dalam Rajah 1.1.



Substance X
Bahan X

Substance Y
Bahan Y

Substance Z
Bahan Z

Diagram / *Rajah* 1.1

Based on Diagram 1.1./ *Berdasarkan Rajah* 1.1

- Suggest substance X, Y and Z./*Cadangkan bahan* X, Y *dan* Z
- Explain the differences for observations/*Terangkan perbezaan bagi pemerhatian*
- Classify the substances into electrolyte and non electrolyte/*Kelaskan bahan-bahan itu kepada elektrolit dan bukan elektrolit*.

[*10 marks*]

(b)

Gold electroplating, when used in jewellery manufacturing, allows the manufacturer to provide the market with jewellery that appears to be made of pure gold at a cheaper price as the jewellery is only plated with gold.
Penyaduran logam emas apabila digunakan dalam pembuatan barang kemas memberikan pengilang untuk memasarkan barang kemas seolah-olah dibuat daripada emas tulen tetapi dijual pada harga yang lebih rendah disebabkan barang kemas disadurkan dengan emas.

Reffering to the above statement, describe an experiment in the laboratory how to electroplate an iron ring with gold. Include a labeled diagram in your description.
Merujuk kepada pernyataan di atas, huraikan satu eksperimen dalam makmal bagaimana untuk menyadur cincin besi dengan emas.

Sertakan gambar rajah berlabel dalam huraian anda.

[10 *marks*]

3. (a) You have an impure silver plate. You intend to purify the silver plate.
Suggest a method and electrolyte that can be used to purify it.
Write the half equation for the reaction at anode and cathode.
Anda mempunyai satu kepingan argentum tak tulen. Anda ingin untuk menulenkan kepingan argentum itu.
Cadangkan satu kaedah dan elektrolit yang boleh digunakan untuk menulenkannya.
Tulis setengah persamaan bagi tindak balas di anod dan di katod.

[4 *marks*]

(b) Table 2 shows the set up of apparatus of two experiments to investigate electrolysis process by using different electrodes.
Jadual 2 menunjukkan susunan radas bagi dua eksperimen untuk mengkaji proses elektrolisis dengan menggunakan elektrod yang berlainan.

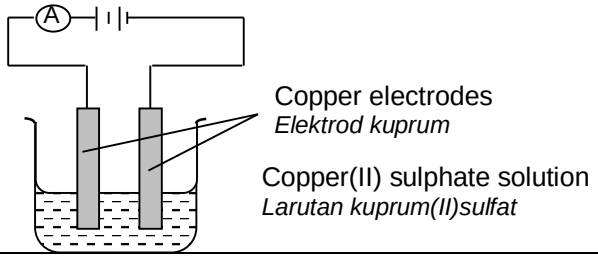
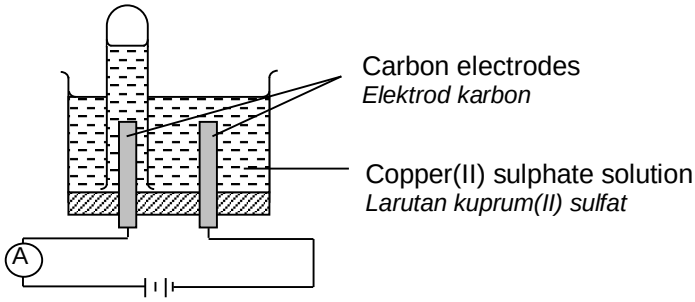
Experiment ***Eksperimen***	**Apparatus set-up** ***Susunan radas***
I	
II	

Table /Jadual 2

(i) Compare the observation and product formed at the anode for both experiments.
Bandingkan pemerhatian dan hasil yang terbentuk di anod bagi kedua-dua eksperimen.

(ii) Write the half equation at the anode for both experiments.
Tuliskan persamaan setengah di anod bagi kedua-dua eksperimen.

[6 *marks*]

(c) Study the following statement. */Kaji pernyataan berikut:*

> Chemical energy can be changed to electrical energy.
> *Tenaga kimia boleh ditukarkan kepada tenaga elektrik.*

Describe a laboratory experiment to prove this statement by using dilute sulphuric acid as the electrolyte and naming two different metals.
Huraikan satu eksperimen untuk membuktikan pernyataan di atas dengan menggunakan asid sulfurik cair sebagai elektrolit dan dua logam yang berlainan yang dinamakan.
Your explanation must include:
Penerangan anda mestilah mengandungi:

- a labelled diagram/ *gambar rajah berlabel*
  - procedure/*prosedur*
  - observation/*pemerhatian*
  - half equation/*setengah persamaan*

[10 *marks*]

4. **.**(a) Rusting occurs in the presence of water and oxygen.
Pengaratan berlaku dengan kehadiran air dan oksigen.

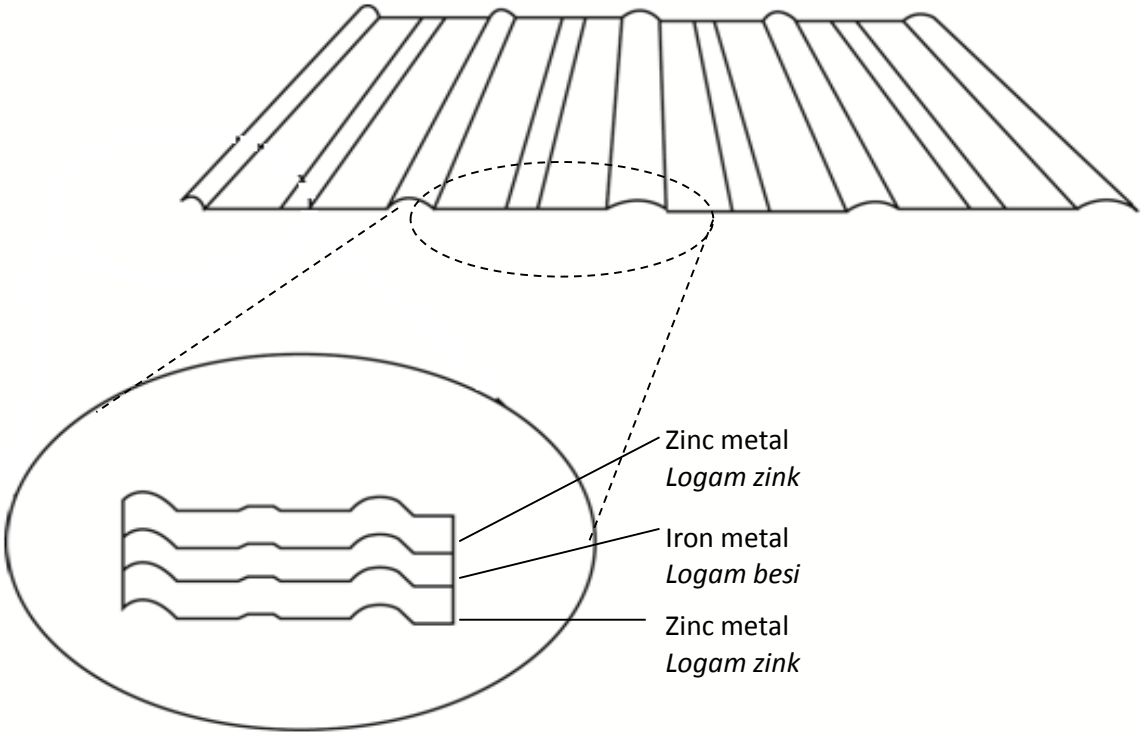
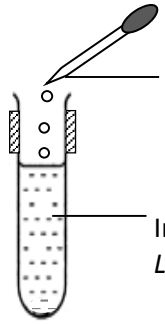
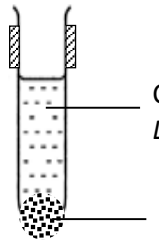


Diagram 4: Zinc roof consisting zinc and iron metals.
Rajah 4: *Atap zink yang terdiri daripada logam zink dan logam besi.*

Most of the houses used zinc roof in which zinc metal acts as outer protective layer to protect iron metal from rusting.
In your opinion, explain why magnesium metal is not suitable to replace zinc metal.
Kebanyakan rumah menggunakan atap zink sebagai bumbung di mana logam zink digunakan sebagai lapisan pelindung luar kepada logam besi yang akan melindunginya daripada berkarat.
Pada pendapat anda, terangkan mengapa logam magnesium tidak sesuai menggantikan logam zink.

[4 *marks*]

(b) Table below shows two sets of experiment to study redox reaction.
Jadual di bawah menunjukkan dua set eksperimen untuk mengkaji tindak balas redoks.

Experiment *Eksperimen*	Set-up of apparatus *Susunan Radas*	Observation *Pemerhatian*
I	 Bromine water *Air bromin* Iron(II) sulphate solution *Larutan ferum(II) sulfat*	The green colour of iron(II) sulphate solution turns yellow. *Warna hijau larutan ferum*(II) *sulfat bertukar kuning.*
II	 Copper(II)sulphate solution *Larutan kuprum(II)sulfat* Zinc powder *Serbuk zink* Heat *Panaskan*	The blue colour of copper(II) sulphate solution turns colourless.Brown solid formed. *Warna biru larutan kuprum*(II)*sulfat bertukar tanpa warna.Pepejal perang terbentuk*

Based on the observation , explain oxidation and reduction in experiment I and experiment II.Your answer include the following:
Berdasarkan pemerhatian , terangkan pengoksidaan dan penurunan dalam eksperimen I *dan eksperimen* II.
Jawapan anda mengandungi perkara berikut :

- Substance that oxidised and reduced/*bahan yang dioksidakan dan diturunkan*
- oxidising agent and reducing agent/*agen pengoksidaan dan agen penurunan*
- half equation for oxidation and reduction in Experiment II/ *setengah bagi pengoksidaan dan penurunan dalam Eksperimen* II

[10 *marks*]

(c) An experiment is carried out to determine the position of metal P, Q and copper in Reactivity Series./ Table below shows the results of experiment when the mixture of metal powder and metal oxide powder is heated.
Satu eksperimen dijalankan untuk menentukan kedudukan logam P, Q dan kuprum dalam Siri Kereaktifan. Jadual di bawah menunjukkan keputusan eksperimen bila campuran serbuk logam dan oksida logam dipanaskan.

Experiment *Eksperimen*	I	II	III
Mixture *Campuran*	P + copper(II) oxide P + *kuprum*(II) *oksida*	Q + copper(II) oxide Q + *kuprum*(II) *oksida*	P + oxide Q P + *oksida* Q
Observation *Pemerhatian*	Black powder turn to brown *Serbuk hitam bertukar ke perang*	Black powder turn to brown *Serbuk hitam bertukar ke perang*	No changes *Tiada perubahan*

Based on the results in Table above, arranged the metal P, Q and copper in order of increasing reactivity towards oxygen. Explain your answer.
Berdasarkan keputusan dalam Jadual di atas, susun logam P, Q *dan kuprum mengikut susunan kereaktifan menaik terhadap oksigen. Terangkan jawapan anda.*

[6 *marks*]

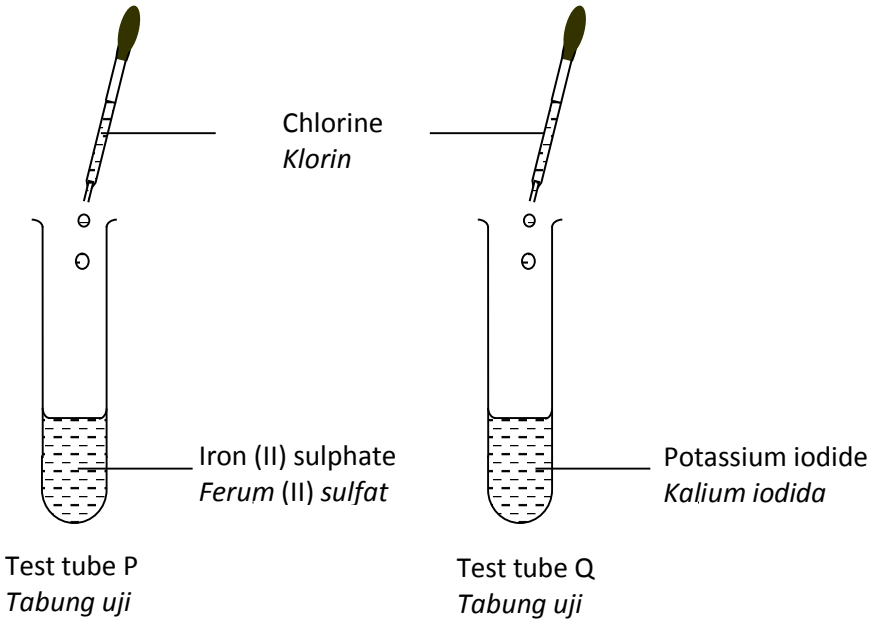
5. (a) The following are the equations of two reactions:
Berikut adalah persamaan bagi dua tindak balas:

Reaction I *Tindak balas* I	: $NaOH + HCl \longrightarrow NaCl + H_2O$
Reaction II *Tindak balas* II	:$Mg + Zn(NO_3)_2 \longrightarrow Mg(NO_3)_2 + Zn$

Determine which reaction is a redox reaction. Explain your answer in term of oxidation number.
Tentukan tindak balas manakah tindak balas redoks. Terangkan jawapan anda dari segi nombor pengoksidaan.

[4 *marks*]

(b) Diagram 5 shows two redox reactions that take place in test tubes P and Q.
Rajah 5 *menunjukkan dua tindak balas redoks yang berlaku dalan tabung uji* P *dan* Q.



Diagram/*Rajah* 5

State reducing agent in test tube P and test tube Q.
Write the ionic equation for the redox reaction in test tubes P and Q.
Nyatakan agen penurunan dalam tabung uji P *dan tabung uji* Q.
Tuliskan persamaan ion untuk tindak balas redoks dalam tabung uji P *dan* Q

[6 *marks*]

(c) Table 5 shows the observations of two experiments to determine the position of carbon in the reactivity series of metal.
Jadual 5 *menununjukkan pemerhatian bagi dua eksperimen untuk menentukan kedudukan karbon dalam siri kereaktifan logam.*

Experiment *Eksperimen*	Reactants *Bahan tindak balas*	Observation *Pemerhatian*
I	Carbon + oxide of metal P *Karbon + oksida logam* P	A flame spreads to the whole mixture. A brown residue is formed. *Nyalaan merebak ke ke seluruhan campuran. Baki berwarna perang terbentuk.*
II	Carbon + oxide of metal Q *Karbon + oksida logam* Q	No change *Tiada perubahan*
III	Carbon + oxide of metal R *Karbon + oksida logam* R	A glow spreads to the whole mixture. A grey residue is formed. *Baraan merebak ke keseluruhan campuran. Baki berwarna kelabu terbentuk.*

Table/*Jadual* 5

Based on observations in Table 2, arrange the reactivity of metals P, Q, and R in descending order.
Explain your answer.
Suggest one metal for Q.
Berdasarkan pemerhatian dalam Jadual 2*, susun kereaktifan logam-logam* P, Q *dan R dalam turutan menurun. Terangkan jawapan anda.*
Cadangkan satu logam bagi Q.

[10 *marks*]

6. (a) The chemical equation below is a redox reaction. X is a metal.
Persamaan kimia di bawah ialah suatu tindak balas redoks. X *ialah suatu logam*.

$X + CuSO_4 \rightarrow XSO_4 + Cu$

Suggest metal X. Give a reason.
Cadangkan logam X. *Berikan satu sebab bagi jawapan anda*.
Explain in term of oxidation number why the reaction above is the redox reaction.
Terangkan dari segi nombor pengoksidaan mengapa tindak balas di atas ialah tindak balas redoks.

[4 *marks*]

(b) Table below shows the formulae for two compound of oxides of iron .
Jadual di bawah menunjukkan formula bagi dua sebatian oksida ferum.

Compound *Sebatian*	Formulae *Formula*
X	FeO
Y	Fe_2O_3

(i) State the oxidation number of iron in the both compounds.
Nyatakan nombor pengoksidaan bagi ferum dalam kedua-dua sebatian tersebut.

[2 *marks*]

(ii) Name both of the compounds based on the IUPAC nomenclature system.
Explain your answer.
Namakan kedua-dua sebatian tersebut berdasarkan sistem tatanama IUPAC.
Terangkan jawapan anda.

[4 *marks*]

(c)

The transfer of electrons occurs from the reducing agent to the oxidising agent through the connecting wires. *Pemindahan elektron berlaku daripada agen penurunan ke agen pengoksidaan melalui wayar penyambung*.

You are given the following apparatus:
U-tube , galvanometer , connecting wires, stopper, dropper, carbon electrodes and retort stand with clamps.
Suggest suitable chemicals and describe an experiment to verify the above statement using the given apparatus.

Anda diberi radas berikut:
Tiub U *, galvanometer , wayar penyambung , penutup , penitis , elektrod karbon dan kaki retort dengan penyepit.*
Cadangkan bahan kimia-bahan kimia yang sesuai dan huraikan satu eksperimen untuk mengesahkan pernyataan di atas dengan menggunakan radas yang diberi.

[10 *marks*]

SET ③

1. **Acids and Bases**
2. **Salts**
3. **Rate of reaction**
4. **Thermochemistry**

https://cikguadura.wordpress.com/

1. (a) Your brother's leg is stung by bees.
What should you apply to his leg to relieve the pain without causing further injury? Explain why.
Kaki *adik anda disengat oleh lebah*
Apakah *yang harus anda sapukan pada kakinya untuk mengurangkan kesakitan tanpa menyebabkan kecederaan lebih teruk? Terangkan mengapa.*

[3 *marks*]

(b) Analgesic is commonly used to relieve pain. In the market, we also have water soluble analgesic tablets for fast relief. A student try to carry out investigation the solubility on this analgesic tablets as shown in Diagram 1.1 below.
Analgesik kerap digunakan untuk melegakan kesakitan. Dalam pasaran, kita dapat juga analgesik yang terlarutkan dalam air. Seorang pelajar menjalankan penyiasatan tentang keterlarutan analgesik ini seperti ditunjukkan dalam Rajah 1.1.

Content / *Kandungan*
Paracetamol, sorbitol powder, saccharin sodium, citric acid, sodium carbonate
Paracetamol, serbuk sorbitol, natrium sakarin, asid sitrik, natrium karbonat

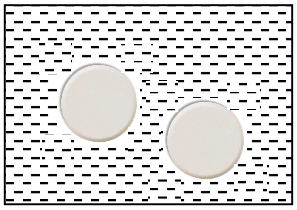
Case ***Kes***	**X**	**Y**
Action *Tindakan*	 Two Analgesic tablets added into water *Dua biji analgesik ditambahkan ke dalam air*	 Two Analgesic tablets added into cooking oil *Dua biji analgesik ditambahkan ke dalam minyak masak*
Observation *Pemerhatian*	Bubbles of colorless gas released *Gelembung-gelembung gas tak berwarna dibebaskan*	No change *Tiada perubahan*

Diagram / *Rajah* 1.1

Explain the difference in observation between case X and Y.
Terangkam perbezaan pemerhatian antara kes X *dan* Y.

[6 *marks*]

(c) Table 1 shows the concentration and pH value of sulphuric acid and nitric acid.
Jadual 1 menunjukkan kepekatan dan nilai pH bagi asid sulfurik dan asid nitrik.

Acid ***Asid***	**Concentration / mol dm^{-3}** ***Kepekatan* / mol dm^{-3}**	**pH value** **Nilai pH**
Sulphuric acid *Asid sulfurik*	0.005	2.0
Nitric acid *Asid nitrik*	0.005	2.3

Table / *Jadual* 1

Compare the pH value between sulphuric acid and nitric acid. Explain.
Bandingkan nilai pH *antara asid sulfurik dan asid nitrik. Terangkan.*

[4 *marks*]

(d) Diagram 1.2 shows the steps in preparation of potassium chloride salt.
Rajah 1.2 *menunjukkan langkah-langkah dalam penyediaan garam kalium klorida.*

STEP 1 /*LANGKAH* 1
Preparation of potassium hydroxide solution
14.0 g solid potassium hydroxide is dissolve in water to produce 250 cm^{3}solution

Penyediaan larutan kalium hidroksida
14.0 g *pepejal kalium hidroksida dilarutkan dalam air untuk menghasilkan* 250 cm^3*larutan.*
STEP 2 / *LANGKAH* 2
Preparation of potassium chloride salt
25.0 cm^3 of potassium hydroxide solution neutralised 25 cm^3 of the hydrochloric acid 1moldm^{-3}.

Penyediaan garam kalium klorida
25.0 cm^3*larutan kalium hidroksida meneutralkan* 25 cm^3*asid hidrochlorik* 1moldm^{-3}

Diagram / *Rajah 1.2*

Based on the information in Diagram 1.2 calculate
[Relative atomic mass: H=1, O=16, K=39, Cl=35.5]
Berdasarkan maklumat dalam Rajah 7.2 *hitungkan*
[*Jisim atom relatif*: H=1, O=16, K=39, Cl=35.5]

(i) the concentration of potassium hydroxide solution in mol dm^{-3}.
kepekatan larutan kalium hidroksida dalam mol dm^{-3}.

[2 *marks*]

(ii) the mass of potassium chloride obtained.
jisim kalium klorida yang diperolehi.

