SIJIL PELAJARAN MALAYSIA   4541/1
TRIAL EXAMINATION 2011
ZONE A, KUCHING
CHEMISTRY
Kertas 1
1 ¼ jam   **Satu jam lima belas minit**

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

1. *Calon dikehendaki membaca maklumat di halaman belakang kertas soalan ini.*

Kertas soalan ini mengandungi 23 halaman bercetak.

[Lihat halaman sebelah

1   P is a noble gas. Which of the following shows the electron arrangement of atom P?

    A   2. 1

    B   2. 8

    C   2. 8. 4

    D   2. 8. 7

2   Which of the following substances consists of molecules?

    A   Zinc

    B   Carbon

    C   Sulphur trioxide

    D   Potassium oxide

3   A particle W has 17 protons, 18 electrons and 18 neutrons.
    Which of the following is the standard representation for atom W ?

    A $^{35}_{18}W$ **C** $^{35}_{17}W$

    B $^{36}_{17}W$ **D** $^{36}_{18}W$

4   When steam condenses, the particles

    A   lose energy to their surroundings

    B   move further apart

    C   become smaller in size

    D   vibrate at fixed positions

5 The relative formula mass of ammonium sulphate, $(NH_4)_2SO_4$ is
[Relative atomic mass of H=1, N=14, O=16 and S=32]

    A 132

    B 142

    C 150

    D 160

6 Which of the following is **not** matched correctly?

	Substance	Molecular Formula
A	Butanol	C_4H_9OH
B	Nitric acid	HNO_2
C	Nitrogen dioxide	NO_2
D	Sodium oxide	Na_2O

7 Which of the following statement is **not true** for one mole of a substance?

    A 1 mole of hydrogen gas contains 6.02×10^{23} molecules

    B 1 mole of zinc contains 6.02×10^{23} atoms

    C 1 mole of carbon dioxide contains the same number of molecules as the number of atoms in 12 g of carbon-12

    D 1 mole of water contains the same number of atoms as in 12 g of carbon-12

8 The Law of Octaves in the development of the modern Periodic Table was proposed by

    A John Newlands

    B Lothar Meyer

    C Johann Dobereiner

    D Dmitri Mendeleev

[Lihat halaman sebelah

9   Which of the following is **not** a characteristic property of the transition elements?

A   Exhibit amphoteric properties

B   Their salts are coloured

C   Function as catalysts

D   Show different oxidation numbers in their compounds

10   The information below describes the properties of element X.

> - **Conducts electricity**
> - **Soft and shiny**
> - **Reacts vigorously with water**

Which of the following elements best fits the above properties?

A   Aluminium

B   Iron

C   Calcium

D   Potassium

11   Which of the following statements are true regarding Group 17 elements when going down the group?

I   Number of occupied electron shells increases

II   Reactivity of the elements decreases

III   The ability to accept electrons decreases

IV   Electronegativity increases

A   I and III

B   II and IV

C   I, II and III

D   I, II, III and IV

12 Diagram 1 shows the electron arrangement of a compound formed between atoms X and Y.
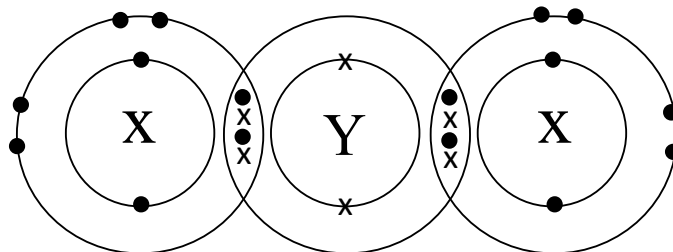

Diagram 1

Which of the following statements is **true** about the compound?

A   It is an ionic compound

B   It contains covalent bond.

C   It has a high boiling point

D   It is formed by electron transfer

13 Magnesium atom differs from magnesium ion because magnesium atom has

A   more electrons

B   more protons

C   smaller atomic size

D   more neutrons

14 Which of the following statements are true when Group 1 element reacts with Group 17 element ?

I   An atom of Group 1 will lose one electron and an atom of Group 17 will receive one electron

II   An ionic compound will be formed

III   Redox reaction occurs

IV   The compound formed can conduct electricity in solid state

A   I and II

B   III and IV

C   I, II and III
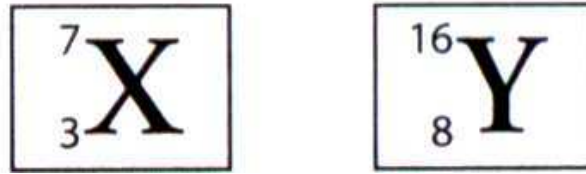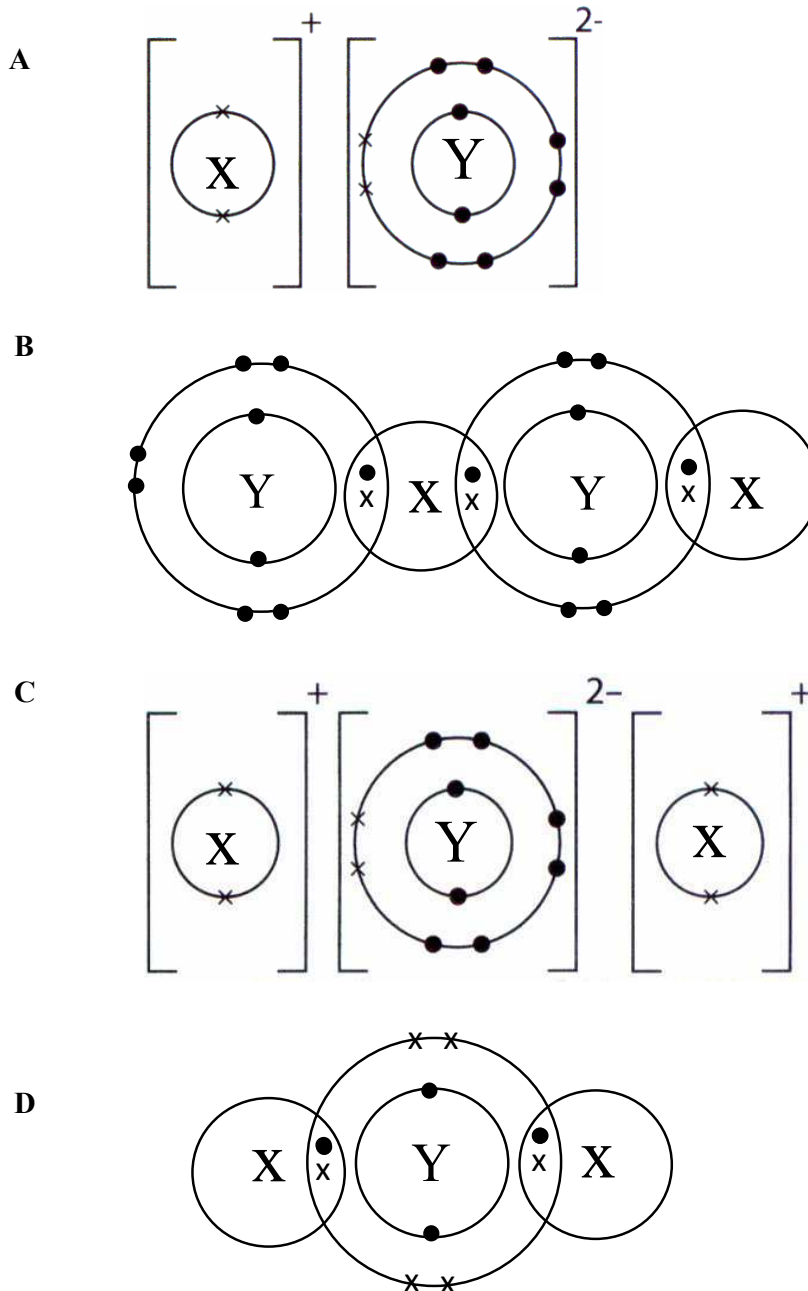
D   I, III and IV

15

Diagram 2

Diagram 2 shows the standard representation for atoms X and Y. Which of the following shows the correct electron arrangement for the compound formed when X reacts with Y ?

A

B

C

D

16   Which of the following does **not** affect the selective discharge of ions during the electrolysis of an aqueous solution?

   A   The temperature of the solution

   B   The types of electrodes used

   C   The position of the ions in the electrochemical series

   D   The concentration of ions

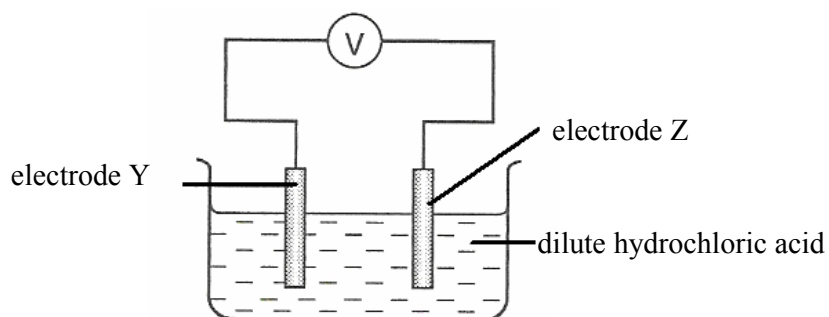17   Diagram 3 shows the set-up of apparatus for a simple voltaic cell.

Diagram 3

Which of the following pairs of electrodes Y and Z gives the highest voltmeter reading?

	Electrode Y	Electrode Z
A	Silver	Copper
B	Magnesium	Silver
C	Zinc	Iron
D	Magnesium	Copper

18   Molten lead(II) iodide is electrolysed as shown in Diagram 4.
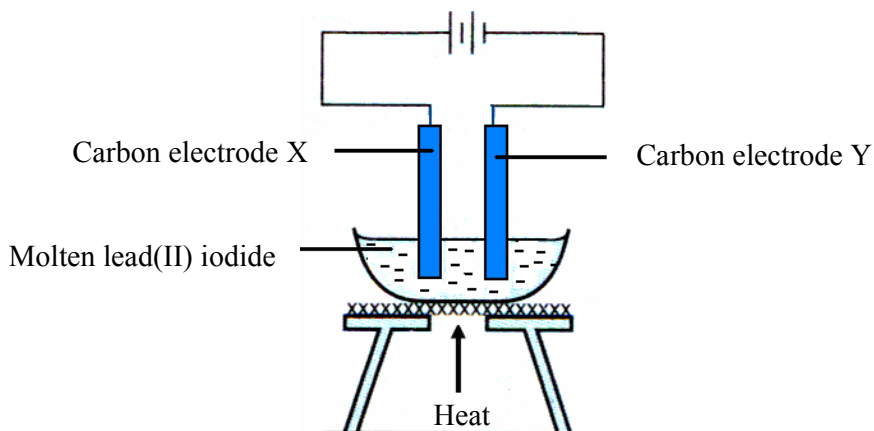

Diagram 4

Which of the following is observed at electrode X?

A   Black solid is deposited

B   Brown liquid is formed

C   Brown vapour is produced

D   Purple vapour is produced

19   Table 1 shows the results of an experiment to construct the electrochemical series by the displacement of metals from their salt solutions.

Metal \ Solution	$P(NO_3)_2$	$Q(NO_3)_2$	$R(NO_3)_2$
P		√	√
Q	X		√
R	X	X	

Table 1

√   -   displacement reaction occurs
X   -   no displacement reaction

Which of the following metals could be P, Q and R ?

	P	**Q**	**R**
A	Mg	Ag	Sn
B	Mg	Zn	Cu
C	Ag	Sn	Mg
D	Zn	Cu	Mg

20 Diagram 5 shows the flow of ammonia gas into distilled water which contains a few drops of phenolphthalein.
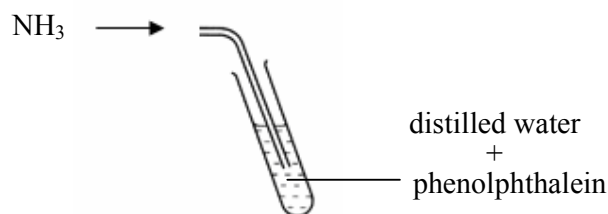
NH_3 ⟶

distilled water
+
phenolphthalein

Diagram 5

Which of the following is the correct observation of the solution?

A The pink solution turns colourless

B The solution turns from red to purple

C The solution turns from green to red

D The colourless solution turns pink

21 Which of the following statements is **true** about alkalis?

A Alkalis are bases that are soluble in water.

B Weak alkalis undergo high degree of ionisation.

C Strong alkalis have low pH value

D Alkalis are not corrosive

22 Which ionic equation represents the reaction between sulphuric acid and aqueous sodium hydroxide?

A $2H^+ + O^{2-} \rightarrow H_2O$

B $H^+ + OH^- \rightarrow H_2O$

C $2Na^+ + SO_4^{2-} \rightarrow Na_2SO_4$

D $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

[Lihat halaman sebelah

23 200 cm^3 of 0.5 mol dm^{-3} hydrochloric acid was prepared from a standard solution 2.0 mol dm^{-3} hydrochloric acid by dilution method.

Calculate the volume of 2.0 mol dm^{-3} hydrochloric acid required.

A 50 cm^3

B 75 cm^3

C 100 cm^3

D 150 cm^3

24 Insoluble salts are prepared by

A reaction between an acid and an alkali

B reaction between an acid and metal oxide

C precipitation method using double decomposition reaction

D reaction between an acid and metal carbonate

25 Diagram 6 shows the observation for the confirmatory test for nitrate ion.
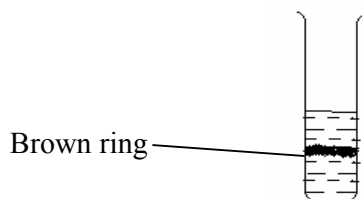
Brown ring

Diagram 6

Which of the following reagents are used in this confirmatory test?

I   Dilute sulphuric acid

II   Iron(II) sulphate solution

III   Dilute nitric acid

IV   Concentrated sulphuric acid

A   I and III

B   II and IV

C   I, II and III

D   I, II and IV

26 Which of the following chemicals can be used to prepare copper(II) sulphate?

   I   Copper and sulphuric acid

   II   Copper(II) oxide and sulphuric acid

   III   Copper(II) carbonate and sulphuric acid

   IV   Copper(II) chloride and sodium sulphate

   A   I and II

   B   II and III

   C   I, III and IV

   D   I, II, III and IV

27   Diagram 7 shows a reaction scheme involving solution P.
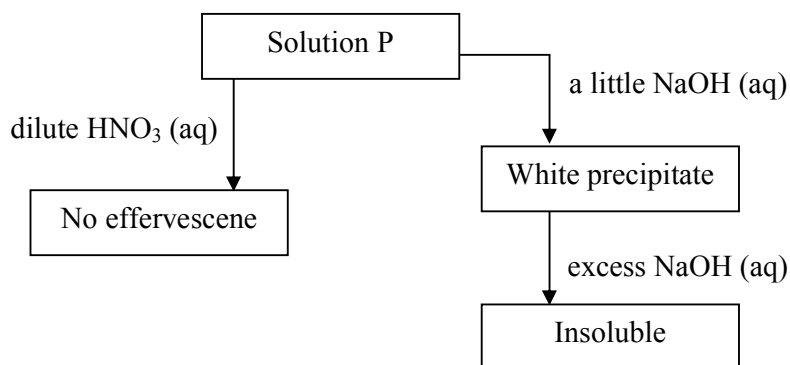
Diagram 7

Solution P contains

   A   calcium chloride

   B   magnesium carbonate

   C   lead (II) nitrate

   D   zinc sulphate

28   Ceramic pots are more suitable as cooking utensils compared to aluminium pots. This is because :

I   ceramics have higher melting points than aluminium

II   ceramics are more chemically inert than aluminium

III   ceramics can withstand higher temperature than aluminium

IV   ceramics can conduct electricity better than aluminium

A   I and III

B   II and IV

C   I, II and III

D   I, II, III and IV

29

Glass S	▪ High density
	▪ High refractive index.
	▪ Low melting point ($600\,^0C$)
	▪ Used to make decorative glassware

Glass S is

A borosilicate glass

B soda lime glass

C lead glass

D fused silicate glass

30   Which of the following equation represents the correct sequence of the production of sulphuric acid in industry ?

I $2SO_2 + O_2 \rightleftharpoons 2SO_3$

II $S + O_2 \rightarrow SO_2$

III $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

IV $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$
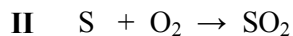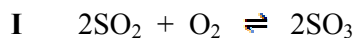
A   I, II, III, IV

B   II, III, I, IV

C   II, I, III, IV

D   II, I, IV, III

31   A catalyst can increase the rate of reaction by

A   increasing the movement of the reactant particles

B   increasing the energy of the reactants

C   increasing the frequency of collision of the reactants

D   reducing the activation energy of a reaction

32

Time / min	0	1	1.5	2.0	2.5
Volume of gas / cm^3	0	10	20	28	35

Table 2

Table 2 shows the volume of oxygen gas collected at certain time intervals for the decomposition of hydrogen peroxide. The average rate of decomposition of hydrogen peroxide in the first 2 minutes is:

A   58 cm^3 min^{-1}

B   28 cm^3 min^{-1}

C   18 cm^3 min^{-1}

D   14 cm^3 min^{-1}

[Lihat halaman sebelah

33 Diagram 8 shows the set-up of apparatus used to determine the rate of reaction between zinc and sulphuric acid.
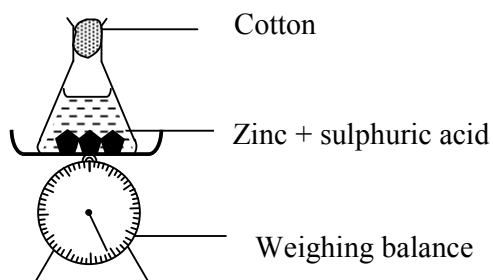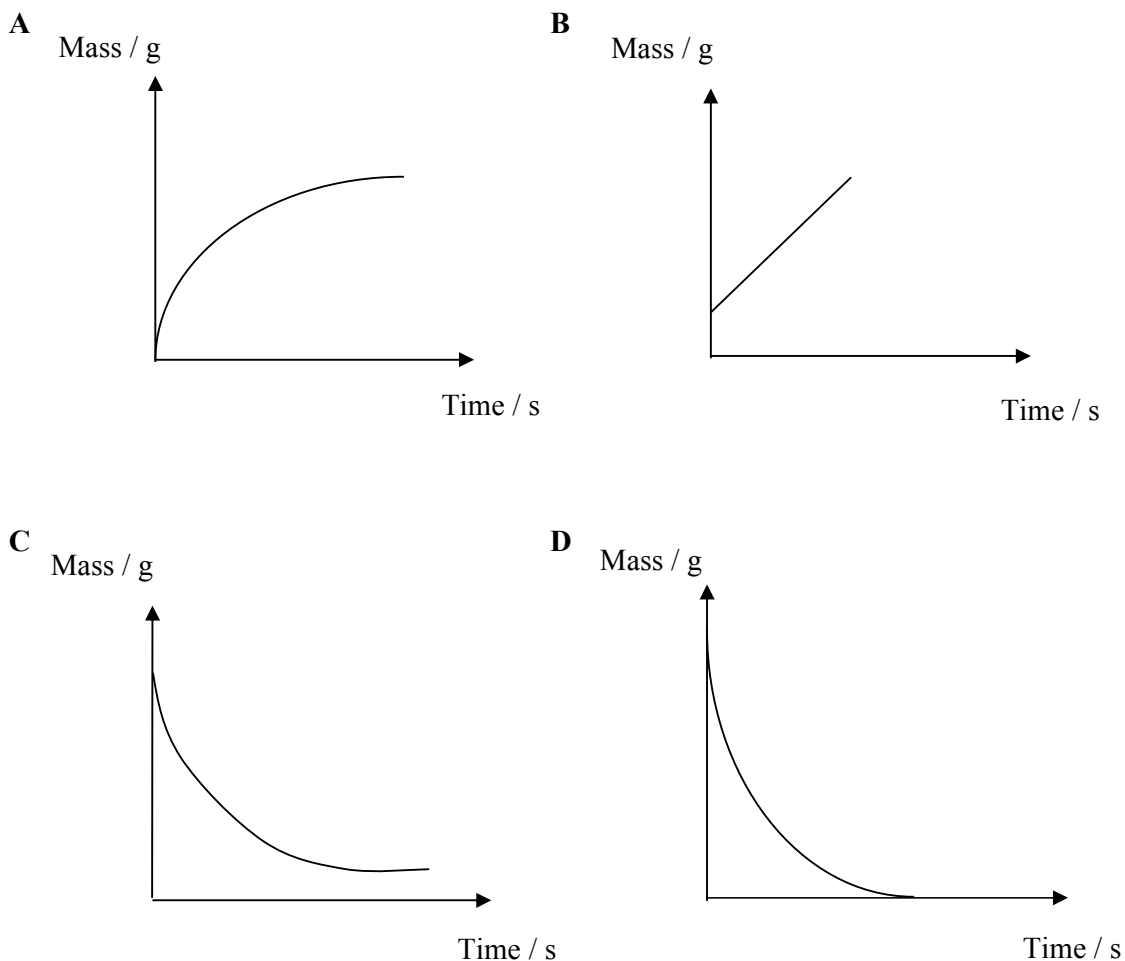

Cotton

Zinc + sulphuric acid

Weighing balance

Diagram 8

Which of the following graphs is obtained when the total mass of the flask and its content is plotted against time?

A

Mass / g

Time / s

B

Mass / g

Time / s

C

Mass / g

Time / s

D

Mass / g

Time / s

34 Diagram 9 shows the graph of volume of hydrogen gas released against time for the reaction between magnesium and hydrochloric acid. Curve S represents the graph for the reaction between 25 cm^3 of 0.50 mol dm^{-3} of hydrochloric acid and 2.0 g magnesium powder at 35 ^{0}C.

Volume of hydrogen
  gas / cm^3
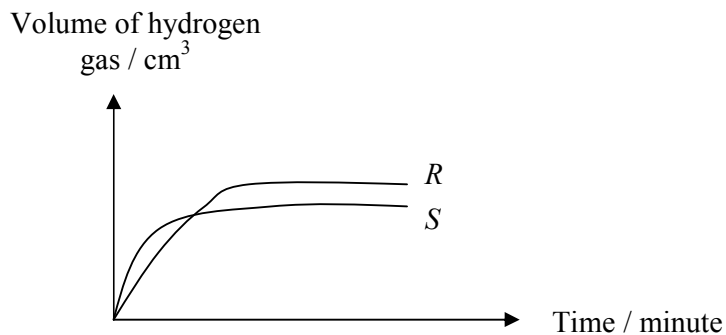
Diagram 9

Which of the following experiments produces curve R?