[5 *marks]*

2. (a) Diagram 2.1 shows the information of acids HX and H_2X
Rajah 2.1 *menunjukkan maklumat bagi asid* HX *dan* H_2X

- Acid HX is a monoprotic acid while H_2X is a diprotic acid.
- Both acid HX and H_2X are strong acids.
- *Asid* HX *adalah asid monoprotik manakala asid* H_2X *adalah asid diprotik*
- *Kedua-dua asid* HX *dan* H_2X *adalah asid kuat*

Diagram 2.1 / *Rajah* 2.1

Referring to the information in Diagram 2.1,
Merujuk kepada maklumat dalam Rajah 2.1,

(i) suggest suitable examples of /*cadangkan contoh yang sesuai bagi*
- diprotic acid */ asid diprotik*
- monoprotic acid /*asid monoprotik*

(ii) based on your answer in (a)(i), explain what is meant by
berdasarkan jawapan anda di (a)(i), *terangkan apakah yang dimaksudkan dengan*
- diprotic acid / *asid diprotik*
- monoprotic acid / *asid monoprotik*

[4 *marks*]

(b) Table 2.1 shows the pH value of sodium hydroxide solution and ammonia aqueous solution of the same concentration
Jadual 2.1 *menunjukkan nilai* pH *bagi larutan natrium hidroksida dan larutan berair ammonia yang berkepekatan sama.*

Alkali	Concentration / mol dm^{-3} *Kepekatan* / mol dm^{-3}	pH value nilai pH
Sodium hydroxide solution *Larutan natrium hidroksida*	0.1	13
Ammonia aqueous solution *Larutan berair ammonia*	0.1	10

Table 2.1 / *Jadual*2.1

Explain why sodium hydroxide solution and ammonia aqueous solution of the same concentration have different pH value.
Terangkan mengapa larutan natrium hidroksida dan larutan berair ammonia yang berkepekatan sama mempunyai nilai pH *berbeza.*

[6 *marks*]

(c) Describe how to prepare 250 cm^3 of 1.0 mol dm^{-3} potassium hydroxide starting from solid potassium hydroxide. State the size of volumetric flask used and calculate the mass of potassium hydroxide needed.
Huraikan bagaimana menyediakan 250 cm^3 larutan kalium hidroksida 1.0 mol dm^{-3} bermula dengan pepejl kalium hidroksida. Nyatakan saiz kelalang volmetrik yang digunakan dan hitungkan jisim kalsium hidroksida yang diperlukan
[Relative atomic mass: H, 1; O, 16; K, 39] /[*Jisim atom relatif* : H, 1; O, 16; K, 39]

[10 *marks*]

3. Diagram 3.1 shows the steps of preparation of salt G. Excess lead(II) oxide powder is dissolved in 50 cm^3 of 1.0 mol dm^{-3} nitric acid.
Rajah 3.1 *menunjukkan langkah-langkah bagi penyediaaan garam* G. *Serbuk plumbum*(II) *oksida berlebihan dilarutkan dalam* 50 cm^3 *asid nitrik* 1.0 mol dm^{-3}.

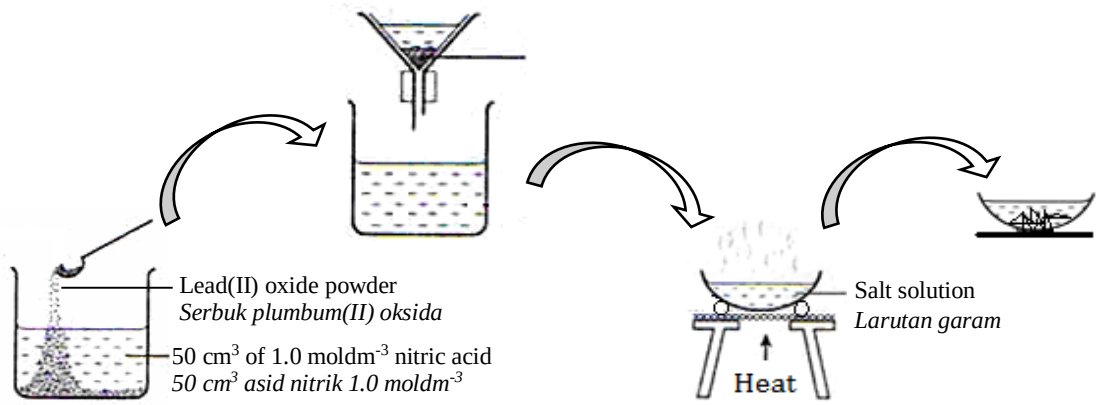


Diagram 3.1 / *Rajah 3.1*

(a) What is the meaning of salt?
Apakah maksud bagi garam?

……

[1 *mark*]

(b) Write the chemical formula of salt G formed.
Tuliskan formula kimia bagi garam G *yang terbentuk.*

……

[1 *mark*]

(c) Why is excess lead(II) oxide powder added to nitric acid?
Mengapakah serbuk plumbum(II) *oksida berlebihan ditambahkan kepada asid nitrik*?

……

[1 *mark*]

(d) (i) Write the ionic equation for the reaction between lead(II) oxide and nitric acid.
Tuliskan persamaan ion bagi tindak balas antara plumbum(II) *oksida dan asid nitrik.*

……

[2 *marks*]

(ii) Calculate the mass of salt G formed.
[Molar mass of salt G = 331gmol^{-1}]
Hitungkan jisim bagi garam G *yang terbentuk*.
[*Jisim molar* garam G = 331gmol^{-1}]

[3 *marks*]

(e) Salt G formed contains nitrate ion. Describe a chemical test to verify the ion.
Garam G *yang terbentuk mengandungi ion nitrat.*
Huraikan satu ujian kimia untuk mengesahkan ion itu.

……

……

……

[2 *marks*]

4. Diagram 4 shows a flow chart for the qualitative analysis of salt W. The green colour of carbonate salt W is heated strongly to produce black colour of solid X and colourless gas Z.
Rajah 2 *menunjukkan carta alir analisis kualitatif bagi garam* W. *Garamkarbonat* W *yang berwarna hijau dipanaskan dengan kuat menghasilkan pepejal* X *berwarna hitam dan gas tak berwarna Z* .

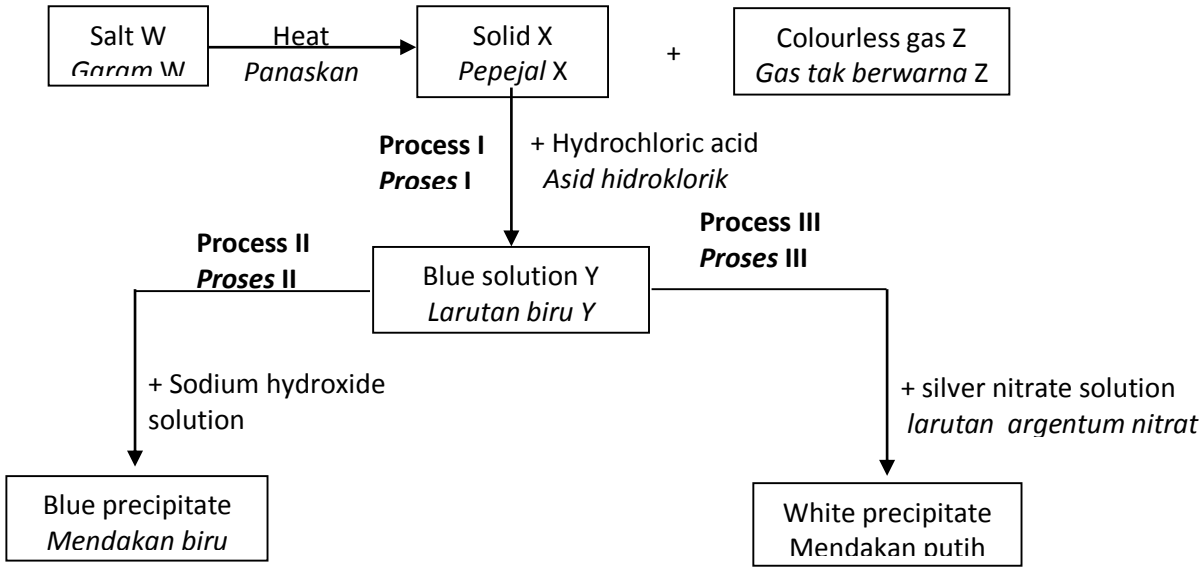


Diagram 4/*Rajah 4*

(a) Based on Diagram 4,
Berdasarkan Rajah 4,

(i) State the name of salt W and solid X.
Nyatakan nama bagi garam W *dan pepejal* X.
Salt W
Garam W:.....

Solid X
Pepejal X :.....

[2 *marks*]

(ii) Describe a chemical test to identify gas Z.
Huraikan satu ujian kimia untuk mengenal pasti gas Z.

.....

.....

[2 *marks*]

(iii) What is the name of reaction in Process I?
Apakah nama tindak balas dalam Proses I?

.....

[1 *mark*]

(iv) Write a balanced chemical equation for the reaction in Process I.
Tuliskan persamaan kimia yang seimbang bagi tindak balas dalam Proses I.

.....

[2 *marks*]

(b) Based on the observation in Process II and Process III, state the cation and anion present in solution Y.
Berdasarkan pemerhatian dalam Proses II dan Proses III, nyatakan kation dan anion yang hadir dalam larutan Y.

Cation :.....
Kation
Anion :.....
Anion

[2 *marks*]

(c) (i) Write the ionic equation for the reaction occur in Process III.
Tuliskan persamaan ion bagi tindak balas yang berlaku dalam Proses III.

.....

[1 *mark*]

(ii) What is the name of reaction occur in Process III?
Apakah nama tindak balas yang berlaku dalam Proses III*?*

.....

[1 *mark*]

SECTION B

5 (a) Diagram 5.1 shows the names for two type of salts.
*Rajah 5.*1 *menunjukkan nama bagi dua jenis garam.*

- Copper(II) chloride/ *Kuprum*(II) *klorida*
- Lead(II) chloride/ *Plumbum*(II) *klorida*

Diagram 5.1/*Rajah 5*.1

(i) Based on the salt given in Diagram 5.1, write the formula of an insoluble salt.
State the name of reaction to prepare insoluble salt.
Berdasarkan garam yang diberikan dalam Rajah 5.1*, tuliskan formula garam yang tak terlarutkan.*
Nyatakan nama bagi tindak balas menyediakan garam tak terlarutkan.

[2 *marks*]

(ii) State the suitable chemicals required to produce copper(II) chloride and lead(II) chloride salts.
Nyatakan bahan-bahan kimia yang sesui untuk menyediakan garam kuprum(II) *klorida dan plumbum*(II) *klorida.*

[4 *marks*]

(b) Diagram 5.2 shows reactions involving solid S. When heated, solid S decomposes to solid T, brown gas U and colourless gas W. Gas U relights glowing wooden splinter.
*Rajah*3.2 *menunjukkan tindak balas yang melibatkan pepejal* S. *Bila dipanaskan, pepejal* S *terurai kepada pepejal* T, *gas perang* U dan *gas tak berwarna* U. *Gas* W *menyalakan semula kayu uji berbara.*

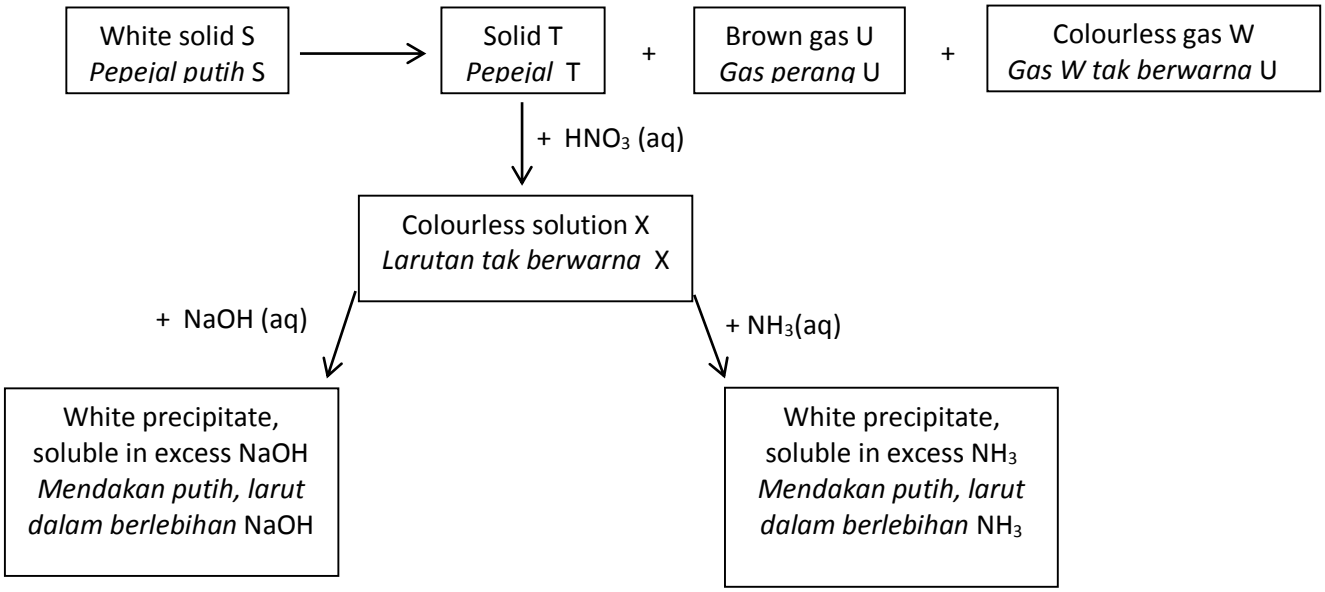


Diagram 5.2/ *Rajah* 5.2

(i) Identify solid S, solid T, gas U and gas W.
Kenal pasti pepejal S, *pepejal* T, *gas* U *dan gas* W

[4*marks*]

(ii) Write the chemical equation for the heating of solid S.
Tuliskan persamaan kimia untuk pemanasan pepejal S.

[2 *marks*]

(c) A student carried out an experiment to construct an ionic equation for the formation of barium sulphate. Table 5.3 shows the height of precipitate formed when 5.0 cm^3 of 0.5 mol dm^{-3} potassium sulphate solution is added with 1.0 cm^3, 2.0 cm^3, 3.0 cm^3, 4.0 cm^3, 5.0 cm^3, 6.0 cm^3, 7.0 cm^3 and 8.0 cm^3 of 0.5 mol dm^{-3} barium chloride solution respectively in eight test tubes.
*Seorang pelajar telah menjalankan satu eksperimen untuk membina persamaan ion bagi pembentukan barium sulfat. Jadual 5.*3 *menunjukkan tinggi mendakan yang terbentuk apabila* 5.0cm^3*larutan kalium sulfat*0.5 mol dm^{-3}*ditambahkan dengan masing-masing* 1.0 cm^3, 2.0 cm^3, 3.0 cm^3, 4.0 cm^3, 5.0 cm^3, 6.0 cm^3, 7.0 cm^3*dan* 8.0 cm^3*larutan barium klorida dalam lapan tabung uji*.

Test tube *Tabung uji*	1	2	3	4	5	6	7	8
Volume of 0.5 mol dm^{-3} potassium sulphate solution / cm^3 *Isipadu larutan kalium sulfat* 0.5 mol dm^{-3} / cm^3	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Volume of 0.5 mol dm^{-3} barium chloride solution / cm^3 *Isipadu larutan barium klorida* 0.5 mol dm^{-3} / cm^3	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0
Height of precipitate/ cm *Tinggi mendakan/*cm	1.2	1.4	1.6	1.8	2.0	2.0	2.0	2.0

Table 5.3 / *Jadual* 5.3

(i) Based on Table 3.3, draw a graph of the height of the precipitate against volume of 1.0 mol dm^{-3} barium chloride solution.
Berdasarkan Jadual 3.3*, lukiskan graf tinggi mendakan melawan isi padu larutan barium klorida* 1 mol dm^{-3} .

[3 *marks*]

(ii) On the graph that you have drawn in a(i) , mark the minimum volume of 1.0 mol dm^{-3} barium chloride solution needed to react completely with 5.0 cm^3 of 1.0 mol dm^{-3} potassium sulphate solution.
Pada kertas graf yang telah anda lukiskan di (a) (i)*, tandakan isi padu minimum larutan barium klorida* 1.0 mol dm^{-3} *yang diperlukan untuk bertindak balas lengkap dengan*5.0 cm^3*larutan kalium sulfat* 1.0 mol dm^{-3}.

[1 *mark*]

(iii) Calculate the number of mole of barium ions and number of moles of sulphate ions required for the formation of barium sulphate. Then calculate the number of moles of sulphate ions that react with 1 mole of barium ion.
Hitungkan bilangan mol ion barium dan bilangan mol ion sulfat yang diperlukan untuk pembentukan barium sulfat. Kemudian hitungkan bilangan mol ion sulfat yang bertindak balas dengan 1 mol *ion barium*

[3 *marks*]

(iv) Write the ionic equation for the formation of barium sulphate
Tuliskan persamaan ion untuk pembentukan barium klorida

[1 *mark*]

SET 3 :SALT
SECTION C

6 (a) A farmer discovers that his vegetables are not growing well due to soil problems. By using your chemistry knowledge, state two possible causes and ways to overcome the problems by naming the chemical used.
Seorang petani mendapati sayuran yang ditanamnya tidak subur disebabkan masalah tanah. Dengan menggunakan pengetahuan kimia anda, nyatakan dua penyebab yang mungkin dan cara untuk mengatasi masalah ini dengan menamakan bahan kimia yang digunakan.

[4 *marks*]

(b) Table 6 shows the information on action of heat for two lead salts, P and Q.
Jadual 6 *menunjukkan maklumat bagi tindakan haba ke atas dua garam plumbum P dan Q,*

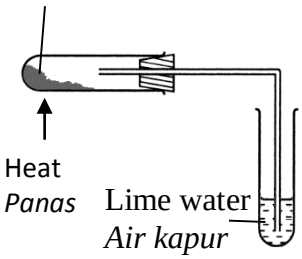
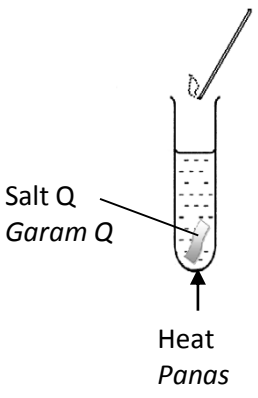
Experiment	Products	Observation
Salt P *Garam P*  	Residue R *Baki R*	Brown solid when hot, yellow when cold *Pepejal perang bila panas, kuning bila sejuk*
	Gas A *Gas A*	Lime water become chalky *Air kapur menjadi keruh*
 	Residue R *Baki R*	Brown solid when hot, yellow when cold *Pepejal perang bila panas, kuning bila sejuk*
	Gas B *Gas B*	Brown gas *Gas perang*
	Gas C *Gas C*	Rekindles glowing splinder *Menyalakan kayu uji berbara*

Table 6/ *Jadual 6*

Based on Table 6, identify residue R, gas A, gas B and gas C.
Write the chemical formulae for salt P and Q.
Berdasarkan Jadual 6, kenal pasti baki R, gas A, gas B dan gas C.
Tuliska formula kimia bagi garam P dan garam Q.

[6*marks*]

(b) By using all the chemical substances given below and suitable apparatus, describe a laboratory experiment to prepare dry zinc sulphate salt.
Dengan menggunakan bahan kimia yang diberikan di bawah dan alat radas yang sesuai, huraikan satu eksperimen di makmal untuk menyediakan garam zink sulfat kering.

- Zinc nitrate solution/ *Larutan zink nitrat*
- Dilute sulphuric acid */Asid sulfurik cair*
- Sodium carbonate solution/ *Larutan natrium karbonat*

In your description, include chemical equations involved.
Dalam huraian anda sertakan persamaan kimia yang terlibat.

[12 *marks*]

SET 3 : RATE OF REACTION (SECTION A & B)

SECTION A

7 Ahmad takes part in Young Scientist Competition during Science Week at school. He carries out an experiment to investigate rate of reaction between eggs shell and ethanoic acid. The eggs shell contains calcium carbonate and chemical equation below shows the chemical reaction that occurred.

$$CaCO_3\,(s) + 2CH_3COOH\,(aq) \rightarrow (CH_3COO)_2Ca\,(aq) + CO_2\,(g) + H_2O\,(l)$$

Ahmad mengambil bahagian dalam Pertandingan Saintis Muda semasa Minggu Sains di sekolah.Dia menjalankan satu eksperimen untuk mengkaji kadar tindak balas antara kulit telur dengan asid etanoik. Kulit telur mengandungi kalsium karbonat dan persamaan kimia di bawah menunjukkan tindak balas kimia yang berlaku.

$$CaCO_3\,(p) + 2CH_3COOH\,(ak) \rightarrow (CH_3COO)_2Ca\,(ak) + CO_2\,(g) + H_2O\,(c)$$

Table 7 shows the volume of carbon dioxide gas collected at 30 second interval.
Jadual 7 menunjukkan isi padu gas kabon dioksida yang dikumpulkan pada sela masa 30 saat.