	Volume of 0.5 mol dm^{-3} hydrochloric acid / cm^3	Temperature / ^{0}C	Magnesium
A	20	30	Powder
B	25	35	Granules
C	30	30	Granules
D	40	35	Powder

35 Ethene can be differentiated from ethane because ethene can

A decolourise bromine water while ethane cannot decolourise bromine water at room conditions

B burn in air while ethane cannot burn in air

C react with alcohol to produce ester while ethane cannot react with alcohol

D dissolve in water while ethane cannot dissolve in water

36 Hydrocarbon A is burned completely in excess oxygen. Which of the following are the products formed?

 A Carbon and water

 B Carbon monoxide and water

 C Carbon and hydrogen

 D Carbon dioxide and water

37

$$CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_2 - CH_2 - OH$$
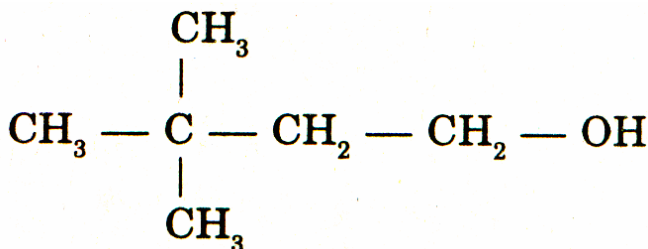
Name the above compound according to the IUPAC nomenclature.

 A 2-methylbutanol

 B 3-methylbutanol

 C 2,2-dimethylbutan-1-ol

 D 3,3-dimethylbutan-1-ol

38 Which of the following isomers of pentene does **not** exist?

 A Pent-2-ene

 B 2,2-dimethylpropene

 C 2-methylbut-2-ene

 D 3-methylbut-1-ene

39 What is the oxidation number for Cl in $NaClO_3$?

 A -1

 B +1

 C +3

 D +5

[Lihat halaman sebelah

40   Diagram 10 shows four test tubes filled with a mixture of jelly solution, phenolphthalein and potassium hexacyanoferrate(III) solution. Each iron nail is coiled with different metals.

Jelly solution + potassium hexacyanoferrate(III), $K_3Fe(CN)_6$ solution + phenolphthalein
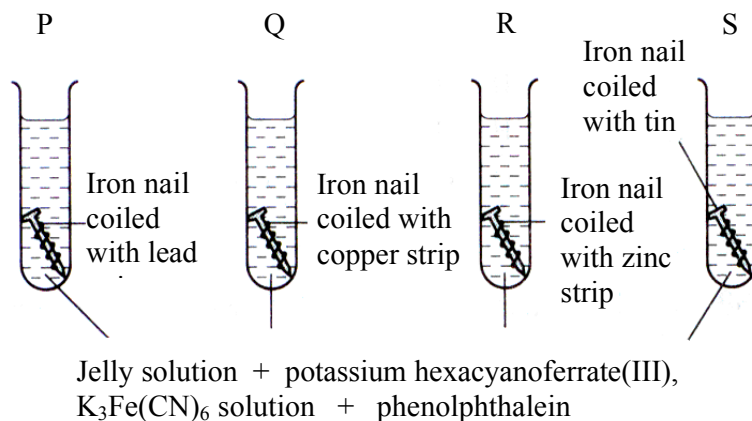
Diagram 10

Which test tube has the highest intensity of blue colouration?

A   P

B   Q

C   R

D   S

41   Which of the following reactions are redox reactions?

I $CuO(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + H_2O(l)$

II $Cl_2(aq) + 2KI(aq) \rightarrow 2KCl(aq) + I_2(aq)$

III $Ba(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaNO_3(aq)$

IV $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$

A   I and II

B   II and IV

C   III and IV

D   I, II and IV

Lihat halaman sebelah

42   An experiment is done as shown in Diagram 11.
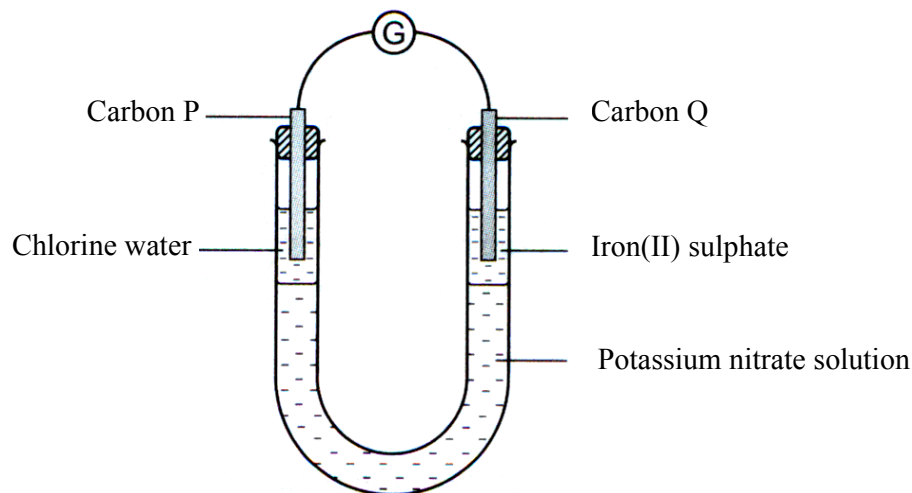
Diagram 11

Which of the following statements are true about the experiment?

I   The solution around electrode Q becomes yellow after the reaction has been completed

II   Electrons flow from electrode Q to electrode P through the wire

III   Chlorine water serves as the oxidising agent

IV   Electrode P serves as positive terminal

A   I and II

B   I and III

C   II, III and IV

D   I, II, III and IV

43   When sodium hydroxide solution is added to hydrochloric acid, the temperature of the solution increases. The reaction is

A   exothermic

B   monothermic

C   endothermic

D   isothermic

44   Diagram 12 shows the energy level for the reaction A + B → C. The activation energy
      for the reaction is
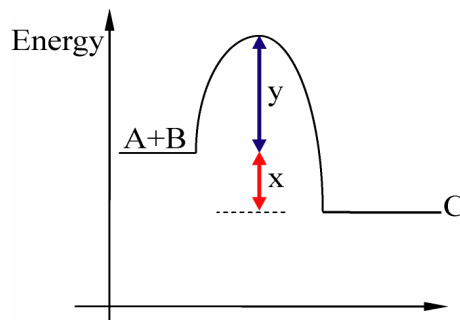
Diagram 12

A   x

B   y

C   (x + y)

D   (y − x)

45   Which of the following acids releases the largest amount of heat energy when 1 mole of
      acid reacts with excess sodium hydroxide solution?

A   Nitric acid

B   Hydrochloric acid

C   Ethanoic acid

D   Sulphuric acid

46 When 1.2 g of substance Z is burned in excess oxygen, the heat released causes an increase in temperature of 100 cm^3 water by 2.7 ^{0}C. What is the heat of combustion of substance Z?
[Relative molecular mass of Z = 60. Specific heat capacity of water is 4.2 J g^{-1} ^{0}C^{-1}]

A $\dfrac{1.2 \times 4.2 \times 2.7}{60 \times 1000}$ kJ mol^{-1}

B $\dfrac{1.2 \times 4.2 \times 2.7 \times 60}{100 \times 1000}$ kJ mol^{-1}

C $\dfrac{100 \times 2.7 \times 4.2 \times 1.2}{1000 \times 60}$ kJ mol^{-1}

D $\dfrac{100 \times 2.7 \times 4.2 \times 60}{1000 \times 1.2}$ kJ mol^{-1}

47
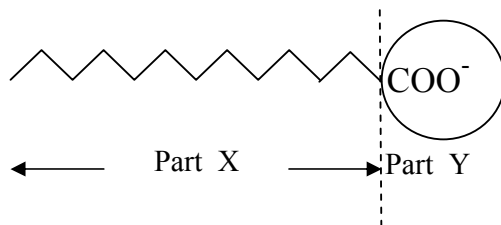
Diagram 13

Diagram 13 shows a soap anion. Which of the following statements is true ?

A Parts X and Y are soluble in water

B Parts X and Y are soluble in grease

C Part X is soluble in grease and part Y is soluble in water

D Part X is soluble in water and part Y is soluble in grease

48

	Chemical additives of detergent	Function
I	Sodium silicate	Acts as bleaching agent
II	Biological enzyme	Decompose organic stains
III	Sodium perborate	Acts as drying agent
IV	Phosphate salts	Clean up dirt formed by calcium salts

Which of the chemical additives of detergent above is matched to its function?

A   I and II

B   II and IV

C   I, III and IV

D   II, III and IV

49   The word equation below shows how compound *X*, a food additive is prepared.

Carboxylic acid + alcohol → compound X + water
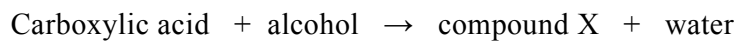
What is the use of compound X?

A Flavouring agent

B Thickening agent

C Colouring

D Antioxidant

50 ▪ Patient P complained of headache and fever to a doctor.

    ▪ Patient Q was diagnosed with schizophrenia, where this patient lost touch with reality, illogical thinking, cannot communicate well and isolated himself from society.

    ▪ Patient R was diagnosed having depression, fears and prolong tension, panic from pressure and other psychological problems.

    ▪ Patient S was found to have ear infection.

Which of the following types and examples of medicine are correctly matched with the above patients?

	Patient	Types of medicine	Examples of medicine
I	P	Analgesic	Paracetamol
II	Q	Antipsychotic	Streptomycin
III	R	Antidepressant	Barbiturate
IV	S	Antibiotic	Amphetamine

A I and II

B II and IV

C I and III

D I, II and IV

---- END OF QUESTION PAPER ---

INFORMATION FOR CANDIDATES

1. This question paper consists of **50** questions.

2. Answer **all** questions.

3. Each question is followed by four alternative answers, **A, B, C** or **D**. For each question, choose **one** answer only. Blacken your answer on the objective answer sheet provided.

4. If you wish to change your answer, erase the blackened mark that you have made. Then blacken the space for the new answer.

5. The diagrams in the question provided are not drawn to scale unless stated.

6. You may use a scientific calculator.

4541/2

NAMA

**Chemistry
Kertas 2
September
2011**

NO KAD PENGENALAN

2 ½ jam

ANGKA GILIRAN

SPM TRIAL EXAMINATION 2011

FOR

SECONDARY SCHOOLS IN ZONE A

CHEMISTRY

Kertas 2

Dua jam tiga puluh minit

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

1. *Write your name, Identity Card number and Index Number in the space provided*

2. *Candidates are advised to read the information on Page 20*

Untuk Kegunaan Pemeriksa			
Kod Pemeriksa			
Bahagian	Soalan	Markah Penuh	Markah Diperolehi
A	1	10	
	2	10	
	3	10	
	4	10	
	5	10	
	6	10	
B	1	20	
	2	20	
C	3	20	
	4	20	
Jumlah			

Kertas soalan ini mengalami 19 halaman bercetak

4541/2

**[Lihat sebelah
SULIT**

2

Section A

[60 *marks*]

Answer **all** questions in this section.

1 Table 1 shows the number of protons, electrons and neutrons for particles V, W, X, Y and Z.

Particles	Number of protons	Number of electrons	Number of neutrons
V	8	8	8
W	8	10	9
X	11	10	12
Y	12	12	12
Z	17	17	18

Table 1

Use the information given in Table 1 to answer the following questions.

(*a*) (i) Write the electron arrangement of particle X.

1(*a*)(i)

	1

……………………………………………………………………………...

[1 *mark*]

1(*a*)(ii)

	1

(ii) State the group in which element X is situated in the Periodic Table.

……………………………………………………………………………

[1 *mark*]

(*b*) In which period can element Y be found in the Periodic Table? Explain your answer.

1(*b*)

	2

……………………………………………………………………………............

……………………………………………………………………………...……..

[2 *marks*]

1(*c*)(i)

	1

(*c*) (i) State the type of ion for particle W.

……………………………………………………………………...…

[1 *mark*]

1(*c*)(ii)

	1

(ii) Write the half-equation for the formation of particle W from its atom.

……………………………………………………………………………….

[1 *mark*]

1(*d*)(i)

(*d*)   (i)   What is the nucleon number of particle W?

………………………………………………………………………………....

[1 *mark*]

1(*d*)(ii)

     (ii)   Which two particles are a pair of isotopes?

………………………………………………………………………………....

[1 *mark*]

1(*d*)(iii)

     (iii)   Explain your answer in **1**(*d*) (ii).

………………………………………………………………………....

………………………………………………………………………....

[1 *mark*]

1(*e*)

(*e*)   State **one** element that exists as a gas at room temperature.

………………………………………………………………………...…….

[1 *mark*]

2   A student wants to carry out an experiment to electroplate an iron key with silver. The set-up of the apparatus is shown in Diagram 1.

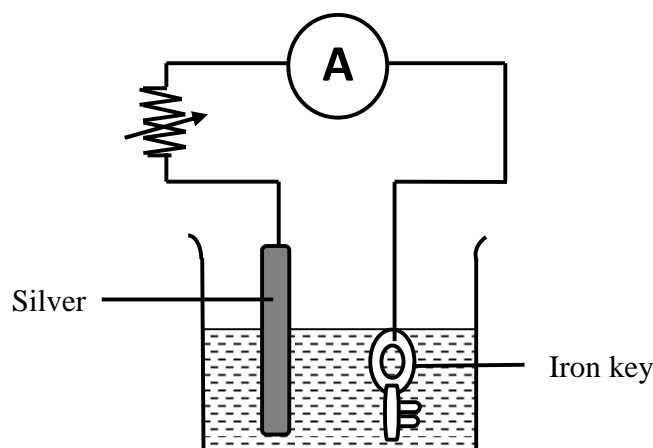

Silver ———

Iron key

Diagram 1

2(*a*)

(*a*)   State **one** mistake in the set-up of the apparatus.

....

[1 *mark*]

2(*b*)

[ ] 1

(*b*) Which terminal should the key be connected to?

....
[1 *mark*]

2(*c*)

[ ] 1

(*c*) Suggest a suitable electrolyte for the electroplating.

....
[1 *mark*]

2(*d*)(i)

[ ] 1

(*d*) (i) State the observation at the silver plate

....
[1 *mark*]

2(*d*)(ii)

[ ] 1

(ii) Write the half-equation for the reaction in **2**(*d*) (i).

....
[1 *mark*]

2(*d*)(iii)

[ ] 1

(iii) Write the half-equation for the reaction occurring at the iron key.

....
[1 *mark*]

(*e*) Suggest **two** ways how the student can get a smooth and evenly electroplated key.

2(*e*)

[ ] 2

……………………………………………………………………………………………………

…………………………………………………………………………………………………
[2 *marks*]

2(*f*)

[ ] 1

(*f*) State **one** purpose why electroplating is carried out in industries.

…………………………………………………………………………………………………
[1 *marks*]

3 Table 2 shows the manufactured substances in industry.

Manufactured substances	X	Glass	Polymer	Y
Example	Reinforced concrete	Lead crystal glass	Polypropene	Bronze

Table 2

(*a*) Identify the type of manufactured substances X and Y.

Substance X : ……………………………………………………………..……....

Substance Y : ……………………………………………………………………

[2 *marks*]

3(*a*)

2

(*b*) (i) Draw and label the arrangement of particles in bronze.

[2 *marks*]

3(*b*)(i)

2

(ii) State **one** purpose of alloying.

…………………………………………………………………………………...

[1 *mark*]

3(*b*)(ii)

1

(*c*) The following information shows the composition of the components that made up lead crystal glass.

- Silicon dioxide
- Sodium oxide
- Compound J

(i) Name compound J.

…………………………………………………………………………………

[1 *mark*]

3(*c*)(i)

1

3(*c*)(ii)

	1

(ii) State **one** special property of lead crystal glass.

………………………………………………………………………………………

[1 *marks*]

(*d*) Diagram 2 shows the structure of polypropene.

$$\left[\begin{array}{cccc} CH_3 & H & CH_3 & H \\ | & | & | & | \\ C & C & C & C \\ | & | & | & | \\ H & H & H & H \end{array} \right]_n$$
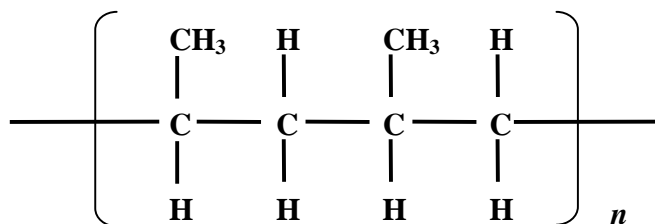
Diagram 2

(i)   Draw the structure of monomer of polypropene and name the monomer.

Name of monomer : …………………………..

[2 *marks*]

3(*d*)(i)

	2

3(*d*)(ii)

	1

(ii) Name the type of polymerisation involved in the production of polypropene.

………………………………………………………………………………………

[1 *mark*]

4 A group of students carried out an experiment to study the rate of reaction between excess calcium carbonate and hydrochloric acid. The volume of carbon dioxide gas evolved is collected and recorded at intervals of 30 seconds as shown in Table 3 below.

Time / s	0	30	60	90	120	150	180
Volume of CO_2 gas collected / cm^3	0.00	23.00	35.00	42.00	44.00	44.00	44.00

Table 3

(*a*) (i) Write a balanced chemical equation for the above reaction.

....

[2 *marks*]

(ii) Draw a labelled diagram to show the set-up of apparatus to carry out the experiment in the laboratory.

[2 *marks*]

(*b*) On the graph paper on page 8, draw the graph of volume of carbon dioxide gas collected against time taken.

[3 *marks*]

4(*a*)(i)
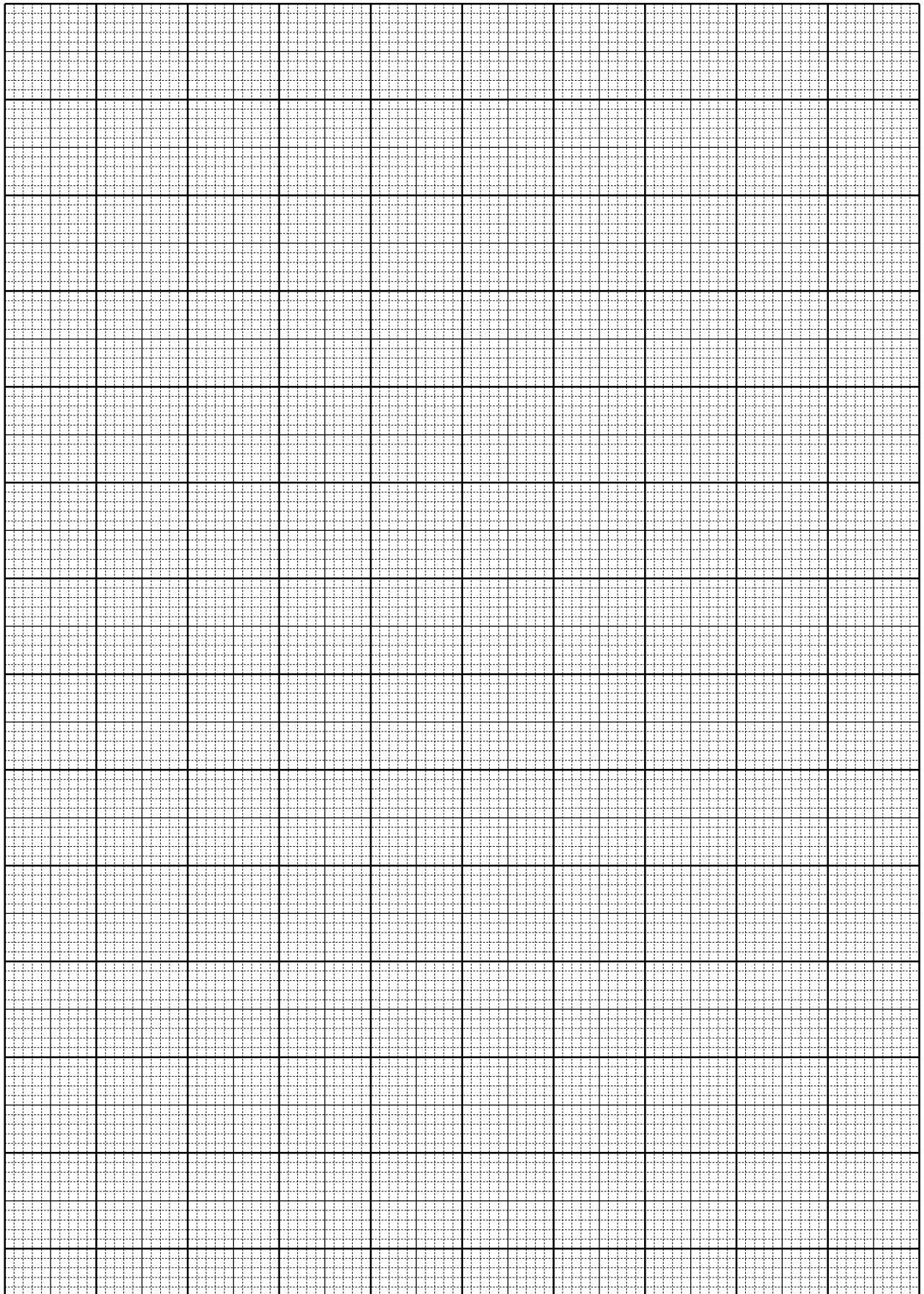
2

4(*a*)(ii)

2

4(*b*)

3

(*c*) From the graph that you have drawn in **4**(*b*)**,** determine the rate of reaction at the 90th second.

4(*c*)

| | 2 |

[2 *marks*]

(*d*) (i) In this reaction, how does the rate of reaction change with time ?

4(*d*)(i)

| | 1 |

……………………………………………………………………………………….
[1 *mark*]

(ii) Explain your answer in **4**(*d*) (i).

4(*d*)(ii)

| | 1 |

……………………………………………………………………………………
……………………………………………………………………………………
[*1 mark*]

5 Diagram 3 shows the structural formula of the monomer of natural rubber.

```
              H
              |
          H─C─H
              |
     H        |      H   H
     |        |      |   |
H ─ C = C ─ C = C ─ H
```

Diagram 3

5(*a*)

| | 1 |
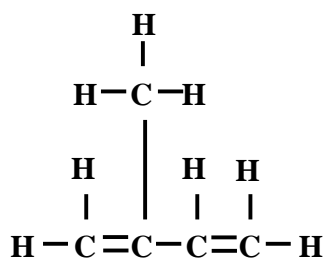
(*a*) Name the monomer of natural rubber.

……………………………………………………………………………………………..
[*1 mark*]

5(*b*)

(*b*)   Name the process involved in the formation of natural rubber from its monomer.

…………………………………………………………………………………………

[1 *mark*]

(*c*)   Draw the structural formula of natural rubber.

5(*c*)

[1 *mark*]

(*d*)   The properties of natural rubber can be improved by treating rubber with sulphur.

5(*d*)(i)

.

(i) Name the process involved.

…………………………………………………………………………………………

[1 *mark*]

(ii) Draw the structural formula for the rubber produced.

5(*d*)(ii)

[1 *mark*]

5(*d*)(iii)

(iii) State **one** property of vulcanised rubber.