Time / s	0	30	60	90	120	150	180	210
Total volume of CO_2 gas collected / cm^3	0	16.00	30.00	39.00	42.50	44.00	44.00	44.00

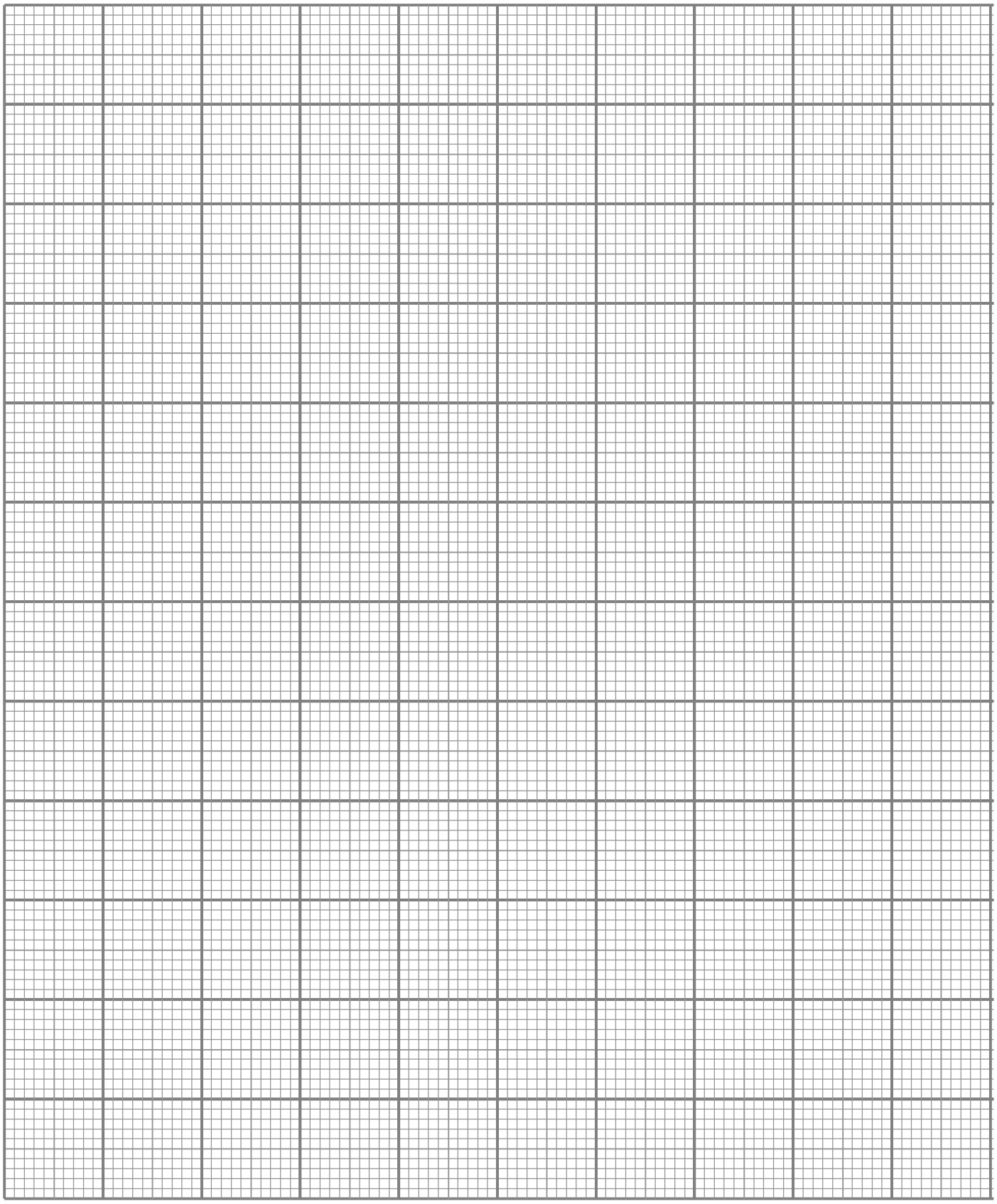
Table 7 / *Jadual* 7

(a) Draw a labelled diagram to show the apparatus set-up and materials used by Ahmad to carry out the experiment.
Lukis satu gambar rajah berlabel untuk menunjukkan susunan radas dan bahan-bahan yang digunakan oleh Ahmad untuk menjalankan experiment itu.

[2 marks]

(b) raw a graph of volume of carbon dioxide gas collected against time.
Lukis satu graf isi padu gas karbon dioksida dikumpul melawan masa.

[4 marks]



(c) (i) Determine the rate of reaction at 90 seconds.
Tentukan kadar tindak balas pada 90 *saat.*

[2 marks]

(ii) Calculate the rate of reaction in second minutes.
Hitung kadar tindak balas dalam minit kedua.

[1 mark]

(iii) What is the overall average rate of reaction?
Apakah kadar tindak balas keseluruhan?

[1mark]

8 A student carried out three sets of experiment to investigate factors affecting the rate of reaction. Table 8 shows the information and the result of the experiment.
Seorang pelajar menjalankan tiga set eksperimen untuk mengkaji faktor-faktor yang mempengaruhi kadar tindak balas. Jadual 2 menunjukkan maklumat dan keputusan eksperimen itu.

Set	Reactants *Bahan tindak balas*	Time taken for all the magnesium to dissolve/ s
I	0.3g magnesium ribbon and 50 cm^3 of 1 $moldm^{-3}$ hydrochloric acid 0.3g *pita magnesium dan* 50 cm^3 *asid hdroklorik* 1 $moldm^{-3}$	100
II	0.3g magnesium powder and 50 cm^3 of 1 $moldm^{-3}$ hydrochloric acid 0.3g *serbuk magnesium dan* 50 cm^3 *asid hidroklorik* 1 $moldm^{-3}$	60
III	0.3g magnesium ribbon and 50 cm^3 of 1 $moldm^{-3}$ hydrochloric acid and copper(II) sulphate solution 0.3g *pita magnesium dan* 50 cm^3 *asid hidroklorik* 1 $moldm^{-3}$ *dan larutan kuprum(II) sulfat*	45

Table 8 / *Jadual 8*

(a) Write a chemical equation to show the reaction between magnesium and hydrochloric acid.
Tuliskan persamaan kimia untuk menunjukkan tindak balas antara magnesium dan asid hidroklorik.

……

[2 marks]

(b) Calculate the number of mole of
Hitung bilangan mol bagi

(i) Magnesium
[Relative atomic mass of Mg = 24]
[*Jisim atom relatif Mg* = 24]

[1 mark]

(ii) Hydrochloric acid
Asid hidroklorik

[1 mark]

(c) Calculate the maximum volume of hydrogen gas produce at room condition.
[1 mole of gas occupies the volume of 24 dm^3 at room condition]
Hitung isi padu maksimum gas hidrogen yang dihasilkan pada keadaan bilik
[1 *mol gas menempati isi padu* 24 dm^3 *pada keadaan bilik*]

[2 marks]

(d) What is the average rate of reaction for
Apakah kadar tindak balas purata bagi

(i) Set I

[1 mark]

(ii) Set II.

[1 mark]

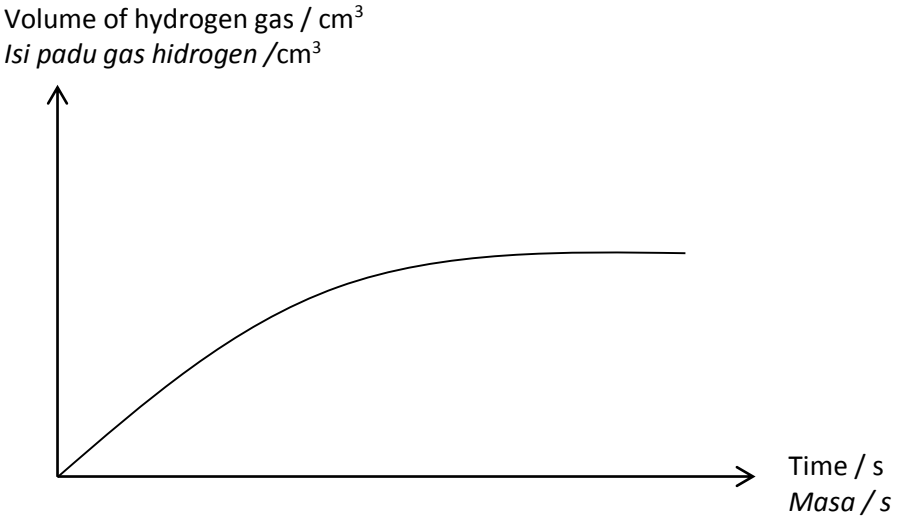
(e) State two factors that affect the rate reaction in this experiment.
Nyatakan dua faktor yang mempengaruhi kadar tindak balas dalam eksperimen itu.

……

……

[2 marks]

(f) (i) Diagram below shows the curve obtained for set I when the volume hydrogen gas liberated against time is plotted.
On the same axes, sketch the curve that you would expect to obtain if the experiment is repeated using 0.3g magnesium ribbon and 50 cm^3 of 2 $moldm^{-3}$ hydrochloric acid
Rajah di bawah menunjukkan lengkung yang diperolehi bagi Set I *apabila isi padu gas hidrogen yang di bebaskan melawan masa diplotkan.*
Pada paksi yang sama, lakarkan lengkung yang anda jangka diperolehi sekiranya eksperimen diulangi menggunakan 0.3g *pita magnesium dan* 50 cm^3 *asid hidroklorik* 2 $moldm^{-3}$



[1 mark]

(ii) Explain how you obtain the curve in (f)(i)
Terangkan bagaimana anda memperolehi lengkung di (f)(i)

……

……

[3 marks]

SECTION B

9 (a) Each year, more than 140 million tonnes of ammonia is produced around the world. Ammonia is manufactured in industries through Haber Process.
State three ways how to get the production of ammonia in a shorter time.
Setiap tahun lebih daripada 140 juta tan ammonia dihasilkan di seluruh dunia. Ammonia ini di perbuat dalam industri melalui Proses Haber.
Nyatakan tiga cara untuk mendapatkan penghasilan ammonia dalam masa yang lebih singkat.

[3 marks]

(b) Hydrogen peroxide is harmful and must be removed as soon as it is produce in the cell. Cells make the enzyme catalase to remove hydrogen peroxide. Enzyme catalase in liver can alter the decomposition of hydogen peroxide. Diagram 3 shows the apparatus set up and observation of the experiment to investigate the decomposition of hydrogen peroxide.
Hidrogen peroksida adalah merbahaya dan mesti disingkirkan sebaik sahaja ianya dihasilkan dalam sel. Sel-sel membuatkan enzim katalase menyingkirkan hidrogen peroksida. Rajah 9 menunjukkan susunan radas dan pemerhatian bagi eksperimen untuk menyiasat penguraian hidrogen peroksida.

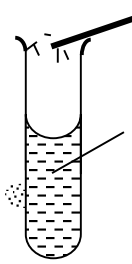
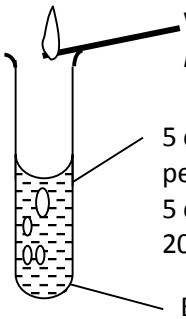
Experiment [*Eksperimen*]	Observation [*Pemerhatian*]
Experiment I *Eksperimen* I  Wooden splinter *Kayu uji berbara* 5 cm^3 of 20-volumeof hydrogen peroxide solution. 5 cm^3 *larutan hidrogen peroksida* 20-*isipadu.*	- The glowing splinter still glows dimly. - No effervescence occurs - *Kayu uji berbara masih berbara malap* - *Tiada pembuakan berlaku.*
Experiment II *Eksperimen II*  Wooden splinter *Kayu uji berbara* 5 cm^3 of 20-volume of hydrogen peroxide solution 5 cm^3 *larutan hidrogen peroksida* 20-*isipadu* Enzyme catalase in liver *Enzim katalase dalam hati*	- The glowing splinter relights brightly. - Effervescence occurs. - Kayu uji berbara menyala dengan terang. - Pembuakan berlaku.

Diagram 9 / *Rajah* 9

(i) Write a chemical equation to represent the decomposition of hydrogen peroxide.
Tuliskan persamaan kimia bagi penguraian hidrogen peroksida.

[1 mark]

(ii) What is the function of enzyme catalase in the experiment? Explain using collision theory how the addition of the enzyme catalase affects the rate of decomposition of hydrogen peroxide.
Apakah fungsi enzim katalase dalam eksperimen. Terangkan dengan menggunakan teori pelanggaran bagaimana penambahan enzim katalase mempengaruhi kadar penguraian hidrogen peroksida.

[5 marks]

(iii) Draw an energy profile diagram for the decomposition of hydrogen peroxide with and without the presence of enzyme catalase.
Lukis gambar rajah profil tenaga untuk penguraian hidrogen peroksida dengan kehadiran enzim katalase dan tanpa kehadiran enzim katalase.

[3 marks]

(c) A group of students carry out two experiments to investigate how a factor affects the rate of a reaction. Table 9 shows the information about the reactants and the temperature used in each experiment.
Sekumpulan pelajar menjalankan dua eksperimen untuk mengkaji faktor yang mempengaruhi kadar suatu tindak balas. Jadual 9 *menerangkan mengenai bahan tindak balas dan suhu yang digunakan dalam setiap eksperimen.*

Experiment *Eksperimen*	Reactants *Bahan tindak balas*	Temperature /^{o}C
I	Excess zinc granule and 30 cm^3 of 0.5 mol dm^{-3} hydrochloric acid *Ketulan zink berlebihan dan* 30 cm^3*asid hidroklorik* 0.5 mol dm^{-3}	30
II	Excess zinc granule and 30 cm^3 of 0.5 mol dm^{-3} sulphuric acid *Ketulan zink berlebihan dan* 30 cm^3*asid sulfurik* 0.5 mol dm^{-3}	30

Table 9 / *Jadual* 9

(i) Sketch on the same axes, the graph of total volume of gas collected against time for the two experiments.
Lakar di atas paksi yang sama, graf bagi jumlah isi padu gas terkumpul melawan masa untuk kedua-dua eksperimen.

[3 marks]

(ii) Compare the rate of reaction between Experiment I and Experiment II. Explain the difference in the rate of reaction with reference to the collision theory.
Bandingkan kadar tindak balas antara Eksperimen I *dan Eksperimen* II. *Terangkan perbezaan kadar tindak balas ini dengan merujuk kepada teori pelanggaran.*

[5 marks]

SET 3 :RATE OF REACTION
SECTION C

10 A group of students carried out experiments to investigate the factor affecting the rate of reaction between metal P and HX acid. Table 10 shows the information of the reactants and time taken to collect 30 cm^3 of hydrogen gas.
Sekumpulan pelajar telah menjalankan eksperimen untuk mengkaji kesan faktor yang mempengaruhi kadar tindak balas antara logam P *dan asid* HX. *Jadual 10 menunjukkan maklumat bagi bahan tindak balas dan masa diambil untuk mengumpul* 30 cm^3 *gas hidrogen.*

Experiment ***Eksperimen***	**Reactants** ***Bahan tindak balas***	**Time taken collect 30 cm^3 of hydrogen gas (s)**
I	Powdered metal P and 50 cm^3 of 1.0 mol dm^{-3} HX acid *Serbuk logam* P *dan* 50 cm^3 *asid* HX1.0 mol dm^{-3}	10
II	Powdered metal P and 100 cm^3 of 0.5 mol dm^{-3} HX acid *Serbuk logam* P *dan* 100 cm^3 *asid* HX 0.5 mol dm^{-3}	20

Table 10 / *Jadual* 10

(a) Suggest the name of metal P and HX acid
By using the named metal P and HX acid, write the chemical equation for the reaction between metal P and HX acid
Cadangkan nama logam P *dan asid* HX. Dengan menggunakan *logam* P *dan asid* HX *yang dinamakan, tulis persamaan kimia bagi tindakbalas antara logam P dan asid* HX*..*

[4 *marks*]

(b) Calculate the average rate of reaction for Experiment I and Experiment II.
Hitung kadar tindak balas purata bagi Eksperimen I *dan Eksperimen* II.

[2 *marks*]

(c) By using the collision theory, explain the difference in the rate of reaction between Experiment I and Experiment II.
Dengan menggunakan teori perlanggaran, terangkan perbezaan kadar tindak balas antara Eksperimen I *dan Eksperimen* II.

[5*marks*]

(d) Base on the reactants used in Experiment I, describe an experiment how the size of reactant **or** concentration affect the rate of reaction.
Berdasarkan bahan tindak balas yang digunakan dalam Eksperimen I, huraikan satu eksperimen bagaimana saiz bahan tindak ***atau*** *kepekatan mempengaruhi kadar tindak balas*.

[9*marks*]

SET 3 : THERMOCHEMISTRY (SECTION B)

11 Diagram 11 shows the energy level of Reactions I and II.

Rajah 11 menunjukkan aras tenaga bagi Tindak balas I dan Tindak balas II.

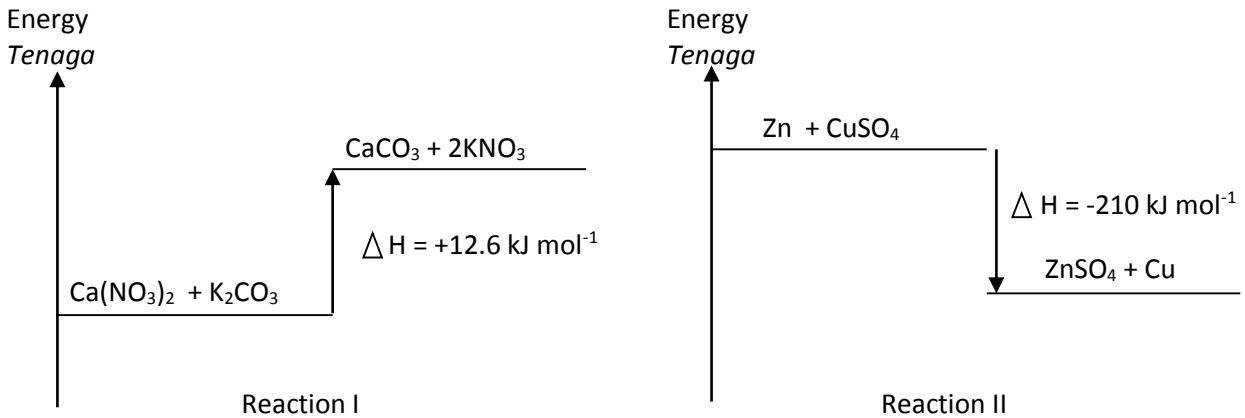


Diagram 11 / *Rajah* 11

Based on Diagram 11, compare the energy level diagram in Reactions I and II.
Berdasarkan Rajah11, bandingkan gambar rajah tenaga dalam Tindak balas I dan Tindak balas II.

[3 marks]

(b) Table 11 shows the molecular formula and the heat of combustion for ethane and propane.
Jadual 11 *menunjukkan formula molekul dan haba pembakaran bagi etana dan propana*.

Alkane ***Alkana***	**Molecular Formula** ***Formula molekul***	**Heat of combustion/ kJ mol^{-1}** ***Haba Pembakaran/ kJ mol^{-1}***
Ethane *Etana*	C_2H_6	-1602
Propane *Propana*	C_3H_8	-2202

Table 11 / *Jadual* 11

Based on the information in Table 11, explain why there is a difference in the values of the heat of combustion between ethane and propane.
Berdasarkan maklumat dalam Jadual 11, terangkan mengapa nilai haba pembakaran bagi etana dan propana berbeza.

[3 marks]

(c) (i) 50 cm^3 of 1.0 $moldm^{-3}$ hydrochloric acid is reacted with 50.0 cm^3 of 1.0 $moldm^{-3}$ sodium hydroxide solution. Temperature increases and the change in temperature of the mixture is 7 ^OC.
Calculate the heat of neutralization for this reaction.
[Specific heat capacity of solution = 4.2 $Jg^{-1}\ ^OC^{-1}$; Density of solution = 1 gcm^{-3}]

50 cm^3 *asid hidroklorik* 1.0 $moldm^{-3}$ *bertindak balas dengan* 50.0 cm^3 *larutan natrium hidroksida* 1.0 $moldm^{-3}$. *Suhu meningkat dan perubahan suhu campuran adalah* 7 ^OC.
Hitungkan haba peneutralan bagi tindak balas ini
[Muatan haba tentu larutan = 4.2 J $g^{-1}\ ^OC^{-1}$*; Ketumpatan larutan=* 1 g cm^{-3} *]*

[4 marks]

(iii) If 50 cm^3 of 1.0 $moldm^{-3}$ ethanoic acid is used to replace the acid hydrochloric acid in (c)(i) reacted with 50.0 cm^3 of 1.0 $moldm^{-3}$ sodium hydroxide solution, the change in temperature of the mixture is less than 7 ^OC.
Explain why?

Sekiranya 50 cm^3 *asid etanoik* 1.0 $moldm^{-3}$ *digunakan bagi menggantikan asid hidroklorik di (c)(i) bertindak balas dengan dengan* 50.0 cm^3 *larutan natrium hidroksida* 1.0 $moldm^{-3}$, *perubahan suhu campuran adalah kurang dari* 7 ^OC.
Terangkan mengapa.

(d) Thermochemical equation below is obtained from an experiment.
Persamaan termokimia di bawah di perolehi dari suatu eksperiment.

$Ca^{2+}(aq) + CO_3^{2-}(aq) \rightarrow CaCO_3(s) \qquad \Delta H = +12.6\ kJmol^{-1}$

Describe a laboratory experiment to determine the heat of precipitation for the above reaction. In your answer, include the following:
Huraikan satu eksperimen untuk menentukan haba pemendakan bagi tindak balas di atas. Dalam jawapan anda sertakan perkara berikut:

- chemicals required /bahan kimia yang diperlukan
- procedures of the experiment /langkah eksperimen
- data and calculation involved /data dan pengiraan yang terlibat

[8 marks]

SET 3 : THERMOCHEMISTRY
(SECTION C)

12 Table 12 shows the heat of neutralisation of two different monoprotic acids, P and Q, with potassium hydroxide solution.

Jadual 1 *menunjukkan haba peneutralan bagi dua asid monoprotik yang berlainan, P dan Q dengan larutan kalium hidroksida.*

Experiment *Eksperimen*	Reactants *Bahan tindak balas*	Heat of neutralisation (kJ mol^{-1}) *Haba peneutralan* (kJ mol^{-1})
I	100 cm^3 of 1.0 $moldm^{-3}$ kalium hydroxide solution + 100 cm^3 of 1.0 mol dm^{-3} monoprotic acid P 100 cm^3 *larutan kalium hidroksida* 1.0 mol dm^{-3} + 100 cm^3 *asid monoprotik* P 1.0 mol dm^{-3}	-55.0
II	100 cm^3 of 1.0 mol dm^{-3} kalium hydroxide solution + 100 cm^3 of 1.0 mol dm^{-3} monoprotic acid Q 100 cm^3 *larutan kalium hidroksida* 1.0 mol dm^{-3} + 100 cm^3 *asid monoprotik* Q 1.0 mol dm^{-3}	-57.0

Table 12 / *Jadual* 12

(a) (i) Based on the information in Table 12, state one example which could be acid P and one which could be acid Q.
Berdasarkan maklumat dalam Jadual 12, nyatakan satu contoh yang mungkin bagi asid P *dan satu contoh yang mungkin bagi asid* Q.

[2 marks]

(ii) Explain why there is a difference in the values of the heat of neutralisation. *Jelaskan mengapa terdapat perbezaan nilai haba peneutralan itu*.

[4 marks]

(b) Calculate the change in temperature of the mixture in experiment I.
[Specific heat capacity of solution: 4.2 Jg 1 $°C^{-1}$]
Hitung perubahan suhu bagi campuran dalam eksperimen I.
[Muatan haba tentu larutan: 4.2 J g 1 $°C^{-1}$]

[4 marks]

(c) By using one of the acid in 1(a)(i), describe one experiment to determine the heat of neutralisation.
Your answer should consist of the following:
- Procedure of the experiment.
- The method to calculate the heat of neutralisation.

Dengan menggunakan satu daripada asid dalam 1(a)(i), *huraikan satu eksperimen untuk menentukan haba peneutralan.*
Jawapan anda perlu mengandungi perkara berikut:
- *Prosedur eksperimen.*
- *Kaedah untuk menghitung haba peneutralan.*

[10 marks]

SET ④

1. **Carbon Compounds**
2. **Manufactured Substancesin Industry**
3. **Chemicals for Consumers**

https://cikguadura.wordpress.com/

1. (a) Table 1 shows the molecular formula of hydrocarbon X and hydrocarbon Y.
Jadual 1 *menunjukkan formula molekul bagi hidrokarbon* X *dan hidrokarbon* Y.

Hydrocarbon/*Hidrokarbon*	**Molecular formula/*Formula molekul***
X	C_4H_{10}
Y	C_4H_8

Table / *Jadual* 1

(i) Identify the saturated hydrocarbon and unsaturated hydrocarbon.
Explain why.
Kenal pasti hidrokarbon tepu dan hidrokarbon tak tepu.
Terangkan mengapa.

[4 *marks*]

(ii) Hydrocarbon Y produced more soot than Hydrocarbon Y when it is burnt in oxygen. Explain your answer.
Hidrokarbon Y *menghasilkan jelaga yang lebih banyak dibandingkan dengan Hidrokarbon* X *apabila dibakar dalam oksigen. Terangkan jawapan anda.*
[Relative atomic mass / *Jisim atom relatif* : C = 12 ; O = 16]

[2 *marks*]

(iii) Draw the structural formula of any **one** of the isomer of hydrocarbon Y and state the name of the structural formula.
*Lukiskan formula struktur bagi mana-mana **satu** isomer bagi hidrokarbon* Y *dan nyatakan nama bagi formula struktur tersebut.*

[2 *marks*]

(iv) Hydrocarbon Y can be converted hydrocarbon X.
- State the name of the process and the condition needed.
- Write the chemical equation involved

Hidrokarbon Y *boleh ditukarkan kepada hidrokarbon* X.
- *Nyatakan nama proses dan keadaan yang diperlukan.*
- *Tuliskan persamaan kimia yang terlibat.*

[4 *marks*]

(b) Diagram 8 shows a series of chemical reactions.
Rajah 8 *menunjukkan satu siri tindak balas kimia.*

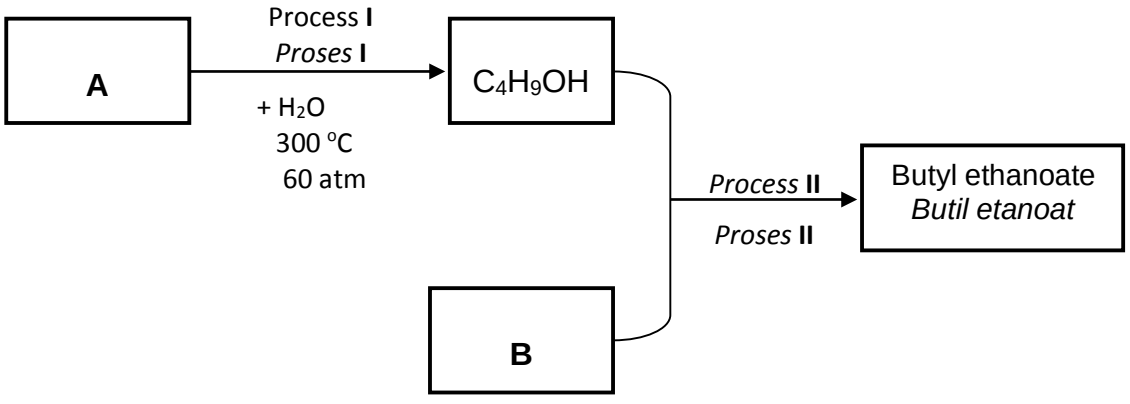


Diagram / *Rajah* 8

(i) State the name of A, B and Process II.
Nyatakan nama bagi A, B *dan Proses* II.

[3 *marks*]

(ii) Write the chemical equation for the reaction in Process I.
Tuliskan persamaan kimia bagi tindak balas dalam Proses I.

[2 *marks*]

(iii) C_4H_9OH can be converted to A.
C_4H_9OH *boleh ditukarkan semula kepada* A.

- Draw the set-up of diagram to carry out the experiment in school laboratory
  Lukiskan gambar rajah susunan radas untuk menjalankan eksperimen tersebut di dalam makmal sekolah
- Write the chemical equation for the reaction
  Tuliskan persamaan kimia bagi tindak balas tersebut

[3 *marks*]

SET 4 : CARBON COMPOUNDS
(SECTION C)

2 (a) Table 2.1 shows the result of two sets of experiment to investigate the coagulation of latex.
Jadual 2.1 menunjukkan keputusan bagi dua set eksperimen untuk menyiasat penggumpalan getah

Set	Type of solution added	Observation
I	Latex + solution X *Susu getah + larutan X*	Latex coagulate very fast *Susu getah menggumpal dengan cepat*
II	Latex + solution Y *Susu getah + larutan Y*	Latex does not coagulate *Susu getah tidak menggumpal*

Table 2.1/*Jadual 2.1*

(i) Suggest one possible substance for solution X. and Y
Cadangkan satu bahan yang mungkin bagi larutan X dan Y

[2 *marks*]

(ii) Explain the process of coagulation of latex in set I
Terangkan proses penggumpalan susu getah dalam set I

[4 *marks*]

(iii) Explain why latex does not coagulate in set II
Terangkan mengapa susu getah tidak menggumpal dalam set II.

[2 *marks*]

(b) Diagram 2.1 shows how compound Q is formed from alkene W.
Rajah 2.1 menunjukkan bagaimana sebatian Q terbentuk dari alkena W.

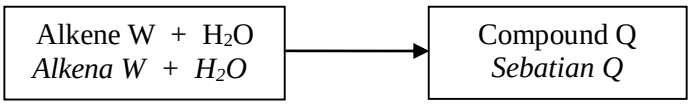


Diagram 2.1/*Rajah 2.1*

(i) Name the homologous series of compound Q.
Namakan siri homolog sebatian Q

[1 mark]

(ii) State two chemical properties of compound Q.
Nyatakan dua sifat kimia bagi sebatian Q.

[2 marks]

(i) By using a compound Q with more than one carbon atom per molecule, describe an experiment to convert compound Q to alkene.

Your answer should consist of the following:

- Procedure of the experiment
- A labelled diagram showing the apparatus set-up
- The test to confirm the product is alkene

Dengan menggunakn sebatian Q yang mempunyai lebih daripada satu atom per molekul, huraikan satu eksperimen untuk menukarkan sebatian Q ke alkena.
Jawapan anda harus terdiri daripada yang berikut :

- *Prosedur eskperimen*
- *Gambarajah berlabel untuk menunjukkan susunan radas*
- *Ujian untuk mengesahkan hasilnya ialah alkena*

[9 marks]

3 (a) Diagram 1.1 shows a factory manufactured sulphuric acid through Contact Process.
Rajah 1.1 *menunjukkan suatu kilang pembuatan asid sulfurik melalui Proses Sentuh.*

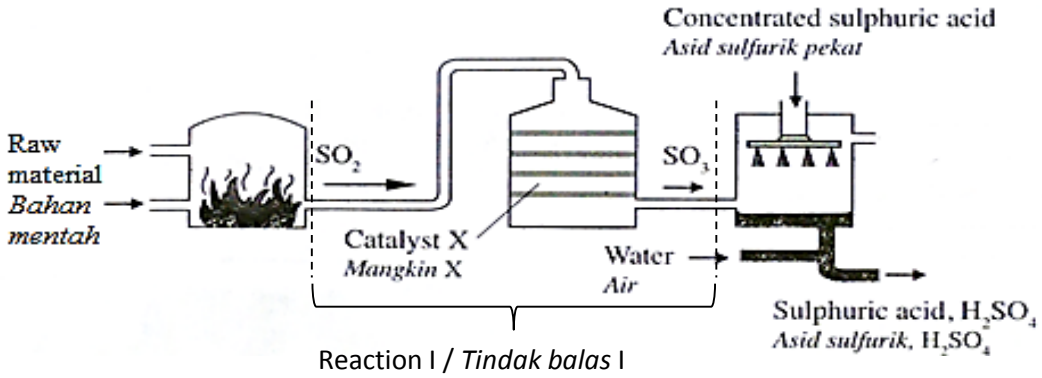


Diagram 3.1 / *Rajah 3*.1

(i) Identify the raw materials and catalyst used in the Contact Process. Write the chemical equation in Reaction I.
Kenal pasti bahan mentah dan mangkin yang digunakan dalam Proses Sentuh itu. Tuliskan persamaan kimia dalam Tindak balas I.

[5 marks]

(ii) Diagram 3.2 shows a waste gas produced during the manufacture of sulfuric acid can cause acid rain and plant cannot grow out well.
Rajah 3.2 *menunjukkan gas buangan terhasil semasa pembuatan asid sulfurik boleh menyebabkan hujan asid dan tumbuhan tidak dapat hidup dengan subur*

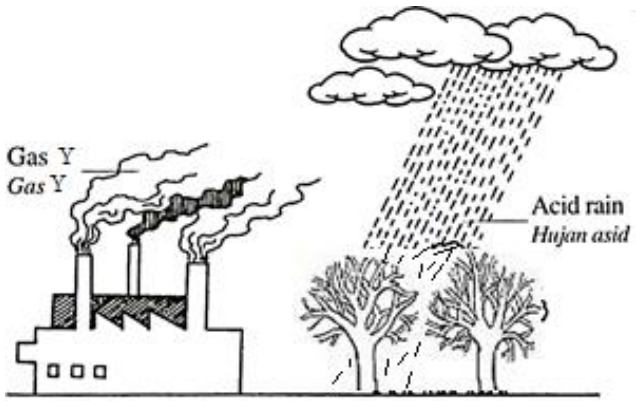


Diagram 3.2 / *Rajah 3*.2

State the name of gas Y release from the factory that cause acid rain. Explain why the plant cannot grow out well and suggest a way to overcome this problem.
Nyatakan nama bagi gas Y *yang dibebaskan dari kilang itu yang menyebabkan hujan asid. Terangkan mengapa tumbuhan tidak tumbuh dengan subur dan cadangkan satu cara untuk mengatasi masalah itu.*

[3 marks]

(b) The following information shows two properties of alloy:
Maklumat berikut menunjukkan dua sifat aloi:

- Alloy P harder than its pure metal./*Aloi* P *lebih keras daripada logam tulennya.*
- It's using to making body of aeroplane./*Ia digunakan untuk membuat badan kapal terbang*.

(i) Name the alloy P. Give **two** characteristics why this alloy is suitable to make a body of aeroplane.
Namakan aloi P. *Berikan **dua** sifat mengapa aloi ini sesuai dibuat badan kapal terbang.*

[3 *marks*]

(ii) Explain in terms of arrangement atoms, why alloy P is harder than its pure metal?
Terangkan dari aspek susunan atom, mengapa aloi P lebih keras dari logam tulennya?

[3 *marks*]

(e) Synthetic polymers are widely use in our daily life even though it can cause environmental pollution.
Explain how synthetic polymers can cause environmental pollution. Suggest two ways to overcome the problems.
Polimer sintetik digunakan dengan meluas dalam kehidupan harian kita walau pun ianya boleh menyebabkan pencemaran alam sekitar.
Terangkan bagaimana polimer sintetik boleh menyebabkan pencemaran alam sekitar.
Cadangkan dua acara untuk mengatasi masalah itu.

[6 *marks*]

SET 4 : MANUFACTURED SUBSTANCESIN INDUSTRY (SECTION C)

4 Diagram 4 shows the industrial manufacture of ammonia.
Rajah 4 menunjukkan penghasilan ammonia dalam industri.

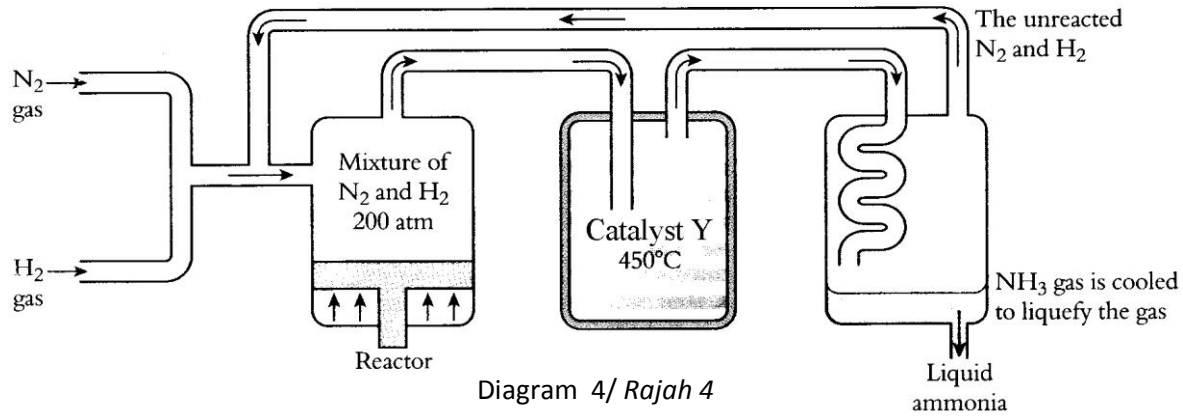


Diagram 4/ *Rajah 4*

(a) State the name of the above process, catalyst Y and write a chemical equation for the reaction between hydrogen and nitrogen.
Nyatakan nama bagi proses di atas, mangkin Y dan tulis persamaan kimia bagi tindak balas antara hidrogen dan nitrogen.

[4 *marks*]

(b) Table 3 shows the diameter of the dent formed in an experiment to compare the hardness of copper and bronze. / *Jadual 3 menunjukkan diameter bagi lekuk yang terbentuk dalam suatu eksperimen untuk membandingkan kekerasan kuprum dan loyang.*

Material/ *Bahan*	Diameter /cm
Copper / *kuprum*	1.0
Bronze / *loyang*	0.5

Table 3/ *Jadual 3*

Based on Table 13, draw a diagram to shows the arrangement of atoms in pure copper and bronze. Compare the hardness between copper and bronze and explain why.
Berdasarkan Jadual 13, lukis sebuah rajah untuk menunjukkan susunan atom dalam kuprum tulen dan loyang. Bandingkan kekerasan antara kuprum dan loyang dan terangkan mengapa.

[6 *marks*]

(c) The iron window frame of Encik Razali's house rusts after several years but the steel window frame of Encik Tarmizi's house does not rust.
By using suitable examples, describe a laboratory experiment to compare the resistant to rust of alloy compared to pure metal.
Include the following in your answer:

- Procedure
- Results
- Conclusion

Bingkai tingkap besi rumah Encik Razali berkarat selepas beberapa tahum tetapi bingkai tingkap keluli rumah Encik Tarmizi tidak berkarat. Dengan menggunakan contoh, huraikan suatu eksperiman makmal untuk membandingkan ketahanan karat bagi aloi berbanding dengan logam tulen.
Masukkan berikut dalam jawapan anda:

- *Prosedur*
- *Keputusan*
- *Kesimpulan*

[10 *marks*]

SET 4 : CHEMICALS FOR CONSUMERS
(SECTION B)

5 (a) Food preservatives are substances added to food so that the food can be kept for longer periods for time. Using two suitable examples, explain how they work as preservative.
Pengawet ialah bahan yang ditambahkan kepada makanan supaya makanan dapat disimpan dalam jangka masa yang lebih panjang. Dengan menggunakan dua contoh yang sesuai, terangkan bagaimana bahan itu bertindak sebagai pengawet.

[4 marks]

(b) The following is the information about a child.
Yang berikut ialah maklumat berkaitan dengan seorang budak.

- 2 years old/ *Umur 2 tahun*
- High fever/ *Demam panas*
- Whooping cough/*Batuk kokol*

(i) Can aspirin be used to treat the child? Explain why.
Bolehkah aspirin digunakan untuk merawat budak itu? Terangkan mengapa.

[2 marks]

(ii) Name two examples of modern medicine that can be used to treat the child .
Namakan dua contoh ubat moden yang boleh digunakan untuk merawat budak itu.

[2 marks]

(iii) Explain the effect if the two modern medicines stated in (b)(ii) are taken overdose or take for a long time.
Terangkan kesan jika dua ubat moden yang dinyatakan dalam (b)(ii) diambil melebihi dos atau diambil pada suatu jangka masa yang panjang.

[2 marks]

(c) Table 5 shows the food additives that are added to a certain food by two chefs.
Jadual 5 menunjukkan bahan tambah makanan yang ditambahkan kepada sebilangan makanan oleh dua orang chef.

Chef Wan	Chef Koh
Turmeric *Kunyit* Sugar, salt and spice *Gula, garam dan rempah* Garlic *Bawang putih*	Tartrazine *Tartrazin* Monosodium glutamate *Mononatrium glutamat* Ascorbic acid *Asid askorbik*

Table 5/ *Jadual 5*

Based on Table 2, categorise the food additives. Include in your answer the function of each type of food additives and the disadvantages of using any two food additives.
Berdasarkan Jadual 2, kelaskan bahan tambah makanan. Dalam jawapan anda, masukkan fungsi setiap jenis bahan tambah makanan dan keburukan menggunakan mana-mana dua bahan tambah makanan.

[10 marks]

6 (a) By using a namely oil and alkali, describe a laboratory experiment to prepare a soap. State how to verify the product formed is soap.
Dengan menggunakan minyak dan alkali yang dinamakan, terangkan satu eksperimen makmal untuk menyediakan sabun.
Nyatakan bagaimana anda mengesahkan hasil yang terbentuk itu adalah sabun.

[10 marks]

(b) Table 6 shows the observations for two experiments to investigate the cleansing effect of soap and detergent on oily stain in hard water.
Jadual 1 menunjukkan pemerhatian bagi dua eksperimen untuk mengkaji kesan pencucian sabun dan detergen ke atas kotoran berminyak dalam air liat.

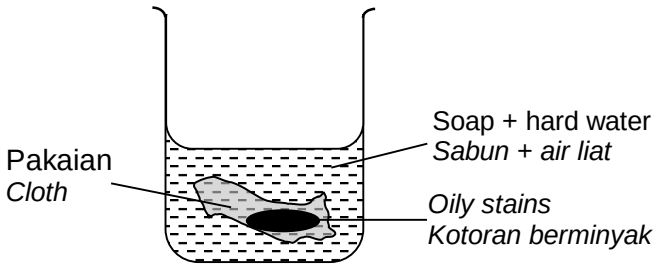
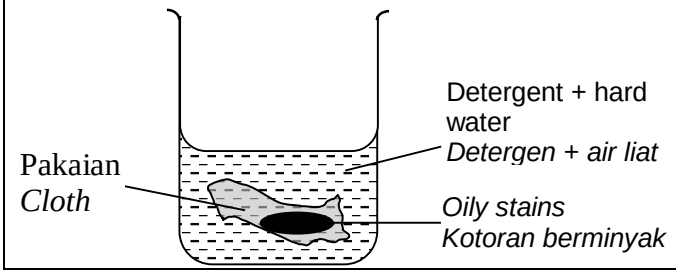
Experiment *Eksperimen*	**Observation** *Pemerhatian*
	Oily stains remained *Kotoran berminyak kekal*
II 	Oily stains disappeared *Kotoran berminyak hilang*

Table 6 / *Jadual* 6

Compare the cleansing effect between Experiment I and Experiment II.
Explain why there are differences in the observations. State the substance which is more suitable as a cleansing agent to remove stain in hard water.
Bandingkan kesan pembersihan antara Eksperimen I dan Eksperimen II.
Terangkan mengapa terdapat perbezaan dalam pemerhatian tersebut. Nyatakan bahan yang lebih sesuai sebagai bahan pencuci kotoran berminyak dalam air liat.