…………………………………………………………………………………………...

[1 *mark*]

(e)   Diagram 6 shows the chemical formulae of two types of cleansing agents.

$$CH_3(CH_2)_{11} - O - \overset{\overset{O}{\parallel}}{\underset{\underset{O}{\parallel}}{S}} - O^- Na^+ \qquad\qquad CH_3(CH_2)_{15} - \overset{}{\underset{\underset{O}{\parallel}}{C}} - O^- Na^+$$

Cleansing Agent A   Cleansing Agent B
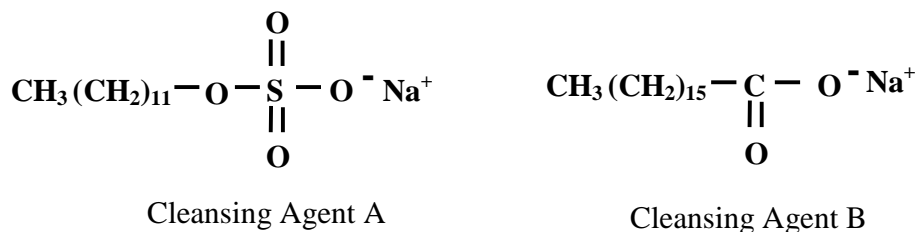
Diagram 6

(i) Name cleansing agent :

A : …………………………………………………………………………

B : …………………………………………………………………………

[2 *marks*]

(ii) Compare the effectiveness of the cleansing agents A and B in hard water. Explain.

…………………………………………………………………………

…………………………………………………………………………

…………………………………………………………………………

[2 *marks*]

6   Diagram 4 shows the set-up of the apparatus to investigate the heat of combustion of ethanol, C_2H_5OH.
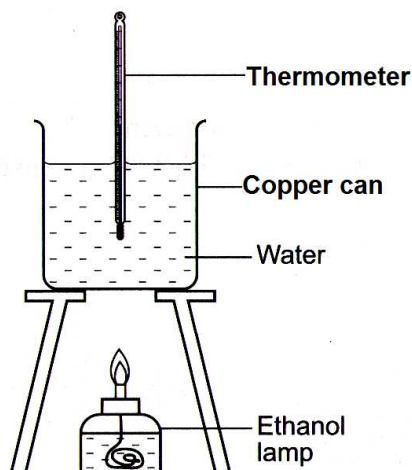
The mass of the ethanol lamp was weighed before it was ignited. 200 cm^3 of water was filled into a copper can which was heated directly using the ethanol lamp shown in Diagram 4. The results recorded are as shown in Table 4 below.

Mass of ethanol lamp before combustion / g	164.56
Mass of ethanol lamp after combustion / g	163.02
Initial temperature of water / ^{o}C	28.0
Highest temperature of water / ^{o}C	48.0

Table 4

(*a*) (i) What is meant by the *heat of combustion* of ethanol?

6(*a*)(i)

1

…………………………………………………………………………….......

……………………………………………………………………………………
[1 *mark*]

(ii) Balance the following chemical equation for the complete combustion of ethanol.

6(*a*)(ii)

1

$\boxed{}$ C$_2$H$_5$OH + $\boxed{}$ O$_2$ → $\boxed{}$ CO$_2$ + $\boxed{}$ H$_2$O
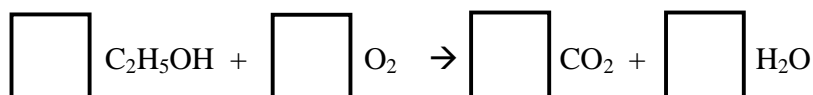
[1 *mark*]

(*b*) (i) Calculate the number of moles of ethanol burnt.
        [Relative molecular mass of ethanol = 46]

6(*b*)(i)

1

[1 *mark*]

(ii) Calculate the heat released in this experiment.
     [Specific heat capacity of water = 4.2 J g^{-1} ^{o}C^{-1}; density of water = 1 g cm^{-3}]

6(*b*)(ii)

1

[1 *mark*]

(iii) Calculate the heat of combustion of ethanol based on **6**(*b*)(i) and **6**(*b*)(ii).

6(*b*)(iii)

	2

[2 *mark*]

(c) Draw energy level diagram for the complete combustion of ethanol.

6(*c*)

	2

[2 *marks*]

(*d*) The heat of combustion determined in the experiment is far less than the actual value of -1376 kJ mol^{-1}. Suggest **two** possible reasons.

……………………………………………………………………….....................

……………………………………………………………………….....................

6(*d*)

	2

[2 *marks*]

Section B

[20 *marks*]

Answer any **one** question from this section.

7   Table 5 below shows the proton number of the atoms of elements P, Q , R and S.

Element	Proton number
P	3
Q	11
R	16
S	17

Table 5

(*a*)   Arrange the size of atoms for elements P, Q, R and S in ascending order.

[1 *mark*]

(*b*)   Determine the position of element R in the Periodic Table. Explain your answer.

[5 *marks*]

(*c*)   Elements P and Q have similar chemical properties but different reactivity with
water. Explain this statement.

[6 *marks*]

(*d*)   Elements Q and S react to form a chemical compound.
(i)   Explain the formation of this compound.

[6 *marks*]

(ii)   State **two** physical properties of the compound formed.

[2 *marks*]

8   Substance X is a hydrocarbon. The empirical formula of substance X is CH_2. Given
that the relative atomic mass of C = 12, H = 1 and Relative Molecular Mass X = 56.
(*a*)   State the meaning of hydrocarbon.

[1 *mark*]

(*b*)   Determine the molecular formula of substance X.

[3 *marks*]

(*c*)   Based on the answer in **8**(*b*), draw the structural formula for all the isomers of X.
Name the isomers.

[6 *marks*]

(*d*) Diagram 5 shows the formation of compound X from glucose and its conversion to several other carbon compounds.
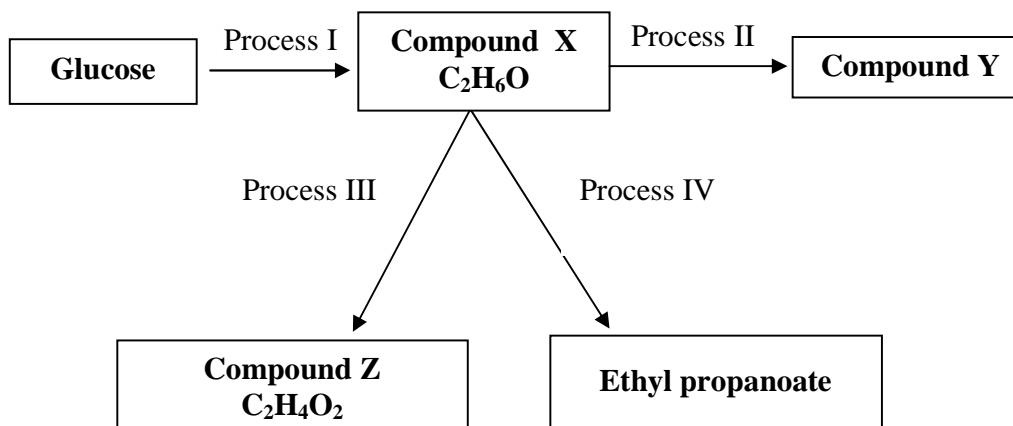

Diagram 5

(i) Name Process I and IV.

[2 *marks*]

(ii) Compound Y is formed when the vapour of compound X is passed over heated porcelain chips in Process II. Draw a labelled diagram to show how this conversion can be carried out in a laboratory. Suggest a chemical test to identify compound Y.

[4 *marks*]

(iii) Compound Z releases carbon dioxide gas when calcium carbonate is added to it. Name the compound Z and the functional group present.

[2 *marks*]

(iv) Describe briefly how you can prepare ethyl propanoate from compound X in the laboratory.

[2 *marks*]

Section C
[20 *marks*]
Answer any **one** question from this section.

9   (*a*)   A student is given the following solutions with the same concentration of
1.0 mol dm^{-3}.

- Ammonia solution, NH_3
- Sulphuric acid, H_2SO_4
- Ethanoic acid, CH_3COOH
- Sodium sulphate, Na_2SO_4
- Hydrochloric acid. HCl
- Potassium hydroxide, KOH

Arrange the above solutions in the order of increasing pH values.

[3 *marks*]

(*b*)   In an experiment, two solutions are tested with a dry red litmus paper and the
results are tabulated below:

Solution	Observation
Ammonia in methylbenzene	No change in colour
Ammonia in water	Red litmus paper turns blue

Explain why only ammonia in water turns red litmus paper blue.

[4 *marks*]

(*c*)   The following shows some salts that can be prepared in laboratory :

- Silver chloride
- Copper(II) nitrate
- Sodium sulphate
- Potassium carbonate

Classify these salts into soluble and insoluble salts.

[2 *marks*]

(*d*)   Some salts can be prepared by the double decomposition reaction.
(i)   Choose a salt from **9**(*c*) that can be prepared using double decomposition
reaction.

[1 *mark*]

(ii) Name the reactants required for the preparation of the salt that you have chosen in **9**(*d*)(i).

[2 *mark*]

(iii) Describe briefly how you can prepare the named salt in **9**(*d*)(i) using the reactants in **9**(*d*)(ii). In your answer, include the balanced chemical equation **and** the ionic equation for the reaction involved.

[8 *marks*]

10 (*a*) Rusting of iron is one of the major problems faced in everyday life. Suggest **three** methods how this problem may be overcome

[3 *marks*]

(*b*) The following shows two chemical equations for reaction I and II.

Reaction I : $HCl + KOH \rightarrow H_2O + KCl$
Reaction II : $2HCl + Zn \rightarrow H_2 + ZnCl_2$
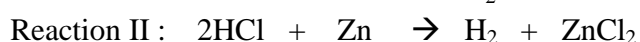
(i) In terms of oxidation numbers, determine which reaction is a redox reaction and which reaction is not a redox reaction. Explain your answer.

[4 *marks*]

(ii) State the oxidising and reducing agents for the redox reaction.