[6 marks]

(c) A patient is suffering from tuberculosis for a period of time.
Suggest type of medicine that should be taken and the prescription should be followed by the patient.
Seorang pesakit mengalami batuk kering dalam suatu tempoh masa yang lama.
Cadangkan jenis ubat yang patut dimakan dan prekripsi yang perlu dipatuhi oleh pesakit itu.

[4 marks]

SET ⑤

PAPER 3 SET 1

PAPER 3 SET 2

GUIDELINES FOR ANSWERING PAPER 3

Structure Question 1or 2 to test the mastery of 11 Scientific Skills

1. Observing
2. Classifying
3. Inferring
4. Measuring (burette , stopwatch, thermometer, voltmeter)
5. Predicting
6. Communicating(e.g construct table and draw graph)
7. Space-Time Relationship
8. Interpreting Data
9. Defining Operationally
10. Controlling Variables
11. Hypothesizing

Marks allocated for each question are as follows: 3 marks/2 marks/1 mark/0

Maximum Score : 11 X 3 = 33

Operational definition is a statement that contains:

1. what you do/procedure and what you see/observation .**Example:**
   1. When acid is added into latex, **white solid** is formed.
      When acid is added into latex, **latex coagulated**.- wrong
   2. When the higher the concentration sodium thiosulphate solution is added into sulphuric acid, time taken for `X~ mark to disappear from sight is shorter.
   3. When iron nail is coiled with copper and immersed into jelly mixed with potassium hexacyanoferrate(III) and phenolphthalein solution, blue spot/colouration is formed.

Operational definition for	**What you do**	**What is observed**
1. Rusting of iron	When an iron nail coiled with a less electropositive metal is immersed in hot agar-agar added with potassium hexacyanoferrate (III) solution,	Blue spots are formed
2. Coagulation of latex	When acid is added to latex	White solid is formed
3. Reactivity of Group 1 elements	When a metal which is lower in Group 1 is put in a basin half filled with water	Brighter flame is formed
4. Precipitation of silver chloride	When silver nitrate solution is added to sodium chloride solution	White solid is formed
5. Voltaic cell	When two different metals are dipped into an electrolyte	The needle of the voltmeter deflects//Voltmeter shows a reading
6. An acid	When a blue litmus paper is dipped into a substance which is dissolved in water,	Blue litmus paper turns red
7. Heat of combustion	When 1 mol of fuel is burnt in excess oxygen	Temperature rises//Thermometer reading increases
8. Hardness of alloy	When a weight is dropped on a steel ball bearing taped on an alloy block	Diameter of dent formed is smaller

Hypothesis: Statement that relates the manipulated variable followed by responding variable with direction.

Example:

1. The higher temperature of the reactant the higher the rate of reaction – 3 marks
   The temperature of the reactant affects the rate of reaction – 2 marks
2. Hexenedecolourised brown bromine water but hexane does not decolourised brown bromine water.
3. When acid is added into latex, latex coagulates, when ammonia is added into latex, latex cannot coagulates

4. Question 3 (essay) Test the Mastery of Planning Experiment.

Experiment	MV	RV	Hypothesis (MV→RV)
Factor of size on Rate of reaction	Size of calcium carbonate	Rate of reaction	When size of calcium carbonate is smaller, the rate of reaction increases
Electrolysis of solution with different concentration using carbon electrodes	Concentration of hydrochloric acid solution	Product at anode	When concentrated hydrochloric is electrolysed, chlorine gas is produced at anode, but when diluted hydrochloric acid is electrolysed, oxygen gas is produced at anode.
To differentiate between hexene and hexane	Hexene and hexane	Decolourised brown bromine water	When hexene is added to bromine water, brown bromine decolorized, but when hexene is added to bromine water, brown bromine remains unchanged.
Heat of combustion of different types of alcohols	Types of alcohols	Heat of combustion	When the number of atoms per molecule alcohol increases, the heat of combustion increase
Coagulation of latex	Acid and ammonia solution	Coagulation of latex	When acid is added to latex, coagulation of latex occurs, but when ammonia solution is added to latex, coagulation of latex does not occur.

4. Question 3 (essay) Test The Mastery of Planning Experiment .

Planning should include the following aspects:

1. Aim of the experiment/Statement of the problem
2. All the variables
3. Statement of the hypothesis
4. List of substances/material and apparatus – should be separated
5. Procedure of the experiment
6. Tabulation of data

Score : (5 X 3) + 2 = 17

The question normally starts with certain situation related to daily life.

Problem statement/ aim of the experiment / hypothesis and variable can be concluded from the situation given.

State all the variables

Manipulated variable :

Responding variable :

Constant variable: list down all the fixed variables to ensure the outcome of the responding variable is related only to the manipulated variables.

Separate the substances and apparatus

- Separate the substances and apparatus
- **Apparatus** : list down the apparatus for the experiment.
  Example: Rate of reaction – stop watch , Termochemistry - thermometer

Procedure :

All the steps taken in the procedure must include the apparatus used, quantity and type of substance (powder, solution, lumps … etc).

No mark is allocated for the diagram. The complete labeled diagram can help students in :

I. Writing the steps taken in the procedure
II. Listing the apparatus and materials

Tabulation of data:

The number of columns and rows in the table is related to the manipulated and responding variables

- **Units must be written** for all the titles in each row and column of the table
- DO NOT WRITE the observation/inference/conclusion in the table.

1. Table 1 shows the four experiments to investigate the acidic or basic properties of the oxides of elements in Period 3.

Sodium oxide and sulphur dioxide are dissolved in water and the pH value of the solution is measured using a pH meter. Insoluble oxides such as magnesium oxide and silicon (IV) oxide are dissolved in nitric acid.
Jadual 1 *menunjukkan empat eksperimen untuk mengkaji sifat-sifat asid atau bes oksida bagi unsur-unsur Kala* 3*.*
Natrium oksida dan sulpfur dioksida dilarutkan ke dalam air dan nilai pH *larutannya diukur menggunakan meter* pH*. Oksida tak terlarutkan seperti magnesium oksida dan silicon*(IV) *oksida dilarutkan ke dalam asid nitrik.*

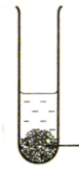
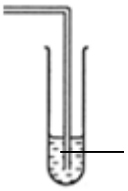
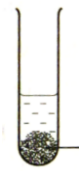
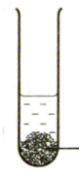
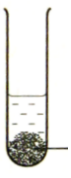
Experiment *Eksperimen*	Solubility in water/acid/alkali *Keterlarutan dalam air/asid/alkali*	pH meter reading/Observation *Bacaan meter* pH*/Pemerhatian*
I	 Sodium oxide in water *Natrium oksida dalam air*	13.45  Colorless solution *Larutan tak*
II	Sulphur dioxide gas → *Gas sulfur dioksida*  Water *Air*	4.5  Colorless solution *Larutan tak berwarna*
III	 Magnesium oxide in acid *Magnesium oksida dalam asid*	 Colorless solution *Larutan tak berwarna*
IV	 Silicone(IV) oxide in nitric acid *Silikon*(IV) *oksida dalam asid nitrik*	 No change *Tiada perubahan*

Table 1/*Jadual* 1

(a) Record the pH value to one decimal place of :
Rekodkan nilai pH *kepada satu titik perpuluhan bagi*:

Experiment / *Eksperimen* I : ……

Experiment / *Eksperimen* II:……

[3 marks]

(b) Based on the pH values and observations in Table 1, state the inference for this experiment.
Berdasarkan kepada nilai pH *dan pemerhatian dalam Jadual* 1*, nyatakan inferens bagi eksperimen ini.*

……

[3 marks]

(c) For this experiment, state the:
Untuk eksperimen ini, nyatakan:

(i) Manipulated variable: ……
Pembolehubah yang dimanipulasikan

(ii) Responding variable: …….
Pembolehubah yang bergerakbalas

(iii) Constant variable: ……..
Pembolehubah yang dimalarkan

[3 marks]

(d) State the hypothesis for this experiment.
Nyatakan hipotesis bagi eksperimen ini.

…….

…….

…….

[3 marks]

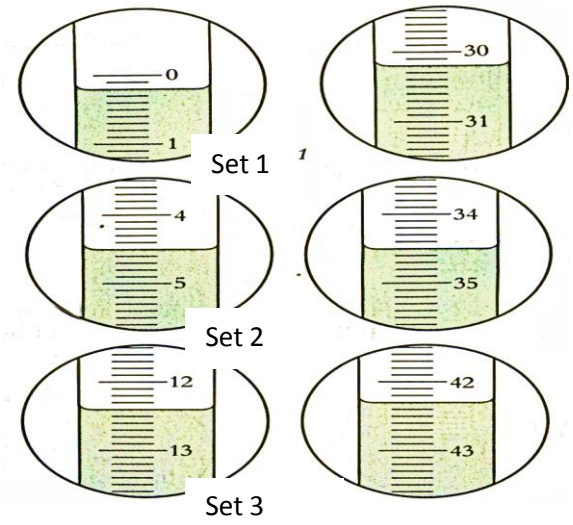
(e) Classify the following oxides into basic oxides and acidic oxides.
Klasifikasikan oksida-oksida berikut kepada oksida bes dan oksida asid.

Copper(II) oxide *Kuprum*(II*) oksida*	Phosphorous pentoxide *Fosforus pentoksida*
Carbon dioxide *Karbon dioksida*	Potassium oxide *Kalium oksida*

Basic oxide / *Oksida bes*	Acidic oxide / *Oksida asid*

[3 marks]

2. A student carried out an experiment to determine the end-point in the titration of hydrochloric acid, HCl and sodium hydroxide, NaOH solution using an acid-base titration. 25.0 cm^3 of sodium hydroxide 0.1 mol dm^{-3} is titrated against hydrochloric acid using phenolphthalein as an indicator. The titration is repeated twice. Diagram 1 shows the results of the titration.
Seorang pelajar menjalankan eksperimen untuk menentukan takat-akhir pentitratan asid hidroklorik, HCl *dan larutan natrium hidroksida,* NaOH *menggunakan pentitratan asid-bes.* 25.0 *cm^3 larutan sodium hidroksida* 0.1 *mol dm^{-3} dititratkan kepada asid hidroklorik menggunakan fenolftalein sebagai penunjuk. Pentitratan diulang sebanyak dua kali lagi. Rajah 1 menunjukkan keputusan pentitratan tersebut.*



Initial burette reading
Bacaan awal buret

Final burette reading
Bacaan akhir buret

(a) Record the results in Table 2.
Rekodkan keputusan dalam Jadual 2

Set	1	2	3
Final burette reading (cm^3) *Bacaan akhir buret* (cm^3)			
Initial burette reading (cm^3) *Bacaan awal buret* (cm^3)			
Volume of hydrochloric acid needed (cm^3) *Isipadau asid yang diperlukan* (cm^3)			

Table 2/*Jadual* 2

[3 marks]

(b) Calculate the average volume of hydrochloric acid used.
H*itungkan purata isipadu asid hidroklorik yang digunakan.*

[3 marks]

(c) State the observation when the end-point is reached in this experiment.
Nyatakan pemerhatian apabila takat-akhir telah di capai dalam eksperimen ini.

……

[3 marks]

(d) State the operational definition for the end-point in this experiment.
Nyakatakan definisi secara operasi bagi takat-akhir dalam eksperimen ini.

……

……

[3 marks]

(e) Determine the molarity of the hydrochloric acid used in this experiment.
Tentukan kemolaran bagi asid hidroklorik yang digunakan dalam eksperimen ini.

[3 marks]

(f) The experiment is repeated by replacing the hydrochloric acid with sulphuric acid of the same concentration.
Predict the volume of the sulphuric acid needed to neutralize the sodium hydroxide solution.
Eksperimen diulang dengan menggantikan asid hidroklorik dengan asid sulfurik yang sama kepekatan.
Ramalkan isipadu asid sulfurik yang diperlukan untuk meneutralkan larutan sodium hidroksida.

……

[3 marks]

3. Diagram 3 shows the result of two different cleaning agent, detergent and soap, used to remove grease stain on a shirt.
Rajah 3 *menunujukkan keputusan dua agen pencuci, detergen dan sabun, yang berbeza, digunakan untuk menanggalkan kotoran bergris pada sehelai baju.*

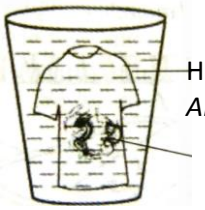
Cleaning agent *Agen pencuci*	Detergent/ *Detergen*	Soap *Sabun*
Cleaning in hard water *Pencucian dalam air liat*	 Hard water + detergent *Air liat + detergen* Grease stain *Kotoran bergris*	 Hard water + soap Grease stain *Kotoran bergris*
Result *Keputusan*	 Grease stain removed *Kotoran bergris ditanggalkan*	 Some grease stain still remain *Masih terdapat sedikit kotoran bergris*

Diagram 3
Rajah 3

Based on Diagram 3, plan one laboratory experiment to compare the effectiveness of the cleansing action between detergent and soap in hard water.
Berdasarkan Rajah 3*, rancang satu eksperimen makmal untuk membandingkan keberkesanan tindakan mencuci antara detergen dan sabun dalam air liat.*

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

(a) Problem statement/*Pernyataan masalah*
(b) All the variables/*Semua pembolehubah*
(c) Statement of the hypothesis/*Pernyataan hypothesis*
(d) List of substances and apparatus/*Senarai bahan dan radas*
(e) Procedure for the experiment/*Prosedur eksperimen*
(f) Tabulation of data/*Penjadualan data*

1 Table 1.1 shows the observation in five test tubes used to investigate the effect of other metals on rusting. A mixture of jelly solution, potassium hexacyanoferrate (III), $K_3Fe(CN)_6$ solution and phenolphthalein were used as medium in each test tube.The observations were recorded after one day.
Jadual 1.1 menunjukkan pemerhatian dalam lima buah tabung uji yang digunakan untuk menyiasat kesan logam lain ke atas pengaratan. Medium yang digunakan di dalam setiap tabung uji adalah campuran larutan agar, larutan kalium heksasianoferat(III), $K_3Fe(CN)_6$ dan fenolftalein. Pemerhatian direkod selepas satu hari.

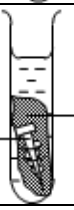
Test tube 1 *Tabung uji 1*	 Iron nail *Paku besi* Blue colour *Warna biru*
Test tube 2 *Tabung uji 2*	 Iron nail coiled with magnesium ribbon *Paku besi dililit dengan pita magnesium* High intensity of pink colour *Keamatan warna merah jambu tinggi*
Test tube 3 *Tabung uji 3*	 Iron nail coiled with copper strip *Paku besi dililit dengan kepingan kuprum* High intensity of blue colour *Keamatan warna biru tinggi*
Test tube 4 *Tabung uji 4*	 Iron nail coiled with zinc strip *Paku besi dililit dengan kepingan zink* Low intensity of pink colour *Keamatan warna merah jambu rendah*
Test tube 5 *Tabung uji 5*	 Iron nail coiled with tin strip *Paku besi dililit dengan kepingan timah* Low intensity of blue colour *Keamatan warna biru rendah*

Table 1.1/ Jaual 1.1

(a) State the observation and inference for each test tube.
Nyatakan pemerhatian dan inferens untuk setiap tabung uji.

Test tube	Observation / *Pemerhatian*	Inference / *Inferens*
1		
2		
3		
4		
5		

[6 marks]

(b) Based on this experiment, explain why there is a difference in observation between test tube 2 and 3.
Berdasarkan eksperimen ini, terangkan mengapa terdapat perbezaan pemerhatian di antara tabung uji 2 dan 3.

……

……

[3 marks]

(c) State the hypothesis for the experiment.
Nyatakan hipotesis bagi eksperimen ini.

……

……

[3 marks]

(d) For this experiment, state:
Bagi eksperimen ini, nyatakan

(i) The manipulated variable : ……..
Pembolehubah dimanipulasi :

(ii) The responding variable : ……..
Pembolehubah bergerakbalas :

(iii) The constant variable : ……..
Pembolehubah dimalarkan :

[3 marks]

(e) State the operational definition for the rusting of iron nail.
Nyatakan definisi secara operasi bagi pengaratan paku besi.

……

……

[3 marks]

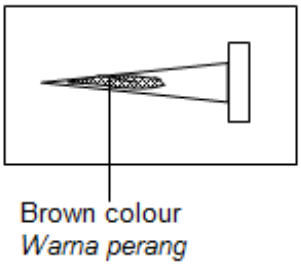
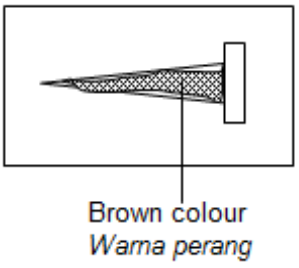
(f) Magnesium, copper, zinc and tin were used in this experiment to investigate the effect of other metals on the rusting of iron nails. Classify the metals by completing Table 1.2.
Magnesium, kuprum, zink dan timah digunakan dalam eksperimen ini untuk mengkaji kesan logam lain ke atas pengaratan paku besi. Kelaskan logam-logam dengan melengkapkan Jadual 1.2.

Metals that inhibit rusting *Logam yang melambatkan pengaratan*	Metals that speed up rusting *Logam yang mempercepatkan pengaratan*

Table 1.2*/Jadual 1.2*

[3 marks]

(g) An iron nail was placed on a moist cotton to investigate the time taken for the iron nail to rust completely. The observations are shown Diagram 1.1.
Sebatang paku besi diletakkan di atas kapas lembap untuk mengkaji masa yang diambil untuk paku besi itu berkarat dengan lengkap. Pemerhatian adalah ditunjuk seperti Rajah 1.1.

	
After one day Selepas satu hari	After two days Selepas dua hari

Rajah 1.1

(i) State the relationship between the time taken and the amount of rust formed.
Nyatakan hubungan di antara masa yang diambil dan kuantiti karat yang terbentuk.

……

……

[3 marks]

(ii) The iron nail will take 5 days to rust completely in the water. Predict the time taken for the iron nail to rust completely if it is placed in salt solution.
Sebatang paku besi mengambil masa 5 hari untuk berkarat dengan lengkap. Ramalkan masa yang diambil untuk paku besi itu berkarat dengan lengkap jika diletakkan dalam larutan garam.

……

[3 marks]

(h) In another experiment, the pairs of metals in test tube 2, 3, 4 and 5 were dipped into dilute sulphuric acid, H_2SO_4 and were connected to a voltmeter. The reading of the voltmeter are shown in Diagram 1.2

Dalam eksperimen yang lain, pasangan logam dalam tabung uji 2, 3, 4 dan 5 dicelupkan ke dalam asid sulfurik cair, H_2SO_4 dan disambungkan kepada voltmeter. Bacaan voltmeter ditunjukkan dalam Rajah 1.2

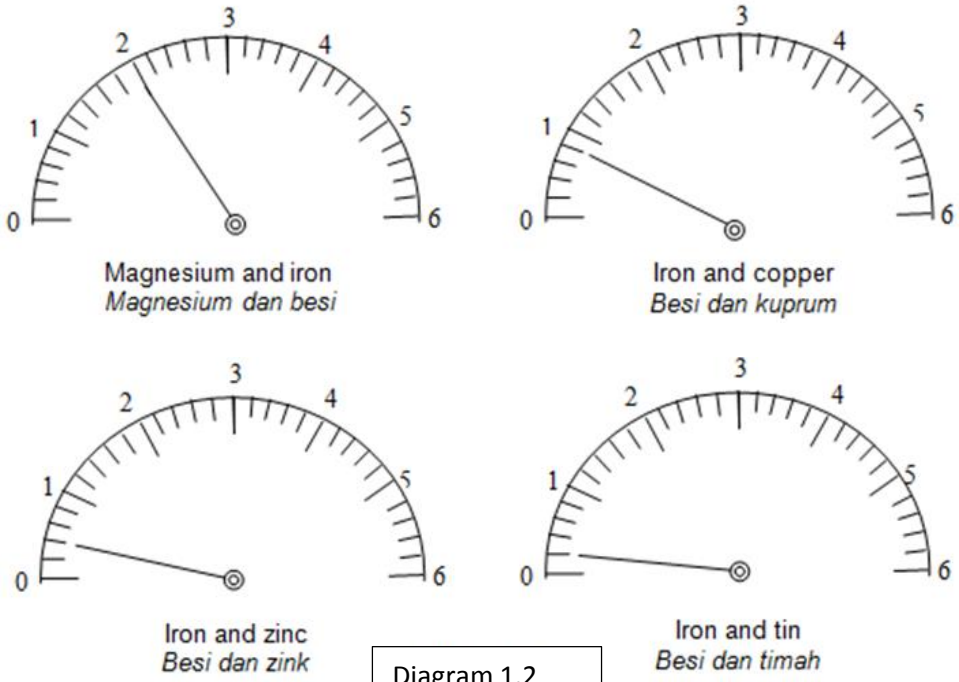


Diagram 1.2

(i) Based on diagram 1, record the voltmeter readings in Table 1.3.

Pairs of metal *Pasangan logam*	Positive terminal *Terminal positif*	Voltmeter reading (V) *Bacaan voltmeter (V)*
Magnesium and iron *Magnesium dan besi*	Iron *Besi*	
Iron and copper *Besi dan kuprum*	Copper *Kuprum*	
Iron and zinc *Besi dan zink*	Iron *Besi*	
Iron and tin *Besi dan timah*	Tin *Timah*	

Table 1.3/ Jadual 1.3

Based Diagram 1, record ammeter reading in Table 1.3
Berdasarkan rajah 1, rekod bacaan voltmeter dalam Jadual 1.3

[3 marks]

(ii) Draw a labelled diagram to show the voltaic cell using magnesium and iron with dilute sulphuric acid as electrolyte.
Lukis gambarajah berlabel untuk menunjukkan sel voltan bagi magnesium dan besi dengan menggunakan asid sulfurik cair sebagai elektrolit.

[3 marks]

Neutralisation is a reaction between an acid and an alkali to form salt and water
Peneutralan adalah tindakbalas antara asid dan alkali untuk menghasilkan garam dan air

3. 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 and sodium hydroxide solution.
Berdasarkan situasi di atas, rancangkan satu eksperimen makmal untuk membandingkan haba peneutralan di antara asid kuat yang dinamakan dengan larutan natrium hidroksida dan haba peneutralan antara asid lemah yang dinamakan dengan larutan natrium hidroksida

   Your planning should include the following aspects:
   Perancangan anda perlu mengikut aspek berikut:

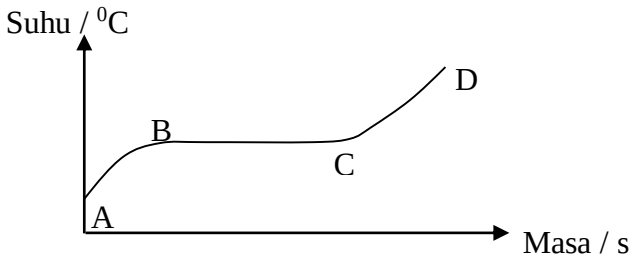
   (a) Problem statement / *pernyataan masalah*
   (b) All the variables / *semua pembolehubah*
   (c) Statement of the hypothesis / *pernyataan hipotesis*
   (d) List of substances and apparatus / *senarai bahan dan radas*
   (e) Procedure of the experiment / *kaedah eksperimen*
   (f) Tabulation of data / *penjadualan data*

BAHAGIAN PENGURUSAN SEKOLAH BERASRAMA PENUH
DAN SEKOLAH KECEMERLANGAN

CHEMISTRY 4541

https://cikguadura.wordpress.com/

JAWAPAN
MODUL X A-PLUS SBP 2015

Question	Answer	Sub-Mark	Mark
1 (a)	1. Attractive force between particle in X is weaker than in Z 2. Less heat energy is needed to overcome the attraction force	1 1	2
(b)	1. X : Solid 2. Melting point and boiling point substance X is higher than room temperature 3. Y : Liquid 4. Melting point substance Y is lower than room temperature but boiling point is higher than room temperature 5. Z : Solid 6. Melting point and boiling point substance Z is higher than room temperature	1 1 1 1 1 1	6
(c)(i)	1. X and Y axes are label and correct unit 2. Correct curve  	1 1	2
(ii)	<u>AB</u> 1. Exist as liquid 2. Particles are arrange closely packed but not in orderly manner 3. Kinetic energy of particles increase <u>BC</u> 4. Exist as liquid and gas 5. Some particles are arrange closely packed but not in orderly manner 6. Some particles are arrange far from each other 7. Kinetic energy of particles remain constant <u>CD</u> 8. Exist as gas 9. Particles are arrange far from each other 10. Kinetic energy of particles increase	 1 1 1 1 1 1 1 1 1 1	10
	TOTAL		20

	Answer	Sub-Mark	Mark
2 (a)	1. Atom T is smaller than R 2. Proton number / number of proton / nuclei charge of T is greater than R. 3. Nuclei attraction force towards electron is greater 4. Atom T is more electronegative than R 5. Atomic size of T is smaller 6. Atom T is more easier to receive electron	1 1 1 1 1 1	6

(b)	1. Correct formulae of reactants and products 2. Number of mole HOT 3. Mole ratio 4. Mass of T and correct unit $T_2 + H_2O \rightarrow HT + HOT$ No. of mole HOT = 0.0001 x 500 // 0.05 1 mole of HOT produce from 1 mole T_2 // 0.05 moles of HOT produce from 0.05 moles of T_2 Mass of T = 0.05 x [2(35.5)] g // 3.55 g	1 1 1 1	4
(c)	<u>R and Q // R and T</u> 1. Electron arrangement of atom R is 2.8.2 2. Electron arrangement of atom Q is 2.6 // electron arrangement of atom T is 2.8.7 3. To achieve stable octet electron arrangement 4. Atom R donates 2 electron to form R^{2+} ion 5. Atom Q receive 2 electron to form Q^{2-} ion // atom T receive 1 electron to form T^- ion 6. Electrostatic force between R^{2+} ion and Q^{2-} ion form ionic bond // Electrostatic force between R^{2+} ion and T^- ion form ionic bond <u>L and Q // L and T</u> 7. Electron arrangement of atom L is 2.4 8. Electron arrangement of atom Q is 2.6 // electron arrangement of atom T is 2.8.7 9. Atom L contribute 4 electron and atom Q contribute 2 electron for sharing // Atom L contribute 4 electron and atom T contribute 1 electron for sharing 10. To achieve stable octet electron arrangement 11. 1 atom L share electron with 2 atom Q to form covalent bond // 1 atom L share electron with 4 atom T to form covalent bond	1 1 1 1 1 1 1 1 1 1 1	Max 10
	TOTAL		20

SET 1 :CHEMICAL FORMULA & EQUATION

3	(a) (i)	<table><tr><td>Element</td><td>C</td><td>H</td><td>O</td></tr><tr><td>Mass (g)</td><td>39.9</td><td>6.7</td><td>53.5</td></tr><tr><td>Number of mole(mol)</td><td>39.9/12 // 3.33</td><td>6.7/1 // 6.7</td><td>53.5/16 // 3.34</td></tr><tr><td>Ratio of mole</td><td>1</td><td>2</td><td>1</td></tr><tr><td colspan="4">Empirical formula is CH_2O</td></tr></table>	1 1 1	3
	(ii)	Relative Molecular mass of $(CH_2O)_n$ = 60// $(12 + 2+16)n = 60$// $n = 2$ Thus, molecular formula = $C_2H_4O_2$	1 1	2
	(iii)	Ethanoic acid	1	1

	(b)	<table><tr><th>Empirical formula// CH_2O</th><th>Molecular formula // $C_2H_4O_2$</th></tr><tr><td>Shows the .simplest ratio of atoms of each element in a compound.</td><td>Shows the actual number of atoms of each element in a molecule of the compound.</td></tr><tr><td>Consists of 1 carbon atom, 2 hydrogen atoms and 1 oxygen atom</td><td>Consists of 2 carbon atoms, 4 hydrogen atoms and 2 oxygen atoms</td></tr><tr><td colspan="2">Both compound contains elements carbon, hydrogen and oxygen.</td></tr><tr><td colspan="2">Both show the same ratio of atoms of each element in a compound</td></tr></table>	1 1 1 1	4
	(c) (i)	Products : Calcium ethanoate Carbon dioxide Water	1 1 1	3
	(ii)	$CaCO_3 + 2CH_3COOH \rightarrow (CH_3COO)_2Ca + CO_2 + H_2O$ [*Correct formula of reactant and products*] [*Balanced equation*]	 1 1	2
	(d)	*Urea , $(NH_2)_2CO$* Percentage of N $= \frac{28}{60} \times 100\% = 46.67\%$ *Ammonium sulphate, $(NH_4)_2SO_4$* Percentage of N $= \frac{28}{132} \times 100\% = 21.21\%$ *Ammonium nitrate, NH_4NO_3* Percentage of N $= \frac{28}{80} \times 100\% = 35\%$ Urea , $(NH_2)_2CO$ the highest percentage of nitrogen by mass.	 1 1 1 1 1	5
		TOTAL		**20**

4	(a) (i)	**1.** Copper(II)oxide **2.** Carbon dioxide **3.** $CuCO_3 \rightarrow CuO + CO_2$	1 1 1+1……4
	(ii)	**1.** Yellow precipitate **2.** Double decomposition/precipitation reaction $2KI + Pb(NO_3)_2 \rightarrow PbI_2 + 2KNO_3$ Formula of reactants and products are correct Balanced	1 1 1 1……..4
	(b)	- XH react with QY_2 to produce QX_2 and HY // Reactants : XH and QY_2 Products : QX_2 and HY - HX aqueous solution react with QY_2 aqueous solution to produce QX_2 solid and HY aqueous solution - 2 mole of HX react with 1 mole of QY_2 to produce 1 mole of QX_2 and 2 mole of HY. - HX : Hydrochloric acid / HCl - QY_2 : Lead (II)nitrate / $Pb(NO_3)_2$	 1 1 1 1 1 1……5

	(c) (i)	**C** **H** 85.70 14.30 12 1 7.14 14.30 7.14 7.14 1 2 The empirical formula CH_2	 1 1 1
	(ii)	$(CH_2)_n = 56$ $[12 + 2(1)]n = 56$ 56 // 4 14 The molecular formula C_4H_8 Butane	 1 1 1 1…….7
			20

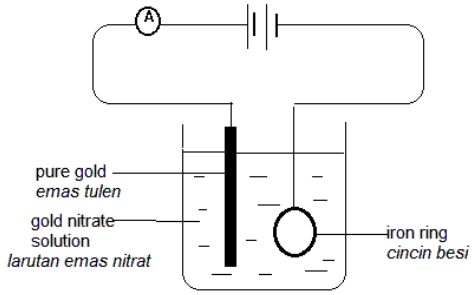
5(a)	1. P : Magnesium/Mg // Zinc/ Zn // Aluminium/ Al 2. Q : Copper/Cu // Lead/Pb // Tin/ Sn 3. P is a reactive metal 4. Q is less reactive than hydrogen //Position of Q is below than hydrogen in Reactivity Series	1 1 1 1	4
(b)	*Balanced chemical equation*: $N_2 + \mathbf{3}H_2 \rightarrow \mathbf{2}NH_3$ *Quantitative aspect*: 1 mol nitrogen reacts with 3 mol hydrogen to produce 2 mol ammonia Number of mole of $NH_3 = \frac{1.7}{17}$ $= 0.1$ mol From the equation, 2 mol of NH_3 : 3 mol of H_2 0.1 mol of NH_3 : 0.15 mol of H_2 Volume of $H_2 = 0.15 \times 24$ $= 3.6\ dm^3$	 1 1 1 1 1 1 1	6

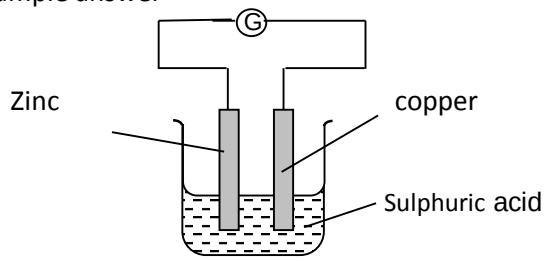
(c)	*Procedure* : 1. A crucible and its lid are weighed 2. 10 cm of cleaned X ribbon is coiled loosely and placed in the crucible. 3. The crucible with its lid and content are weighed again. 4. The crucible is heated strongly without its lid. 5. Using a pair of tongs, the lid is lifted at intervals. 6. When the burning is completed, the lid is removed and the crucible is heated strongly for 2 minutes. 7. The crucible is allowed to cool to room temperature. 8. The crucible and its lid and content are weighed again	 1 1 1 1 1 1 1 1	
	9.[*Results*] Mass of crucible + lid = **a** g Mass of crucible + lid + magnesium = **b** g Mass of crucible + lid + X oxide = **c** g	 1	
	[*Calculation*]		

		Element	**X**	**O**	
		Mass (g)	b-a	c-b	1
		Number of moles (mol)	$\frac{b-a}{24} = m$	$\frac{c-b}{16} = n$	1
		Simplest ratio of moles	**p**	**q**	
		Empirical formula is X_pO_q			1 Max ..10
				TOTAL	**20**

SET 2 ELECTROCHEMISTRY https://cikguadura.wordpress.com/

1	(a)(i)	Experiment I		
		Chlorine gas produced at anode	1	
		Chloride ions is selected for discharge	1	
		Because the concentration of the chloride ions is higher than hydroxide ions	1	
		Experiment II		
		Oxygen gas produced at anode	1	
		hydroxide ions is selected for discharge	1	
		Because it is lower than chloride ions in the electrochemistry series	1	
		Experiment III		
		Copper(II) ions produced at anode	1	
		Copper atoms undergoes ionization to produce copper(II) ions	1	
		Because anode is copper is active electrode	1	
	(ii)	$Cu \rightarrow Cu^{2+} + 2e$	1	10
	(b) (i)	Mg // Zn // [*any suitable metal*]	1	
		$MgSO_4$ // $ZnSO_4$ // [*any suitable solution*]	1	
	(ii)	Positive terminal : Cu	1	
		Negative terminal : X // Mg // Zn	1	
	(iii)	Positive terminal : $Cu^{2+} + 2e \rightarrow Cu$	1	
		Negative terminal : $Mg \rightarrow Mg^{2+} + 2e$ // $Zn \rightarrow Zn^{2+} + 2e$ // [$X \rightarrow X^{2+} + 2e$]	1	6
	(c) (i)	**Z, Y, X, W**	1	1
	(ii)	Positive terminal : **X**	1	
		X ***below*** Z in the electrochemical series // X ***less*** electropositive than Z	1	
		0.6 V	1	3
		TOTAL		20

2	(a)	1.X - glucose solution / (any suitable covalent compound) 2.Y – solid sodium chloride / (any suitable ionic compound in solid state) 3.Z – sodium chloride solution / (any suitable ionic compound in aqueous state) 4. X cannot conduct electricity 5. because X consist of molecule//has no free moving ions 6. Y cannot conduct electricity 7. Because the ions in Y cannot move freely 8. Z can conduct electricity 9.Because the ions in Z move freely 10. **Elektrolyte** | **Non electrolyte** Z | X, Y	1 1 1 1 1 1 1 1 1 1	10
	(b)	 [Functional *Diagram*] …..1 [Labelled] ……..1 1. Iron ring is connected to the negative terminal on the battery. 2. Aurum / Gold plate is connected to the positive terminal of the battery. 3. Pour Aurum nitrate solution into the beaker until half full 4. Gold plate and iron ring are immersed into the aurum nitrate solution. 5. Gold plate and iron ring are connected to batteries as shown in the diagram using connecting wire 5. Cathode: $Au^+ + e \rightarrow Au$ 6. Observation: golden solid is deposited 7. Anode : $Au \rightarrow Au^+ + e$ 8. Observation: gold become thinner	1 1 1 1 1 1 1 1 1 1	10
			TOTAL	**20**

3	(a)	Method : Electrolysis Electrolyte : Silver nitrate Anode : $Ag \rightarrow Ag^+ + e$ Cathode : $Ag^+ + e \rightarrow Ag$	1 1 1 1..4
	(b) (i) and (ii)	<table><tr><th>Experiment I</th><th>Experiment II</th></tr><tr><td>Anode becomes thinner</td><td>Gas bubbles are released</td></tr><tr><td>Copper (II) ion</td><td>Oxygen</td></tr><tr><td>$Cu \rightarrow Cu^{2+} + 2e$</td><td>$4OH^- \rightarrow O_2 + 2H_2O + 4e$</td></tr></table>	2 2 2……6
	(c)	Sample answer  Procedure: 1. Clean both metals with sandpaper. 2. Pour sulphuric acid into a beaker until half full. 3. Dip both metals into sulphuric acid 4. Connect both metals to a voltmeter using connecting wire. Observation: 1. Needle of voltmeter deflects. 2. Negative terminal becomes thinner // gas bubbles are released Half equation: Negative terminal: $Zn \rightarrow Zn^{2+} + 2e$ Positive terminal: $2H^+ + 2e \rightarrow H_2$	1+1 1 1 1 1 1 1 1 1
		TOTAL	20

SET 2 REDOX https://cikguadura.wordpress.com/

4	(a)	Magnesium is more reactive Magnesium is oxidised Magnesium oxide / MgO is formed Magnesium oxide is not strong/permeable/easily peeled off	1 1 1 1	4
	(b)	**<u>Experiment I:</u>** Fe^{2+} ion turns to Fe^{3+} ion Fe^{2+} ion // iron(II) sulphate is oxidised/undergoes oxidation Bromine is reduced/ undergoes reduction Oxidizing agent : Bromine *Reducing agent:* Fe^{2+} ion // iron(II) sulphate **<u>Experiment II:</u>** Cu^{2+} ion turns to Cu/copper atom Zn // Zinc is oxidised/undergoes oxidation Cu^{2+} is reduced/ undergoes reduction *Oxidizing agent:* Cu^{2+} ion // copper(II)sulphate Reducing agent: Zn // Zinc Half equation for oxidation : $Zn \rightarrow Zn^{2+} + 2e$ Half equation for reduction : $Cu^{2+} + 2e \rightarrow Cu$	 1 1 1 1 1 1 1 1 1 1 1 1	Max 10

	(c)	Arrangement in order of increasing reactivity towards oxygen: Cu, P, Q Experiment I P can reduce copper(II) oxide to copper P is more reactive than Cu Experiment II Q can reduce copper(II) oxide to copper Q is more reactive than copper Experiment II P cannot reduce Q oxide to Q P is less reactive than Q	 1..1 1 1 1 1 1 1 [*Any* 5]	 ...6
		TOTAL	20	

5	(a)	Reaction II is a redox reaction Oxidation number of magnesium **<u>increases</u>** from 0 to +2. Oxidation number of zinc in zinc nitrate **<u>decreases</u>** from +2 to 0 No change in oxidation number of all elements before and after reaction	1 1 1 1..4
	(b)	Test tube P : Iron (II) sulphate // Iron (II) ion Test tube Q : Potassium iodide // iodide ion Test tube P: $2Fe^{2+} + Cl_2 \rightarrow 2Fe^{3+} + 2Cl^-$ Correct formulae of reactants and products Balance equation Test tube Q: $2I^- + Cl_2 \rightarrow I_2 + 2Cl^-$ Correct formulae of reactants and products Balance equation	1 1 1 1 1 1..6
	(c)	**<u>Experiment I</u>** Reaction between carbon and oxide of metal P occurs Carbon is more reactive than metal P **<u>Experiment II</u>** Reaction between carbon and oxide of metal Q does not occur Metal Q is more reactive than carbon **<u>Experiment III</u>** Reaction between carbon and oxide of metal R occurs. Carbon is more reactive than metal R Reaction between carbon and oxide of metal P produces flame whereas reaction between carbon and oxide of metal R produces glow. Metal P is less reactive than metal R. Reactivity of metals in descending order is Q, carbon, R, P Q is Aluminium // Magnesium	 1 1 1 1 1 1 1 1 1 1 1
		Total marks	[20]

6	(a)		Sampel answer Metal X = magnesium /zinc Metal X is more electropositive than copper Oxidation number of metal X increases from 0 to +2 Oxidation number of copper decreases from +2 to 0	 1 1 1 1..4
	(b)	(i)	Compound X : oxidation number of iron = **+ 2** Compound Y : oxidation number of iron = **+ 3**	1 1.....**2**
		(ii)	Compound X : Iron(**II**) oxide Compound Y : Iron(**III**) oxide Oxidation number of **<u>iron in compound X</u>** is +2 Oxidation number of **<u>iron in compound Y</u>** is +3	1 1 1 1.....**4**
	(c)		1.<u>Chemicals</u> : [any suitable oxidising agent , any suitable reducing agent ,any suitable electrolyte to allow the flow of ions] Sample answer : Bromine water , iron(II)sulphate solution ,sulphuric acid. Procedure 1.Clamp a U-tube to retort stand 2. Pour sulphuric acid into the U-tube 3. Add iron(II)sulphate solution in one of the arms of the U-tube 4. Add Bromine water into the other arm 5. The solution are [added slowly]// using a dropper 6 Dip the carbon electrodes into the [two separate] solution 7.Connect the galvanometer to the electrodes//complete the circuit. **<u>Observation</u>** - The electrode dipped in the iron(II)sulphate solution acts as the negative terminal - The electrode dipped in the bromine water acts as the positive terminal Conclusion Electrons flow from iron(II)sulphate solution (reducing agent) to bromine water(oxidising agent).	 1 1 1 1 1 1 1 1 1 1..10
				20

SET 3 : ACID & BASE https://cikguadura.wordpress.com/

1 (a)	1. Toothpaste/ baking powder/ soap 2. bee sting is acidic 3. Toothpaste/ baking powder/ soap can neutralize bee sting	1 1 1
(b)	1. Water is present in X but there is no water in in Y. 2. Citric acid ionises in water 3. H^+ ion present 4. H^+ ion reacts with sodium carbonate / bicarbonate to release bubbles of carbon dioxide 5. Without water citric acid exists as molecule // without water H^+ is not present 6. When H^+ ion is not present, citric acid cannot reacts with sodium carbonate / bicarbonate	1 1 1 1 1 1
(c)	1. Sulphuric acid is a diprotic acid but nitric acid is a monoprotic acid 2. 1 mole of sulphuric acid ionize in water to produce two moles of H^+ ion but 1 mole of nitric acid ionize in water to produce one mole of H^+ ion 3. The concentration of H^+ ion in sulphuric acid is double / higher, pH is lower 4. The concentration of H^+ in nitric acid lis lower,the pH is higher	1 1 1 1