[2 *marks*]

(*c*) The products of the electrolysis of an aqueous sodium sulphate, Na_2SO_4 solution using inert electrodes are oxygen and hydrogen. Describe a laboratory experiment to show how this electrolysis can be carried out in a laboratory. Your answer should include the following :

(i)   A labelled diagram to show the collection of gas
(ii)   Procedure
(iii)   Half equations at anode and cathode
(iv)   Explanation of the redox reaction in terms of electron transfer

[11 *marks*]

END OF QUESTION PAPER

http://www.chngtuition.blogspot.com

PERIODIC TABLE OF ELEMENTS

1	2												13	14	15	16	17	18
1 H Hydrogen 1																		**2** He Helium 4
3 Li Lithium 7	**4** Be Beryllium 9												**5** B Boron 11	**6** C Carbon 12	**7** N Nitrogen 14	**8** O Oxygen 16	**9** F Fluorine 19	**10** Ne Neon 20
11 Na Sodium 23	**12** Mg Magnesium 24	3	4	5	6	7	8	9	10	11	12		**13** Al Aluminum 27	**14** Si Silicon 28	**15** P Phosphorus 31	**16** S Sulfur 32	**17** Cl Chlorine 35.5	**18** Ar Argon 40
19 K Potassium 39	**20** Ca Calcium 40	**21** Sc Scandium 45	**22** Ti Titanium 48	**23** V Vanadium 51	**24** Cr Chromium 52	**25** Mn Manganese 55	**26** Fe Iron 56	**27** Co Kobalt 59	**28** Ni Nickel 59	**29** Cu Copper 64	**30** Zn Zinc 65		**31** Ga Gallium 70	**32** Ge Germanium 73	**33** As Arsenic 75	**34** Se Selenium 79	**35** Br Bromine 80	**36** Kr Krypton 84
37 Rb Rubidium 85.5	**38** Sr Strontium 88	**39** Y Yttrium 89	**40** Zr Zirconium 91	**41** Nb Niobium 93	**42** Mo Molybdenum 96	**43*** Tc Technetium 98	**44** Ru Ruthenium 101	**45** Rh Rhodium 103	**46** Pd Palladium 106	**47** Ag Silver 108	**48** Cd Cadmium 112		**49** In Indium 115	**50** Sn Tin 119	**51** Sb Antimony 122	**52** Te Tellurium 128	**53** I Iodine 127	**54** Xe Xenon 131
55 Cs Cesium 144	**56** Ba Barium 137	**57** La Lanthanum 139	**72** Hf Hafnium 178.5	**73** Ta Tantalum 181	**74** W Tungsten 184	**75** Re Rhenium 186	**76** Os Osmium 190	**77** Ir Iridium 192	**78** Pt Platinum 195	**79** Au Gold 197	**80** Hg Mercury 201		**81** Tl Thallium 204	**82** Pb Lead 207	**83** Bi Bismuth 209	**84** Po Polonium 210	**85** At Astatine 210	**86** Rn Radon 222
87 Fr Francium 223	**88** Ra Radium 226	**89** Ac Actinium 227	**104*** *Unq	**105*** *Unp	**106*** *Unh	**107*** *Uns	**108*** *Uno	**109*** *Une										

Transition Elements

Key:
11
Na
Sodium
23
← Proton Number
← Symbol of Elements
← Name of the element
← Relative atomic mass

* - Not exist naturally
* - elements not yet discovered

Lanthanide Series

58 Ce Cerium 140	**59** Pr Praseodimium 141	**60** Nd Neodymium 144	**61*** Pm Promethium 147	**62** Sm Samarium 150	**63** Eu Europium 152	**64** Gd Gadolinium 157	**65** Tb Terbium 159	**66** Dy Dysprosium 162.5	**67** Ho Holmium 165	**68** Er Erbium 167	**69** Tm Tulium 169	**70** Yb Ytterbium 173	**71** Lu Lutetium 175

Actinide Series

90 Th Thorium 232	**91** Pa Protactinium 231	**92** U Uranium 238	**93*** Np Neptunium 237	**94*** Pu Plutonium 242	**95*** Am Americium 243	**96*** Cm Kurium 247	**97*** Bk Berkelium 247	**98*** Cf Californium 251	**99*** Es Einsteinium 254	**100*** Fm Fermium 253	**101*** Md Mendelevium 256	**102*** No Nobelium 254	**103*** Lr Lawrencium 260

INFORMATION FOR CANDIDATES

1. *This question paper consists of three sections:* **Section A**, **Section B** *and* **Section C**.

2. *Answer* **all** *questions in Section A. Write your answers for* **Section A** *in the spaces provided in the question paper.*

3. *Answer one question from* **Section B** *and one question from* **Section C**.
   Write your answers for **Section B** *and* **Section C** *on the `writing paper' provided by the invigilators.*
   Answer questions in **Section B** *and* **Section C** *in detail.*
   You may use equations, diagrams, tables, graphs and other suitable methods to explain your answer.

4. *Show your working. It may help you to get marks.*

5. *If you wish to change your answer, neatly cross out the answer that you have done. Then write down the new answer.*

6. *The diagrams in the questions are not drawn to scale unless stated.*

7. *Marks allocated for each question or part question are shown in brackets.*

8. *The time suggested to answer* **Section A** *is 90 minutes,* **Section B** *is 30 minutes and* **Section C** *is 30 minutes.*

9. *You may use a non-programmable scientific calculator.*

10. *Hand in your answer sheets at the end of the examination*

4541/3
Chemistry
Kertas 3
Sept / Oct
2011
1½ hrs

NO KAD PENGENALAN

						-				-				

ANGKA GILIRAN

Name: _____   Form: 5 _____

School : _____

SPM TRIAL EXAMINATION 2011
FOR
SECONDARY SCHOOLS IN ZONE A, KUCHING

CHEMISTRY

KERTAS 3

Satu jam tiga puluh minit

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

1. *Tulis nombor **kad pengenalan** anda dan **angka giliran** anda pada petak yang disediakan.*

2. *Calon dibenarkan menjawab keseluruhan atau sebahagian soalan sama ada dalam Bahasa Inggeris atau Bahasa Melayu.*

3. *Calon dikehendaki membaca maklumat di halaman belakang kertas soalan ini.*

Untuk Kegunaan Pemeriksa		
Soalan	**Markah Penuh**	**Markah Diperoleh**
1	18	
2	15	
3	17	
JUMLAH	50	

_____

Kertas soalan ini mengandungi **8** halaman bercetak dan tiada halaman tidak bercetak.

[Lihat halaman sebelah
SULIT

1. A student carried out an experiment to investigate the effect of the size of a solid reactant on the rate of reaction. The procedure is as follows:

   1. 25.0 cm^3 of 0.5 mol dm^{-3} hydrochloric acid is added to a conical flask.
   2. 2.0 g of large marble chips is added.
   3. The flask is placed on an electronic balance.
   4. The mass of the flask and its contents is recorded at half-minute intervals until a few constant readings are obtained.
   5. Steps 1 to 4 are repeated using 2.0 g of small marble chips.

   Diagram 1.1 shows the readings of the electronic balance for the mass of the flask and its contents using large marble chips at 0.0 minute, 0.5 minute, 1.0 minute and 1.5 minutes respectively.

t = 0.0 minute	t = 0.5 minute	t = 1.0 minute	t = 1.5 minutes
63.398	62.883	62.579	62.402
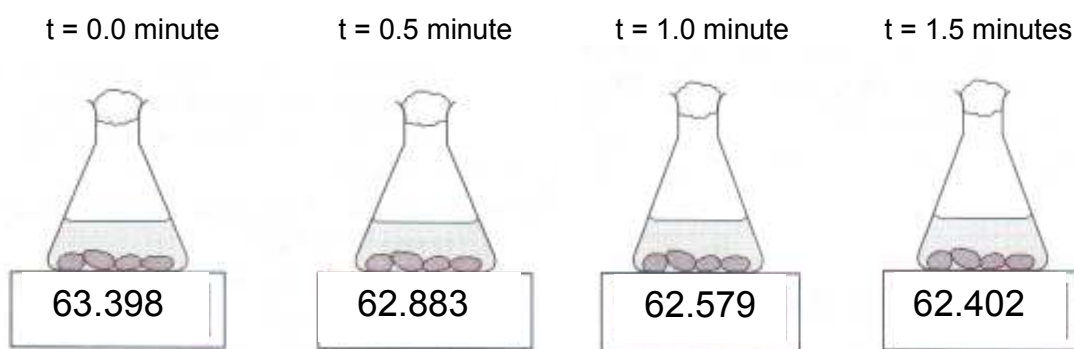
   Diagram 1.1

   Diagram 1.2 shows the readings of the electronic balance for the mass of the flask and its contents using small marble chips at 0.0 minute, 0.5 minute, 1.0 minute and 1.5 minutes respectively.

t = 0.0 minute	t = 0.5 minute	t = 1.0 minute	t = 1.5 minutes
63.401	62.758	62.483	62.298
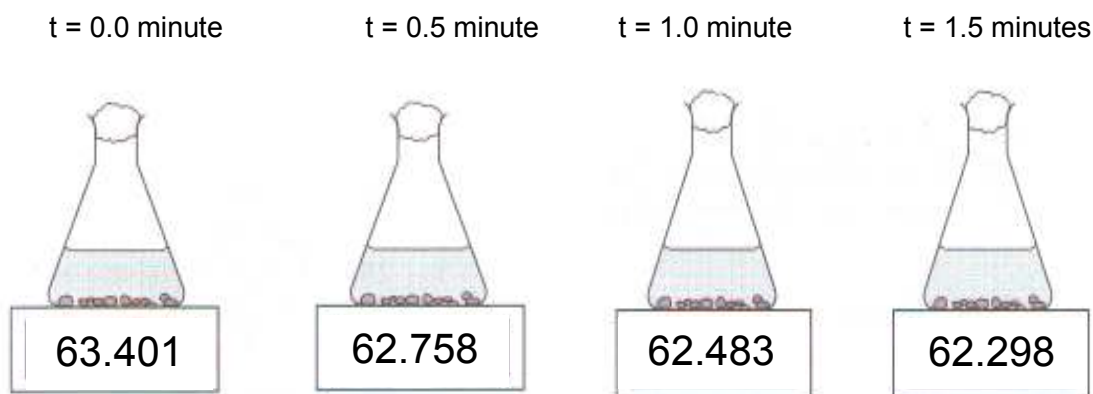
   Diagram 1.2

(a) Record the readings of the electronic balance to two decimal places in **Table 1**.

Time (minute)	Total mass of flask and contents (g)	
	Large marble chips	**Small marble chips**
0.0		
0.5		
1.0		
1.5		
2.0	62.28	62.22
2.5	62.22	62.20
3.0	62.20	62.20
3.5	62.20	62.20
4.0	62.20	62.20

Table 1

(3 marks)

1(a)

(b) State the variables of the experiment:

   (i) Manipulated variable : …………………………………………………………..

   (ii) Responding variable :…………………………………………………………

   (iii) Constant variable : …………………………………………………………..

(3 marks)

1(b)

(c) State the hypothesis of the experiment.

……………………………………………………………………………………………….

……………………………………………………………………………………………….

(3 marks)

1(c)

1(d)

(d) Draw a graph of the readings of the total mass of the flask with its contents against time, for the experiments using large marble chips and small marble chips respectively, chips on the same axes.

(3 marks)

[Lihat halaman sebelah
SULIT

(e) Based on the graph plotted in (d), calculate the overall average rate of reaction for both experiments.

1(e)

(3 marks)

(f) Predict the overall average rate of reaction if the experiment is repeated by using 25.0 cm^3 of 0.5 mol dm^{-3} sulphuric acid and 2.0 g of small marble chips. Explain your answer.

…………………………………………………………………………………………………..

…………………………………………………………………………………………………..