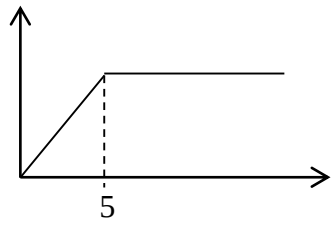
(d)(i)	1. Mole of KOH 2. Molarity of KOH and correct unit Mole KOH = $\frac{14.0}{56}$ // 0.25 Molarity = $\frac{0.25 \text{ x } 1000}{250}$ mol dm^{-3} // 1 mol dm^{-3}	1 1
(ii)	1. Correct formula of reactants 2. Correct formula of products 3. Mole of KOH // Substitution 4. Mole ratio 5. Answer with correct unit HCl + KOH → KCl + H_2O Mole KOH = $\frac{1 \text{ x } 25}{1000}$ // 0.025 From the equation, 1 mol HCl : 1 mol KCl 0.025 mole KOH : 0.025 mole KCl Mass KCl = 0.025mol x 74.5 $gmol^{-1}$ // 1.86 g	1 1 1 1 1
	TOTAL	20

2 (a) (i)	1. Monoprotic acid : HCl / HNO_3 / CH_3COOH 2. Diprotic acid : H_2SO_4 / H_2CO_3	1 1
(ii)	3. 1 mole of HCl will produce 1 mol of H^+ when dissociated / ionises completely in water 4. 1 mole of H_2SO_4 will produce 2 mol of H^+ when dissociated / ionises completely in water	1 1
(b)	1. Sodium hydroxide is a strong alkali 2. Ammonia is a weak alkali 3. Sodium hydroxide ionises completely in water to produce high concentration of OH^- ion 4. Ammonia ionises partially in water to produce low concentration of OH^- ion 5. Concentration of OH^- ion in sodium hydroxide is higher than in ammonia 6. The higher the concentration of OH^- ion the higher the pH value	1 1 1 1 1 1
(c)	1. Volumetric flask used is 250 cm^3 2. Mass of potassium hydroxide needed = 0.25 X 56 = 14 g 3. Weigh 14 g of KOH in a beaker 4. Add water 5. Stir until all KOH dissolve 6. Pour the solution into volumetric flask 7. Rinse beaker, glass rod and filter funnel. 8. Add water into the volumetric flask 9. when near the graduation mark, add water drop by drop until meniscus reaches the graduation mark 10. stopper the volumetric flask and invert the volumetric flask	1 1 1 1 1 1 1 1 1 1
	TOTAL	20

3 (a)	Ionic compound formed when H^+ ion from an acid is replaced by a metal ion or ammonium ion	1
(b)	$Pb(NO_3)_2$	1
(c)	To ensure all the nitric acid reacts completely	1
(d)(i)	1. Correct formula of reactants and products 2. Balanced equation $2H^+ + PbO \rightarrow Pb^{2+} + H_2O$	1 1
(ii)	1. Mole of acid 2. Mole ratio 3. Answer with correct unit $2HNO_3 + PbO \rightarrow Pb(NO_3)_2 + H_2O$ Mole HNO_3 = $\frac{1.0 \times 50}{1000}$ // 0.05 From the equation, 2 mole HNO_3 : 1mol $Pb(NO_3)_2$ 0.05 mole HNO_3 : 0.025 mole $Pb(NO_3)_2$ Mass of $Pb(NO_3)_2$ = 0.025 x 331 g // 8.275 g	1 1 1
(e)	1. Add 1 cm^3 dilute sulphuric acid followed by 1 cm^3 of Iron(II) sulphate solution Tilt the test tube, add slowly concentrated sulphuric acid through the wall of the test tube. 2. Brown ring is formed.	1 1
TOTAL		10

4(a)(i)	Salt W : Copper(II) carbonate Solid X : Copper(II) oxide	1 1
(ii)	1. Pass/Flow gas into lime water 2. Lime water turns cloudy / chalky	1 1
(iii)	Neutralisation	1
(iv)	1. Correct formula of reactants and products 2. Balanced equation $CuO + 2HCl \rightarrow CuCl_2 + H_2O$	1 1
(b)	Cation : Cu^{2+} ion // copper(II) ion Anion : Cl^- ion // chloride ion	1 1
I(i)	$Ag^+ + Cl^- \rightarrow AgCl$	1
(ii)	Double decomposition reaction	1
TOTAL		11

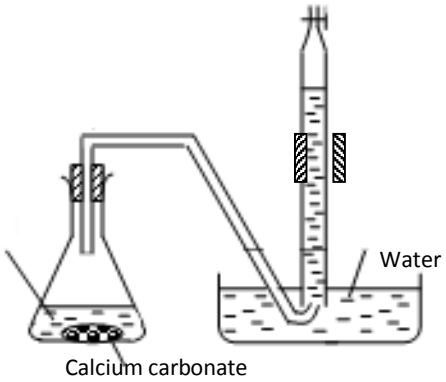
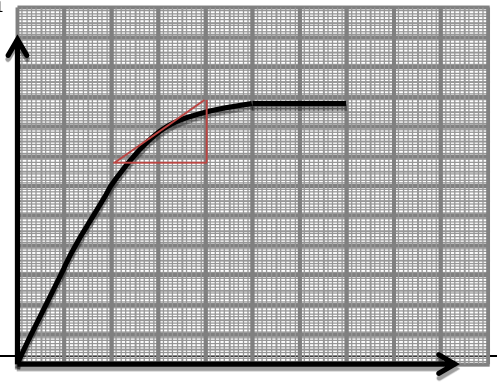
5 (a)(i)	1. $PbCl_2$ 2. Double decomposition reaction	1 1
(ii)	<u>Copper (II) chloride :</u> Copper(II) oxide / copper(II) carbonate , Hydrochloric acid <u>Lead (II) chloride :</u> Lead (II) nitrate solution , sodium chloride solution (any solution that contains Cl^- ion)	 1 + 1 1 + 1

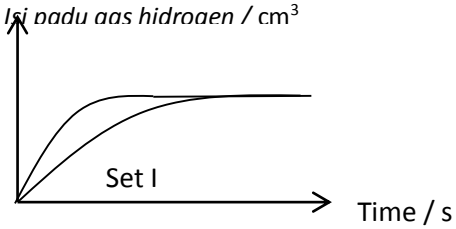
(b)(i)	1. S = zinc nitrate 2. T = zinc oxide 3. U = nitrogen dioxide 4. W = oxygen	1 1 1 1
(ii)	$2Zn(NO_3)_2 \rightarrow 2ZnO + 4NO_2 + O_2$	1+1
(c)(i)	1. Both axes are label and have correct unit 2. Consistent scale and size of graph is more than half of graph paper 3. All points are transferred correctly	1 1 1
(ii)	 	1
(iii)	Mole Ba^{2+} ion = $\frac{0.5 \times 5}{1000}$ // 0.0025 Mole SO_4^{2-} ion = $\frac{0.5 \times 5}{1000}$ // 0.0025 0.0025 mol Ba^{2+} ion : 0.0025 mol SO_4^{2-} ion 1 mol Ba^{2+} ion : 1 mol SO_4^{2-} ion	1 1 1
(iv)	$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$	1
	TOTAL	20

6(a)(i)	<table><tr><th>Possible causes</th><th>Ways to overcome</th></tr><tr><td>Soil too acidic</td><td>Add powdered lime or limestones to neutralise acidity in soil</td></tr><tr><td>Soil too alkaline</td><td>Add a composite of rotting vegetables or leaves to treat basic soil</td></tr><tr><td>Soil not fertile</td><td>Add chemical fertilisers such as ammonium nitrate and urea</td></tr></table>	1+1 1+1
(ii)	R is lead(II) oxide Gas A is carbon dioxide Gas B is nitrogen dioxide Gas C is oxygen The chemical formula for P is $PbCO_3$ The chemical formula for Q is $Pb(NO_3)_2$	1 1 1 1 1 1

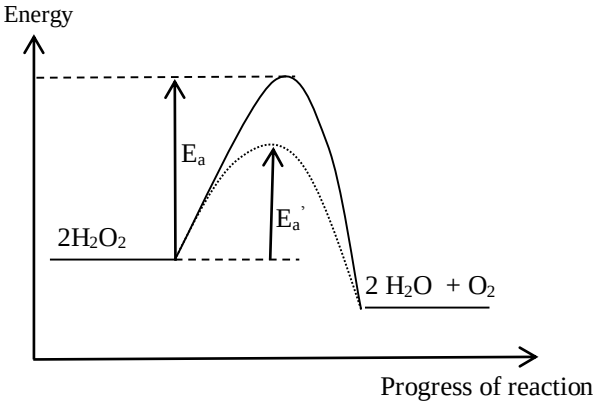
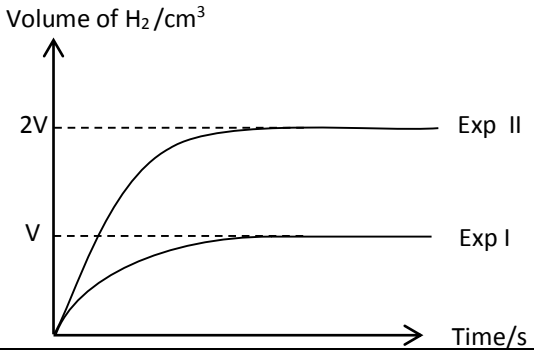
(b)	1. Measure and pour [20-100 cm^3] of [0.1-2.0 mol dm^{-3}]zinc nitrate solution into a beaker	1
	2. Add [20-100 cm^3] of [0.1-2.0 mol dm^{-3}]sodium carbonate solution	1
	3. Stir the mixture and filter	1
	4. Rinse the residue with distilled water	1
	5. $Zn(NO_3)_2 + Na_2CO_3 \rightarrow ZnCO_3 + 2NaNO_3$	1
	6. Measure and pour [20-100cm^3]of [0.1-1.0mol dm^{-3}]sulphuric acid into a beaker	1
	7. Add the residue/ zinc carbonate into the acid until in excess	1
	8. Stir the mixture and filter	1
	9. Heat the filtrate until saturated / 1/3 of original volume	1
	10. Cool the solution to crystallise and filter the mixture	1
	11. Dry the crystal by pressing between two filter papers	1
	12. $ZnCO_3 + H_2SO_4 \rightarrow ZnSO_4 + H_2O + CO_2$	1
TOTAL		20

SET 3 : RATE OF REACTION https://cikguadura.wordpress.com/

7 (a)		*Able to draw a functional and complete, label the apparatus set-up*  1. Functional of apparatus: Clamp the burette, dotted line for water and hydrochloric acid, end of delivery tube below water level in the basin. 2. Label: Hydrochloric acid/ HCl, calcium carbonate/ $CaCO_3$, water	1 1	2
(b)		*Able to draw the graph with these criteria:* 1. Labelled axis with correct unit 2. Uniform scale for X and Y axis & size of the graph is at least half of the graph paper 3. All points are marked 4. Correct shape, Curve is smooth and start from origin point	1 1 1 1	4
c)	(i)	*Able to draw the tangent and show the working and correct unit* 1 Correct tangent at 90 second on the graph 2 Show calculation of the tangent with correct answer and unit Range (0.155 – 0.195) cm^3s^{-1} 	1 1	2
	(ii)	0.21 cm^3/s	1	1
	(iii)	0.29 cm^3/s	1	1
		Total		10

8 (a)		$Mg + 2HCl \rightarrow MgCl_2 + H_2$	1+1	2
(b)	(i)	Mol Mg = $\frac{0.3}{24}$ = 0.0125 mol	1	1
	(ii)	Mol HCl = $\frac{1\ X\ 50}{1000}$ = 0.05 mol	1	1
(c)		From the equation: 1 mol of magnesium: 1 mol hydrogen 0.0125 mol Mg : 0.0125 mol hydrogen Volume of hydrogen = 0.0125 x 24 dm^3 = 0.3 dm^3 / 300 cm^3	 1 1	 2
(d)		Set I Rate of reaction = $\frac{0.3}{100}$ = 0.003 dm^3s^{-1} // $\frac{300}{100}$ = 3 dm^3s^{-1} Set II Rate of reaction = $\frac{0.3}{60}$ = 0.005 dm^3s^{-1} // $\frac{300}{60}$ = 5 dm^3s^{-1}	1 1	 2
(e)		1. Size of **solid** reactant// magenesium 2. The presence of copper(II) sulphate as catalyst	1 1	 2
(f)	(i)	Volume of hydrogen gas / cm^3 *Isi padu gas hidrogen* / cm^3  	1	1
	(ii)	1. Initial rate of is higher because the concentration of HCl is higher 2. Magnesium is the limiting factor // Hydrochloric is in excess 3. Maximum volume of hydrogen gas collected is the same because the number of mole of magnesium used is the same	1 1 1	 3
		Total		14

9 (a)		Use catalyst // Add iron Increase temperature // Carry out Haber Process at 450 – 550 ˚ C Increase pressure // Carry out Haber Process at 200 – 300 atm	1 1 1	 3
(b)	(i)	$2H_2O_2 \rightarrow 2H_2O + O_2$	1	1
	(ii)	1. Function as catalyst 2. Catalyst provide an alternative path with a lower activation energy 3. More colliding hydrogen peroxide molecules/particles can achieve the lower activation energy 4. Frequency of effective collision between hydrogen peroxide molecules increases 5. Rate of reaction increase	1 1 1 1 1	 5

	(iii)	1. Axis 2. Curve without catalyst, E_a 3. Curve with catalyst , E_a'  	1 1 1	3
(c)	(i)	1. Labeled axis with unit 2. Correct curves for both experiments 3. Correct maximum volume  	1 1 1	3
	(ii)	1. The rate of reaction in experiment II is higher than experiment I 2. In experiment II, H_2SO_4 is a diprotic acid whereas in experiment I, HCl is a monoprotic acid. 3. The concentration of H^+ ions/ no. of H^+ ions per unit volume of experiment II is higher than in experiment I 4. The frequency of collision between zinc atoms and hydrogen ions in experiment II higher than experiment I 5. The frequency of effective collision between zinc atoms and hydrogen ions in experiment II higher than experiment I	1 1 1 1 1	5
		TOTAL		20

10 (a)		P : [*any metal situated above Cu in the ECS*] <u>*Example*</u> : Magnesium / Zinc / Aluminium [r : Potassium / sodium] HX : [Any monoprotic acid] <u>*Example*</u> : Hydrochloric acid / Nitric acid [a : weak acid] [*Chemical equations*] 1. Correct formula of reactant and product 2. Balance chemical equations <u>*Sample answer*</u> : Mg + 2HCl → $MgCl_2$ + H_2	1 1 1 1	 4
(b)		Experiment I : Rate of reaction = $\frac{30}{10}$ // 3 $cm^3 s^{-1}$ Experiment II : Rate of reaction = $\frac{30}{20}$ // 1.5 $cm^3 s^{-1}$ [*Unit must be correct*]	1 1	 2
(c)		1. Rate of reaction in experiment I is higher than Experiment II. 2. The concentration of acid in Experiment I is higher than in Experiment II 3. Number of hydrogen ions per unit volume in Experiment I is higher than in Experiment II. 4. Frequency of collision between hydrogen ion and atom metal P in Experiment I is higher than in Experiment II. 5. Frequency of effective collision between hydrogen ion and atom metal P in Experiment I is higher than in Experiment II.	1 1 1 1 1	 5

(d)

<u>*Factor : Size of Reactant*</u>

1. Pour [20-100] cm^3 of [0.1 - 2.0 mol dm^{-3}] HX acid/ HCl/ HNO_3 into a conical flask. 1
2. Filled a burette with water and inverted it over a basin of water. 1
3. Initial burette reading is recorded. 1
4. Granulated / pieces of metal P/ Mg / Zn is added into a conical. 1
5. The conical flask is closed immediately with stopper and start the stopwatch. 1
6. The volume of gas collected is recorded at 30 seconds intervals. 1
7. Step 1 to 8 is repeated by using a powder of metal P/ Mg/ Zn. 1

8. <u>*Results*</u> : 1

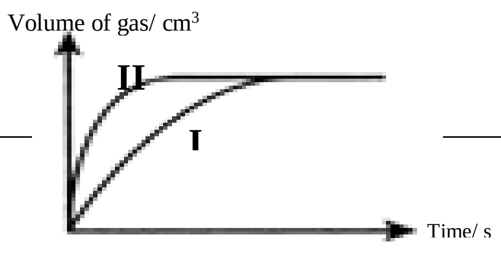
Exp .1 : Using a large piece of metal P/ Mg / Zn

Time(s)	0	30	60	90			
Volume of gas (cm)^3							

Exp. II :Using a powder of metal P /Mg/ Zn

Time (s)	0	30	60	90			
Volume of gas (cm$^{3)}$)							

9. Sketch the graph of volume of gas against time for both experiments at same axes. 1



10. The smaller the size of reactant the higher the rate of reaction — 1

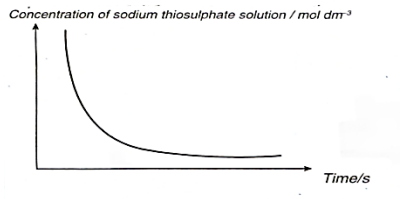
OR

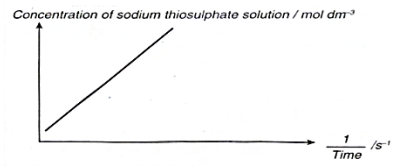
Factor : Concentration — *Max* **9**

1. Pour 50 cm^3 of 0.2 $moldm^{-3}$ sodium thiosulphate solution into a conical flask. — 1
2. The conical flask is placed on top of a piece of paper with a mark 'X' . — 1
3. 5 cm^3 of 1 mol dm^{-3} sulphuric acid is poured into the conical flask. — 1
4. Swirl the conical flask at the same time start the stop watch. — 1
5. The stop watch is stopped immediately when the mark 'X'is no longer visible. — 1 / 1
6. The time taken for the mark 'X' is no longer visible is recorded. — 1
7. Steps 1 to 6 are repeated using different volume of sodium thiosulphate solution with different volumes distilled water as shown in the table. — 1
8. Result

Volume of Na_3Si0_3 / cm^3	50	40	30	20	10
Volume of water/ cm^3	0	10	20	30	40
Concentration of Na_2S_203 solution / mol dm^{-3}					
Time taken for'X' to disappear from sight /s					
1/time / s^{-1}					

9. Graphs of concentration of sodium thiosulphate against time and concentration of sodium thiosulphate against 1/t are plotted. — 1





1

10. The higher the concentration the higher the rate of reaction

Max **9**

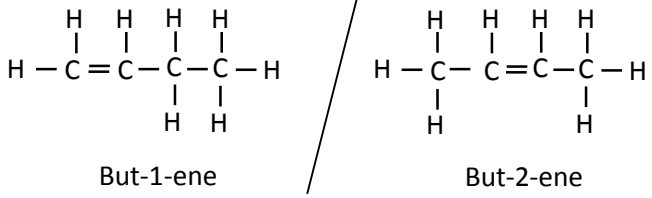
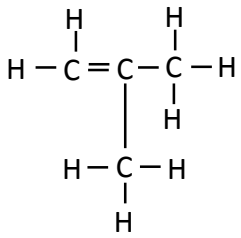
		TOTAL		20

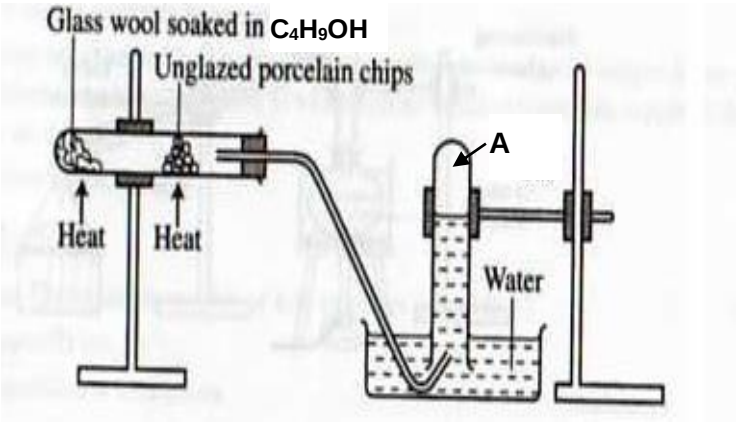
<table>
<tr><th></th><th>Answer</th><th></th><th>Mark</th></tr>
<tr><td>11(a)</td><td>
<table>
<tr><td>Reaction I</td><td>Reaction II</td></tr>
<tr><td>Endothermic // Heat energy absorb from surrounding</td><td>Exothermic // Heat energy release to surrounding</td></tr>
<tr><td>Total energy content of reactant is lower than total energy content of product</td><td>Total energy content of reactant is higher than total energy content of product</td></tr>
<tr><td>Heat energy absorb during bond breaking is greater than heat energy release during bond formation</td><td>Heat energy release during bond formation is greater than heat energy absorb during bond breaking.</td></tr>
</table>
</td><td>1