…………………………………………………………………………………………………

1(f)

(3 marks)

Total 1

2. **Diagram 2** shows the set-up of the apparatus for Experiments I, II and III to investigate the reactivity of chlorine gas, bromine vapour and iodine vapour with heated iron wool respectively.
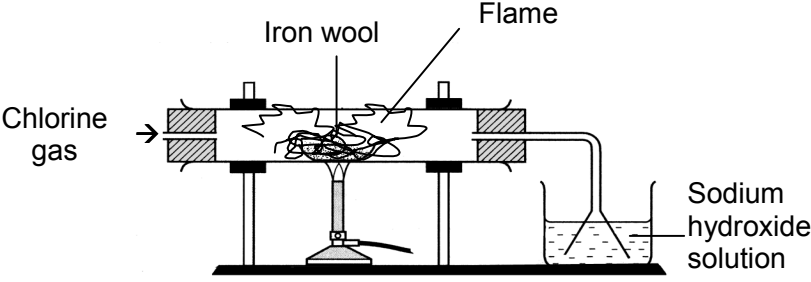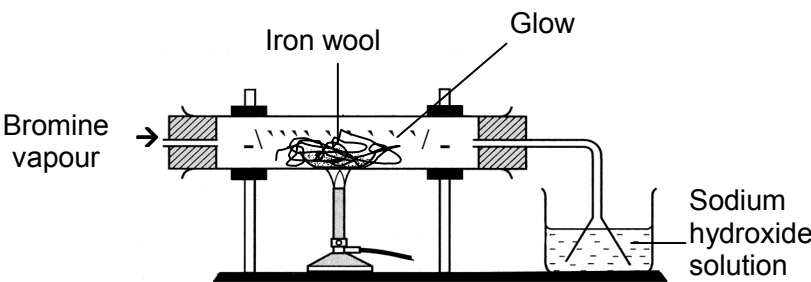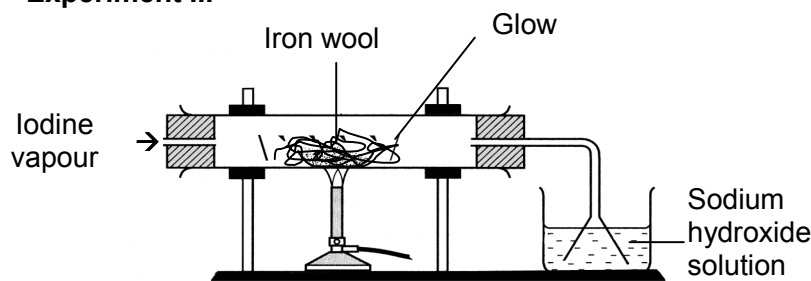
Set-up of the apparatus	Observation
Experiment I	....
Experiment II	....
Experiment III	....

Diagram 2

(a) Record the observations for the reactions of chlorine gas, bromine vapour and iodine vapour with heated iron wool in the spaces provided in **Diagram 2.**

2(a)

(3 marks)

For Examiner's Use

(b) Name the solid formed when chlorine reacts with heated iron wool. Write a balanced chemical equation for the reaction.

………………………………………………………………………………………………

………………………………………………………………………………………………

[3 marks]

2(b)

(c) State the operational definition for reactivity of the halogens.

……………………………………………………………………………………….………

……………………………………………………………………………………………….

[3 marks]

2(c)

(d) Arrange the halogens in ascending order of reactivity.

………………………………………………………………………………………...………

[3 marks]

2(d)

(e) Halogens have different solubilities in water. Classify chlorine, bromine and iodine according to the bleaching ability of the solutions they produced in water.

With bleaching properties	Without bleaching properties

[3 marks]

2(e)

Total 2

3.
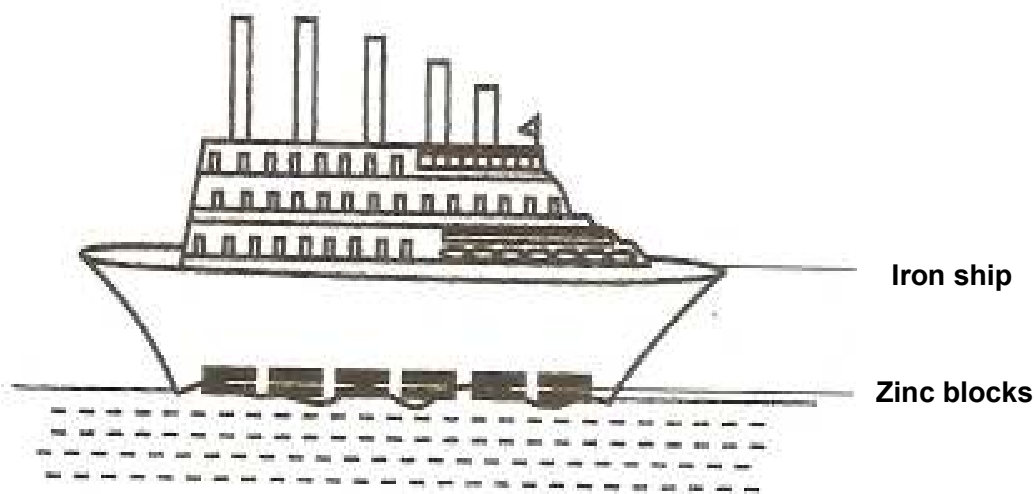
Diagram 3

Diagram 3 shows zinc blocks are placed on the hull of an iron ship to prevent rusting. However, some metals in contact with iron can speed up rusting.

Based on this idea, plan a laboratory experiment to investigate the effect of different metals in contact with iron on the rusting of iron. You are provided with potassium hexacyanoferrate(III) solution [which turns blue when iron(II) ions is formed] and all other necessary materials and apparatus.

Your planning must include all the following items:
(a) Statement of the problem
(b) All the variables
(c) Statement of the hypothesis
(d) List of substances and apparatus
(e) Procedure of the experiment
(f) Tabulation of data

[17 marks]

END OF QUESTION PAPER

INFORMATION FOR CANDIDATES

1. *This question paper consists of **three** questions : **Question 1, Question 2** and **Question 3**.*

2. *Answer **all** questions. Write your answers for **Question 1** and **Question 2** in the spaces provided in the question paper.*

3. *Write your answer for **Question 3** on foolscap papers. You may use equations, diagrams, tables, graphs and other suitable methods to explain your answers.*

4. *Show your working, it may help you to get marks.*

5. *The diagrams in the questions are not drawn to scale unless stated.*

6. *The marks allocated for each question or sub-part of a question are shown in brackets.*

7. *If you wish to change your answer, cross out the answer that you have done. Then write down the new answer.*

8. *You may use a non-programmable scientific calculator.*

9. *You are advised to spend 1 hour to answer **Question 1** and **Question 2** and 30 minutes for **Question 3**.*

10. *Hand in your answers on foolscap papers attached together with this question paper at the end of the examination.*

Marks awarded :

Mark	Description
3	Excellent : The best response
2	Satisfactory : An average response
1	Weak : An inaccurate response
0	No response <u>or</u> wrong response

SPM TRIAL EXAMINATION ZON A KUCHING
Chemistry Paper 1 2011

No.	Answer
1	B
2	C
3	C
4	A
5	A
6	B
7	D
8	A
9	A
10	D
11	C
12	B
13	A
14	C
15	C
16	A
17	B
18	D
19	B
20	D
21	A
22	B
23	A
24	C
25	D
26	B
27	A
28	C
29	C
30	D
31	D
32	B
33	C
34	C
35	A
36	D
37	D
38	B
39	D
40	B
41	B
42	D
43	A
44	B
45	D
46	D
47	C
48	B
49	A
50	C

SULIT
4541/2
Marking Scheme
Chemistry Paper 2
September 2011

_____

PEPERIKSAAN PERCUBAAN SELARAS ZON A KUCHING
SIJIL PELAJARAN MALAYSIA 2011

MARKING SCHEME

CHEMISTRY 4541/2

Paper 2

UNTUK KEGUNAAN PEMERIKSA SAHAJA

Skema Pemarkahan ini mengandungi 9 halaman bercetak   **4541/2**

Section A

1.	.(a)	(i)	2.8	1
		(ii)	Group 1 / Alkali metals	1
	(b)		Period 3.	1
			Atom Y has 3 occupied electron shells / 3 shells occupied with electrons.	1
			* Reject : 3 shells / electron shells	
	(c)	(i)	Anion // negatively-charged particle	1
		(ii)	$W + 2e^- \rightarrow W^{2-}$	1
	(d)	(i)	17	1
		(ii)	V and W	1
		(iii)	Atom V and W have same no. of protons but different no. of neutrons // same proton number but different nucleon number	1
	(e)		V /W/ Z	1

10

2	(a)	No electrical source/No battery connected	1
	(b)	Cathode // negative terminal	1
	(c)	Silver nitrate solution/Silver sulphate solution	1
		* Reject answers if the word "solution" is not mentioned	
	(d)	(i) Silver plate dissolves / becomes thinner / mass decreases	1
		* Reject : silver plate corrodes / ionises	
		(ii) $Ag \rightarrow Ag^+ + e^-$	1
		(iii) $Ag^+ + e^- \rightarrow Ag$	1
	(e)	• Clean iron key with sandpaper	
		• Use low electric current	
		• Use low concentration of electrolyte	2
		* (Any two of the answers)	
	(f)	To prevent corrosion //	
		To improve the appearance	1

9

3   (a)   X - Composite materials   1
            Y - Alloy   1

.(b)   (i)
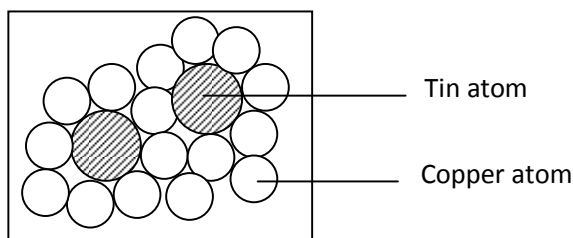
            * number of copper atoms more than tin atoms
            * size of tin atom larger than copper atom   2
            (ii) to improve hardness // to improve appearance // to prevent   1
            corrosion

     (c)   (i) Lead(II) oxide   * Reject : Lead oxide   1

            (ii) has high density // has high refractive index   1

     (d)   (i)

$$
\begin{array}{ccc}
CH_3 & & H \\
| & & | \\
C & = & C \\
| & & | \\
H & & H
\end{array}
$$
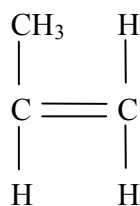
                                                                        1

                        Propene   1
            (ii) Addition polymerisation   1   **10**

4   (a)   (i) $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$

            * Formula of reactants and product correct :   1
            * Balanced :   1   2
            (ii)
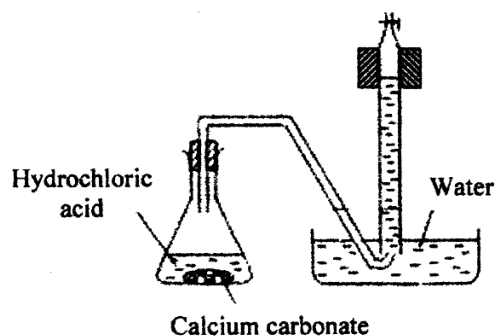
            * Functional - 1 (all connections tight, delivery tube inside the
              burette but below the water surface, burette clamped)
            * Labelled   - 1

                                                                        2

http://www.chngtuition.blogspot.com

(b)   1. Labelled axes with correct units and uniform scale for X and Y axis & size of the graph is at least half of the graph paper.   1
       2. All points plotted correctly.   1
       3. Correct shape, smooth curve and start from origin.   1

(c)   1. Correct tangent at 90th second on the graph.   1
       2. Show calculation of the gradient for tangent at 90th s with correct answer and unit.   1
         * Range : (0.10 -0.17) $cm^3 \, s^{-1}$

(d)   (i) The rate of reaction decreases with time.   1

       (ii) The concentration of the acid decreases.   1
         * Reject : amount of acid

                                                                 11

5. (a)   Isoprene / 2-methylbuta-1,3-diene   1

    (b)   Polymerisation / addition polymerisation   1

    (c)

                                                           1
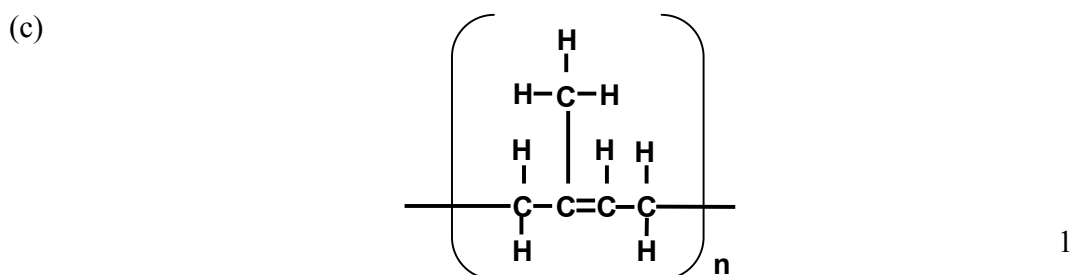
    (d)   (i) Vulcanisation   1

         (ii)

                                                      1
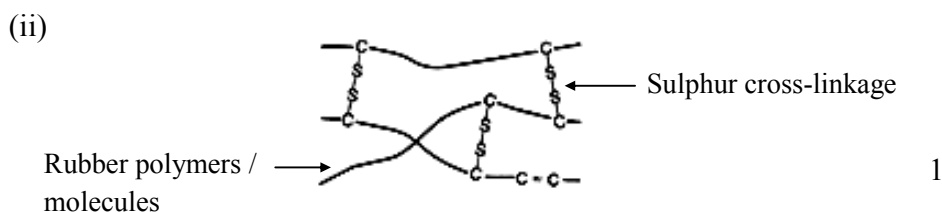
         (iii) Elastic / Strong / Hard / can withstand high temperature / resist oxidation   1

    (e)   (i) A : Detergent // sodium alkyl sulphate   1
             B : Soap // sodium alkyl carboxylate   1
         (ii) A is more effective than B in hard water   1
             Cleansing agent B forms scum with Ca^{2+} and Mg^{2+} ions in hard water whereas cleansing agent A does not.   1

                                                                10

6. (a)   (i) The heat released when one mole of ethanol is completely burnt in   1
                 excess oxygen under standard conditions.