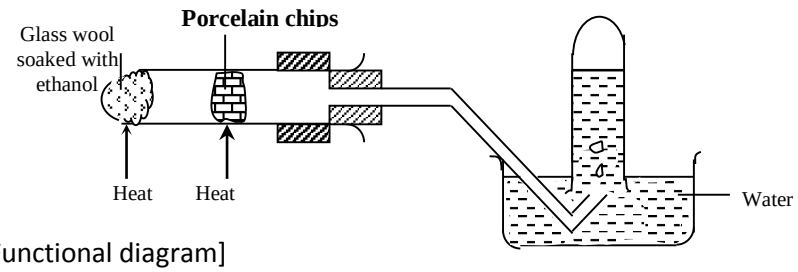
1

1</td><td>3</td></tr>
<tr><td>(b)</td><td>1. Heat of combustion for propane is higher than ethane
2. Number of carbon atom per molecule in propane is greater than ethane
3. The number of moles of carbon dioxide formed in propane is higher than ethane therefore more heat is released</td><td>1
1
1
1</td><td>3</td></tr>
<tr><td>(c)(i)</td><td>1. Heat release
2. Number of moles of HCl or NaOH
3. Mole ratio
4. Heat of neutralization with correct unit and sign
Q = 100 x 4.2 x 7 J // 2 940 J
Number of mole = $\frac{1.0 \times 50.0}{1000}$ // 0.05
$\triangle H = \frac{2940}{0.05}$
$\triangle H$ = - 58.8 kJmol^{-1}</td><td>1
1
1
1</td><td>4</td></tr>
<tr><td>(ii)</td><td>1. Ethanoic acid is weak acid // Ethanoic acid ionise partially in water to produce low concentration of H^+, some remain in the form of molecules
2. Some heat energy is absorb to ionize completely ethanoic acid</td><td>1
1</td><td>2</td></tr>
<tr><td>(d)</td><td>1. Calcium nitrate and sodium carbonate solution // [any suitable soluble salt]
2. Measure [25-100 cm^3] of [0.05-2.0 moldm^{-3}] calcium nitrate solution and pour into a polystyrene cup
3. Record initial temperature
4. Measure [25-100 cm^3] of [0.05-2.0 moldm^{-3}] sodium carbonate solution and record initial temperature
5. Add sodium carbonate solution into the polystyrene cup and stir
6. Record the lowest temperature
7. Result
Initial temperatutre of calcium nitrate = $T_1\ ^0C$
Initial temperatutre of sodium carbonate = $T_2\ ^0C$
Lowest temperatutre of mixture = $T_3\ ^0C$
Temperature change = $\left[\frac{T1+T2}{2}\right]$ - $T_3\ ^0C$ = $\theta\ ^0C$
8. Calculation
Q = m x 4.2 x θ J
Number of mole = $\frac{0.05 \times 100}{1000}$ // 0.005
$\triangle H$ = - $\frac{4.2\ m\theta}{0.005}$ ÷ 1000 kJmol^{-1}</td><td>1
1
1
1
1
1
1
1</td><td>8</td></tr>
<tr><td colspan="2">TOTAL</td><td>20</td></tr>
</table>

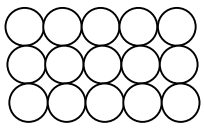
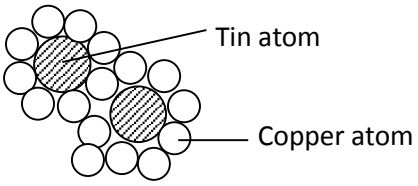
	Answer		Mark
12(a)(i)	P : Ethanoic acid Q : Hydrochloric acid // nitric acid	1 1	2
(ii)	1. P / Ethanoic acid is weak acid while Q / Hydrochoric acid is strong acid 2. P / Ethanoic acid ionize partially in water to produce low concentration of H^+ ion while Q / Hydrochoric acid ionize completely in water to produce high concentration of H^+ ion 3. Most of the ethanoic acid remain as molecule 4. Some of the heat is absorb to ionize completely the molecules of ethanoic acid	1 1 1 1	4
(b)	Number of mole = $\frac{1.0 \times 100}{1000}$ // 0.1 Heat release = 55 000 x 0.1 // 5 500 $\theta = \frac{5\,500}{200\ x\ 4.2}$ θ = 6.5 ^{O}C	1 1 1 1	4
(c)	1. Measure [25-100 cm^3] of [0.05-2.0 $moldm^{-3}$] acid P/Q 2. pour into a polystyrene cup 3. Record initial temperature 4. Measure [25-100 cm^3] of [0.05-2.0 $moldm^{-3}$] potassium hydroxide solution 5. and record initial temperature 6. Add potassium hydroxide solution into the polystyrene cup 7. Stir the mixture 8. Record the highest temperature 9. Result Initial temperatutre of calcium nitrate = T_1 ^{0}C Initial temperatutre of sodium carbonate = T_2 ^{0}C Lowest temperatutre of mixture = T_3 ^{0}C Temperature change = $\left[\frac{T1+ T2}{2}\right]$ - T_3 ^{0}C = θ ^{0}C 10. Calculation Q = m x 4.2 x θ J Number of mole = $\frac{0.05 \times 100}{1000}$ // 0.005 $\triangle$H = - $\frac{4.2\ m\theta}{0.005}$ ÷ 1000 kJmol^{-1}	1 1 1 1 1 1 1 1 1 1	10
	TOTAL		20

1	(a) (i)	*Saturated hydrocarbon* : X Contains only single covalent bond between carbon atoms // C - C single covalent bond *Unsaturated hydrocarbon* : Y Contains at least one double covalent bond between carbon atoms // C = C double covalent bond	1 1 1 1	...4
	(ii)	Percentage of carbon by mass per molecule of hydrocarbon Y is higher. *Calculation* : % of C in Y = $\frac{4(12)}{4(12) + 8(1)}$ x 100 = **85.71** % % of C in X = $\frac{4(12)}{4(12) + 10(1)}$ x 100 = **82.76** %	1 1	...2
	(iii)	[*Any one structural formula of the isomers*] [Correct structural formula] [Correct name] *Answer* :  But-1-ene / But-2-ene  Methylpropene	1 1	...2
	(iv)	Hydrogenation // Addition of hydrogen Temperature : 180 ^{o}C Catalyst : Nickel // Platinum $C_4H_8 + H_2 \rightarrow C_4H_{10}$	1 1 1 1	...4
	(b) (i)	A : Butene B : Ethanoic acid Process II : Esterification	1 1 1	...3
	(ii)	*Chemical equation* : Process I : $C_4H_8 + H_2O \rightarrow C_4H_9OH$	1+1	...2

	(iii)	*Diagram*:  [*Functional diagram*] [*Labels*] Chemical equation: $C_4H_9OH \rightarrow C_4H_8 + H_2O$	1 1 1	...3
		TOTAL		**20**

2	(a) (i)	X - any acid – methanoic acid Y - any alkali – ammonia aqueous solution	1 1
	(ii)	1. Methanoic acid contains hydrogen ions 2. Hydrogen ions neutralise the negative charges of protein membrane 3. Rubber particles collide, 4. Protein membrane breaks 5. Rubber polymers combine together	5 max 4
	(iii)	Ammonia aqueous solution contains hydroxide ions Hydroxide ions neutralise hydrogen ions (acid) produced by activities of bacteria	1 1
	(b) (i)	Alcohol	1
	(ii)	Burns in oxygen to form carbon dioxide and water Oxidised by oxidising agent (acidified potassium dichromate (VI) solution) to form carboxylic acid	1 1
	(iii)	Procedure: 1. Place glass wool in a boiling tube 2. Soak the glass wool with 2 cm^3 of ethanol 3. Place pieces of porous pot chips in the boiling tube 4. Heat the porous pot chips strongly 5. Heat glass wool gently 6. Using test tube collect the gas given off  [Functional diagram] [Labeled – porcelain chips, water, named alcohol, heat] **Test:** Add a few drops of bromine water // acidified potassium manganite(VII) solution Brown colour of bromine water// purple colour acidified potassium manganite(VII) solution decolourised	6 max 5 1 1 1 1
			TOTAL :20

	Answer		Mark
3(a)(i)	<u>Raw material</u> 1. Sulphur 2. Oxygen / air <u>Catalyst</u> 3. Vanadium (V) oxide // V_2O_3 <u>Equation</u> 4. Correct formulae of reactants and product 5. Balanced equation $2\ SO_2 + O_2 \rightarrow 2\ SO_3$	 1 1 1 1 1	 5
(ii)	1. Gas sulphur dioxide 2. The soil is acidic / infertile 3. Add calcium carbonate / calcium oxide	1 1 1	 3
(b)(i)	1. Duralumin 2. Light 3. Strong	1 1 1	 3
(ii)	1. Atoms in alloy P is different size. 2. The presence of foreign atoms disrupt the orderly arrangement of the pure metal. 3. When force is applied, atoms do not slide easily.	1 1 1	 3
(c)	<u>Synthetic polymers cause environmental pollution</u> 1. Improper disposal of polymer 2. Cause drain blockage //Flash flood 3. Burning of polymer 4. Produced poisonous / toxic / acidic gas <u>Ways to overcome problem</u> 5. Use biodegradable polymer 6. Reduce, reuse and recycle polymer 7. Burn in incinerator [Any two]	 1 1 1 1 1 1	 6
	TOTAL	20	

4	(a)	• Haber process • Iron • $N_2 + 3H_2 \rightleftharpoons 2NH_3$	1 1 1+1
	(b)	Pure copper  Bronze  **1.** Bronze is harder than pure copper **2.** Tin atoms are of different size **3.** The presence of tin atoms disrupt the orderly arrangement of copper atoms. **4.** This reduce the layer of atoms from sliding when force is applied.	1 1+1 1 1 1 1 MAX 6

Procedure:

1. Iron nail and steel nail are cleaned using sandpaper. — 1
2. Iron nail is placed into test tube A and steel nail is placed into test tube B. — 1+ 1
3. Pour the agar-agar solution mixed with **potassium hexacyanoferrate(III)** solution into test tubes A and B until it covers the nails. — 1
4. Leave for 1 day.
5. Both test tubes are observed to determine whether there is any blue spots formed or if there are any changes on the nails. — 1 / 1
6. The observations are recorded

Results:

Test tube	The intensity of blue spots
A	High
B	Low

1 / 1

Conclusion: — 1

Iron rust faster than steel.

TOTAL 20

5	(a)	Examples of food preservatives and their functions: • Sodium nitrite/ – slow down the growth of microorganisms in meat • Vinegar – provide an acidic condition that inhibits the growth of microorganisms in pickled foods	1+1 1+1
	(b) (i)	No // cannot Because aspirin can cause brain and liver damage if given to children with flu or chicken pox. // It causes internal bleeding and ulceration	1 1
	(ii)	Paracetamol Codeine	1 1
	(iii)	1. If the child is given a overdose of codeine, it may lead to addition. 2. If the child is given paracetamol on a regular basis for a long time, it may cause skin rashes/ blood disorders /acute inflammation of the pancreas.	1 1
	(c)		

Type of food additives	Examples	Function	
Preservatives	Sugar, salt	To slow down the growth of microorganisms	2
Flavourings	Monosodium glutamate, spice, garlic	To improve and enhance the taste of food	2
Antioxidants	Ascorbic acid	To prevent oxidation of food	2
Dyes/ Colourings	Tartrazine Turmeric	To add or restore the colour in food	

Disadvantages of **any two** food additives: — 2

Sugar – eating too much can cause obesity, tooth decay and diabetes

Salt – may cause high blood pressure, heart attack and stroke.

Tartrazine – can worsen the condition of asthma patients — 1

- May cause children to be hyperactive — 1

MSG – can cause difficult in breathing, headaches and vomiting.

TOTAL 20

6(a)	1. Palm oil and sodium hydroxide //[any suitable vegetable oil and alkali] 2. Pour 10 cm^3 of palm oil into a beaker 3. Add 50 cm^3 of 5 $moldm^{-3}$ sodium hydroxide solution into palm oil 4. Stir the mixture and boil mixture for 10 minutes 5. Add 50 cm^3 of distilled water 6. Add 3 spatula of sodium chloride powder into the mixture and boil for another 5 minutes 7. Allow the mixture cool 8. Filter and wash the soap with distilled water 9. Put some soap into a test tube 10. Add water and shake 11. Foam produced and the solution feel slippery.	1 1 1 1 1 1 1 1 1 1 1	11
(b)	1. Cloth in exp. I is not clean while cloth in exp. II is clean 2. Hard water contain Ca^{2+} ion or Mg^{2+} ion 3. Soap anion reacts with Ca^{2+} ion or Mg^{2+} ion to form scum / insoluble salt. 4. Detergent anion reacts with Ca^{2+} ion or Mg^{2+} ion to form soluble salt // Detergent anion reacts with Ca^{2+} ion or Mg^{2+} ion does not form scum 5. Detergent is more effective than soap in hard water // Detergent is more suitable as a cleansing agent to remove stain in hard water	1 1 1 1 1	5
(c)	1. Antibiotic 2. Patient must complete the course 3. To ensure all bacteria is kill 4. This is to avoid patient get sick again	1 1 1 1	4
	TOTAL	20	

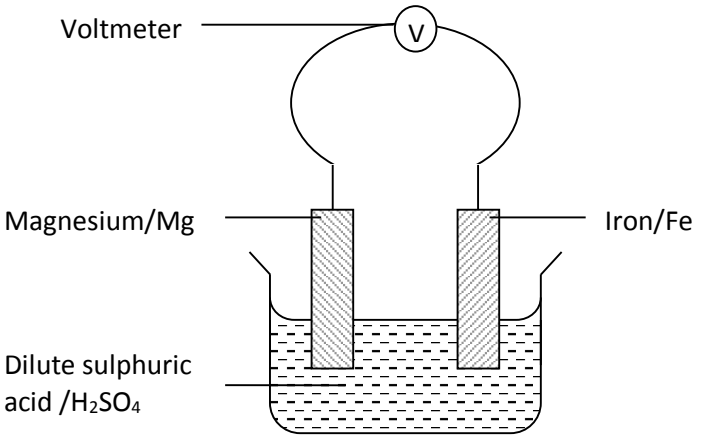
	Answer	Score
1(a)	Experiment I: 13.5 Experiment II: 4.5	3
(b)	Metal oxides are basic oxides, non-metal oxides are acidic oxides	3
(c)	Manipulated Variable: Oxides of the Period 3 elements//Sodium oxide, Sulphur dioxide, magnesium oxide, silicone(IV) oxide Responding variable: Basic and acidic properties//pH values and solubility in acid. Fixed variable: type of solvent//water//acid	3
(d)	Metal oxides shows basic properties while non-metal oxides shows acidic properties.	3
(e)	Basic oxides: Copper(II) oxide, potassium oxide Acidic oxide: Phosphorous pentoxide, carbon dioxide	3

		Score
2 (a)	<table><tr><td>Set</td><td>1</td><td>2</td><td>3</td></tr><tr><td>Final burette reading (cm^3) *Bacaan akhir buret* (cm^3)</td><td>30.20</td><td>34.50</td><td>42.30</td></tr><tr><td>Initial burette reading (cm^3) *Bacaan awal buret* (cm^3)</td><td>0.20</td><td>4.50</td><td>12.40</td></tr><tr><td>Volume of hydrochloric acid needed (cm^3) *Isipadau asid yang diperlukan* (cm^3)</td><td>30.00</td><td>30.00</td><td>29.90</td></tr></table>	3
(b)	$\frac{30.0+30.0+29.9}{3} = 29.97$ //30.0 cm^3	3
(c)	Pink solution turns colourless	3
(d)	Volume of acid added to alkali for pink solution turns colourless.	3
(e)	Chemical equation: $HCl + NaOH \rightarrow NaCl + H_2O$ $\frac{MaVa}{MbVb} = \frac{1}{1}$ $M_a = 0.08$ mol dm^{-3}	3
(f)	15 cm^3	3

	Answers	Score
3(a)	Problem statement: How to compare the effectiveness of cleansing action between detergent and soap in hard water?	3
(b)	Manipulated variable: detergent and soap Responding variable: effectiveness of cleansing action Fixed variable: hard water	3
(c)	Hypothesis: Detergent is more effective in cleansing action than soap in hard water.	3
(d)	Substances and materials Basin/suitable container, soap, detergent, 2 pieces of cloth with grease, glass rod, hard water/magnesium nitrate solution/calcium nitrate solution.	3
(e)	Procedure: 1. Hard water/ magnesium nitrate solution/calcium nitrate solution is poured into a basin/ beaker until half full 2. Add soap into the basin/beaker and stir the mixture. 3. Put in a piece of cloth stained with grease. 4. Rub the cloth. 5. Record the observation. 6. Repeat steps 1 t- 5 by replacing soap with detergent.	3
(f)	Tabulation of data: <table><tr><td>Type of cleaninf agent</td><td>Observation</td></tr><tr><td>Detergent</td><td></td></tr><tr><td>Soap</td><td></td></tr></table>	3

<table>
<tr><th></th><th>RUBRIC</th><th>SCORE</th></tr>
<tr><td>2(a)</td><td>
<table>
<tr><th>Test tube</th><th>Observation</th></tr>
<tr><td>1</td><td>blue colour /solutions</td></tr>
<tr><td>2</td><td>High intensity of pink colour/ solutions</td></tr>
<tr><td>3</td><td>High intensity of blue colour /solutions</td></tr>
<tr><td>4</td><td>Low intensity of pink colour/ solutions</td></tr>
<tr><td>5</td><td>Low intensity of blue colour /solutions</td></tr>
</table>
</td><td>3</td></tr>
<tr><td>2(a)</td><td>
<table>
<tr><th>Test tube</th><th>Inference</th></tr>
<tr><td>1</td><td>Iron(II) / Fe^{2+} ions formed // iron rusts</td></tr>
<tr><td>2</td><td>High concentration of hydroxide ions/OH^- // iron does not rust</td></tr>
<tr><td>3</td><td>High concentration of Iron(II) / Fe^{2+} ions // iron rusts a lot</td></tr>
<tr><td>4</td><td>Low concentration of hydroxide ions/OH^- // iron does not rust</td></tr>
<tr><td>5</td><td>Low concentration of Iron(II) / Fe^{2+} ions // iron rusts a little</td></tr>
</table>
</td><td>3</td></tr>
<tr><td>2(b)</td><td>Iron in test tube 2 does not rust because iron is in contact with a more electropositive metal, but iron in test tube 3 rusts in contact with a less electropositive metal.</td><td>3</td></tr>
<tr><td>2(c)</td><td>When a more electropositive metal is in contact with iron, the metal speeds up rusting of iron . When a less electropositive metal in contact with iron , iron does not rust</td><td>3</td></tr>
<tr><td>2(d)</td><td>(i) Manipulated variables : Different type of metal // Magnesium, copper, zinc and tin
REJECT : position of metals in the electrochemical series
(ii) Responding variable : Rusting of iron //presence of blue color
(iii) Constant variable : iron nail // jelly solutions that contains hexacyanoferrate(III) and phenolphthalein</td><td>3</td></tr>
<tr><td>2(e)</td><td>When iron nail in contact with less electropositive metal, blue coloration is formed</td><td>3</td></tr>
<tr><td>2(f)</td><td>
<table>
<tr><th>Metals that inhibit rusting</th><th>Metals that speed up rusting</th></tr>
<tr><td>Magnesium/Mg
Zinc/Zn</td><td>Tin/Sn
Copper/Cu</td></tr>
</table>
</td><td>3</td></tr>
</table>

<table>
<tr><td>2(g)
(i)</td><td>The longer the time taken, the amount of rust formed increases</td><td>3</td></tr>
<tr><td>2(g)
(ii)</td><td>Less than 5 days</td><td>3</td></tr>
<tr><td>2(h)
(i)</td><td>
<table>
<tr><th>Pairs of metal</th><th>Positive terminal</th><th>Voltmeter reading (V)</th></tr>
<tr><td>Magnesium and iron</td><td>Iron</td><td>2.0</td></tr>
<tr><td>Iron and copper</td><td>Copper</td><td>0.8</td></tr>
<tr><td>Iron and zinc</td><td>Iron</td><td>0.4</td></tr>
<tr><td>Iron and tin</td><td>Tin</td><td>0.2</td></tr>
</table>
</td><td>3</td></tr>
</table>

2(h) (ii)		3

3 (a)	How do the heat of neutralisation for reactions between acids and alkalis of different strengths differ?	3
3 (b)	Manipulated Variable : different strength of acid // hydrochloric acid and ethanoic acid Responding variable : the value of heat of neutralisation Fixed variable : volume and concentration of acid // volume and concentration of alkali // polystyrene cup	3
3 (c)	When strong acid/hydrochloric acid neutralize strong alkali/sodium hydroxide solution, heat of neutralization is higher. When weak acid/ethanoic acid neutralize strong alkali/sodium hydroxide solutiuon, heat of neutralization is lower	3
3 (d)	Apparatus : Measuring cylinders, polystyrene cup with covers, thermometer Material : 2.0 mol dm^3 sodium hydroxide, 2.0 mol dm^3 ethanoic acid, 2.0 mol dm^3 hydrochloric acid	3
3 (e)	1. Measure 50 cm^3 of 2.0 mol dm^{-3} sodium hydroxide solution, NaOH solution using a measuring cylinder. Pour it into a polystyrene cup with a cover. 2. Measure 50 cm^3 of 2.0 mol dm^{-3} hydrochloric solution, HCl solution using another measuring cylinder. Pour it into another polystyrene cup with a cover. 3. Leave both the polystyrene cups on the table for 5 minutes. After 5 minutes, measure and record the initial temperatures of both the solution. 4. Pour the hydrochloric acid, HCl quickly and carefully into the polystyrene cup containing sodium hydroxide solution. 5. Stir the mixture using the thermometer. 6. Record the highest temperature of the reaction mixture. 7. Repeat steps 1 to 5 using ethanoic acid to replace the hydrochloric acid.	3
3 (f)		3

	Hydrochloric acid	Ethanoic acid
Initial temperature of alkali/ ^oC		
Initial temperature of acid/^oC		
Highest temperature of the reaction mixture/^oC		

END OF MARKING SCHEME