          (ii) $\boxed{1}$ C_2H_5OH + $\boxed{3}$ O_2 → $\boxed{2}$ CO_2 + $\boxed{3}$ H_2O
                                                                                          1
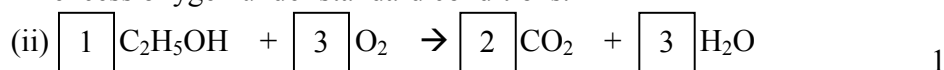
    (b)   (i)   Number of moles of ethanol burnt
                    = (1.54)/ 46 = 0.0335 mol   1

            (ii)   Heat released
                    = 200 x 4.2 x 1 x (48.0 – 28.0)
                    =16 800 J / 16.8 kJ   (Must have correct units)   1

            (iii)   Heat released when 1 mol of ethanol is burnt
                     =(16.8)/ 0.0335
                     =501.5 kJ
                    Therefore, heat of combustion of ethanol is -501.5 kJ mol^{-1}.   2
                    * Correct answer :   1
                    * Correct unit and negative sign shown :   1

    (c)   Energy

                    C_2H_5OH + $3O_2$

                                          $\triangle H$= -501.5 kJ mol^{-1}

                                          2 CO_2 + $3H_2O$
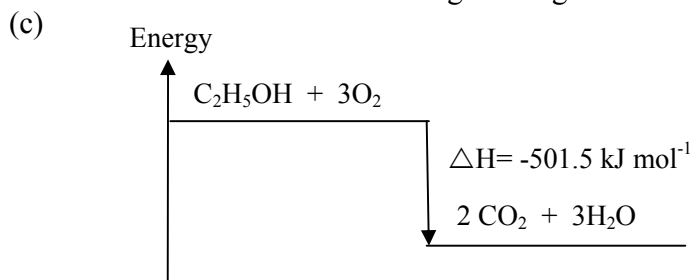
          * Vertical axis with arrow pointing upwards, labelled *energy* and two
             horizontal levels   1
          * Exothermic reaction and correct formula of reactants, products and
             balanced   1

    (d)   • Heat loss to surrounding (through radiation and convection).
          • Incomplete combustion of ethanol
          • Heat absorbed by copper can / thermometer
          • Spirit/ethanol lamp is too far from the copper can   2
             * (any 2 of the above)

                                                                                          10

Section B

7	(a)	1. Electron arrangement of R = 2.8.6		1	
		2. Group 16		1	
		3. because atom R has 6 valence electrons		1	
		4. Period 3		1	
		5. because atom R has 3 occupied electron shells // 3 shells occupied with electrons		1	**5**
	(b)	Atomic size in ascending order - P , S , R , Q		1	**1**
	(c)	1 Similar chemical properties : Atom P and Q have the same **no.** of valence electron		1	
		2 Q is more reactive than P		1	
		3 Atomic size of Q is bigger than P		1	
		4 Valence electron is further away from nucleus in atom Q than P		1	
		5 Force of attraction between nucleus and valence electron in atom Q is weaker than atom P		1	
		6 Easier for atom Q to release / lose / donate electron than atom P		1	**6**

(d) (i)

1 Atom Q, electron arrangement 2.8.1 and Atom S, electron arrangement 2.8.7   1

2 One atom Q releases / loses/ donates one valence electron to form ion Q^+, // $Q \rightarrow Q^+ + e^-$ 1

3 Electron released is transferred and accepted by atom S   1

4 One atom of S receives one electron to form ion S^-, 2.8 // $S + e^- \rightarrow S^-$ 1

5 Both ions achieved a stable (octet) electron arrangement   1

6 The oppositely-charged ions Q^+ and S^- are held together by strong electrostatic forces of attraction /ionic bond   1

7 with chemical formula QS   1   **6**

   * Point 4 (if shown), 6 & 7 can be given based on electron arrangement diagram drawn (if any)

                          [maximum 6 marks]

(ii)

• Has high melting and boiling points

• Soluble in water but not in organic solvents

• Can conduct electricity in molten and aqueous solution   **2**
    * (any 2 of the above)

                                                  20

8   (a)   Substance/compound that contains carbon and hydrogen atoms / elements   1   **1**
     only   * Reject : if "only" is not mentioned

   (b)   1. $n(CH_2) = 56$ 1
           $12n + 2n = 56$
       2. $n = 4$ 1
       3.   Molecular formula C_4H_8 1   **3**

   (c)   * Correct structural formula
        * Correct name
       Examples:

          But-1-ene   But-2-ene   2-Methylpropene   1+1

                                                                1+1

                                                                1+1

                                                                      6

   (d)   (i)   Process I : Fermentation   Process IV : Esterification   1+1   **2**

       (ii)

Glass wool soaked with ethanol · Porcelain chips · Heat · ethene · water

       *   Labelled   - 1
       *   Functional - 1   1+1

       1.   Bubble / pass the gas through bromine water,   1
       2.   the **brown** colour of bromine decolourises / becomes colourless   1
                                 OR
       1.   Bubble/ pass the gas through **acidified** potassium manganate(VII)   1
           solution,
       2.   the **purple** colour of acidified potassium manganate(VII) solution
           decolourises / becomes colourless   1   **4**
          * reject: if not mentioned "acidified" and "solution"

       (iii) 1. Ethanoic acid/ acetic acid ;   2. carboxyl group

                                                               1+1   **2**
       (iv)
       1. To a mixture of ethanol and propanoic acid in a test tube   1
       2. Add a few drops of concentrated sulphuric acid and warm gently   1   **2**

                                                                         20

Section C

9   (a) H_2SO_4 , HCl , CH_3COOH, Na_2SO_4, NH_3, KOH

    →

    Increasing pH values

    * All correct sequence – 3
    * Any 4 correct consecutive sequence – 2   3   **3**
    * Any 3 correct sequence // correct position for H_2SO_4 and KOH – 1

   (b) 1. ammonia exist as molecule in methylbenzene   1
        2. there is no hydroxide ion present // the solution is not alkaline   1
        3. ammonia ionises partially in water to produce hydroxide ion   1
            // $NH_3 + H_2O \rightarrow NH_4^+ + OH^-$
        4. the presence of OH^- ions makes the solution alkaline   1   **4**

   (c)

Soluble salts	Insoluble salts
• Copper(II) nitrate	• Silver chloride
• Sodium sulphate	
• Potassium carbonate	

                                                   1+1
    * All correct - 2 marks   **2**
    * 2 or 3 correct -1 marks

   (d) (i)   Silver chloride   1   **1**
        (ii)
           1. *Any solution that produces cation* (Ag^+)   1
           2. + *Any solution that produces anion* (Cl^-)   1   **2**
        (iii)

    Procedure :
    1. Pour (20-100 cm^3)of (0.1 – 1.0 mol dm^{-3}) silver nitrate into a   1
        beaker.
    2. Add (20-100 cm^3)of (0.1 – 1.0 mol dm^{-3}) sodium chloride into a   1
        beaker.
    3. Stir the mixture with a glass rod.   1
    4. Filter the reacting mixture .   1
    5. Rinse the residue with distilled water.   1
    6. Press dry the residue with filter paper.   1
    7. Chemical equation : $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$ 1
    8. Ionic equation : $Ag^+ + Cl^- \rightarrow AgCl$ 1
                                                                                                  8
                                                                                                  20

    * Accept any pair of reactants in (d) (ii).

10   (a)   • using a protective layer to cover / coat the iron surface
           • using a sacrificial metal
           • by forming alloys   **2**
              * (any two of the above)

    (b)   (i)

Reaction I : not a redox reaction   1
No change in oxidation number of all elements before and after the   1
reaction.

$$HCl \; + \; KOH \; \rightarrow \; H_2O \; + \; KCl$$
Oxidation No.   +1 -1   +1 -2 +1   +1 -2   +1 -1
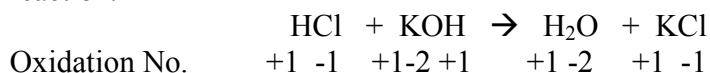
Reaction II : a redox reaction   1
Oxidation numbers of zinc increase from 0 to +2   1
and hydrogen decreases from + 1 to 0   1   **5**
* if mentioned oxidation no. changes : 1 mark only
$$2 \, HCl \; + \; Zn \; \rightarrow \; H_2 \; + \; ZnCl_2$$
Oxidation No.   +1 -1   0   0   +2 -1
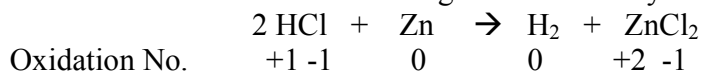
        (ii)   Oxidising agent : Hydrogen ions //hydrochloric acid   1
               Reducing agent : Zinc metal / atom   1   **2**

    (c)   (i)

Sodium sulphate   Carbon
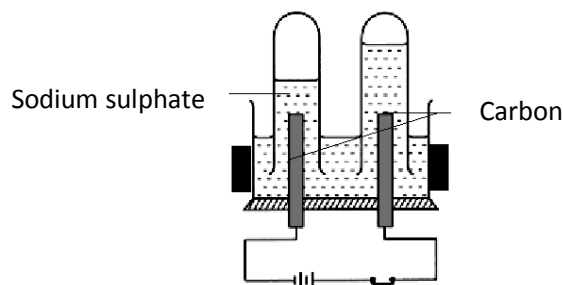
    * Labelled - 1

    * Functional - 1 (able to collect gas / battery present / circuit complete)   2   **2**

    (ii) Procedure :
         1. Fill an electrolytic cell with 0.1 mol dm^{-3} sodium sulphate,   1
            Na_2SO_4 solution until half full.
         2. Set-up the apparatus as shown above and connect the electrodes
            with wires to the power supply.   1
         3. Turn on the switch for 15 minutes.   1   **3**
         4. Record observations at the anode and cathode and test the gases
            produced .   1
            * (Maximum : 3 marks)

    (iii) Half equation :
         1.   At anode : $4 \, OH^- \; \rightarrow \; 2 \, H_2O \; + \; O_2 \; + \; 4e^-$
         2.   At cathode : $2H^+ \; + \; 2e^- \; \rightarrow \; H_2$ 1
                                     1
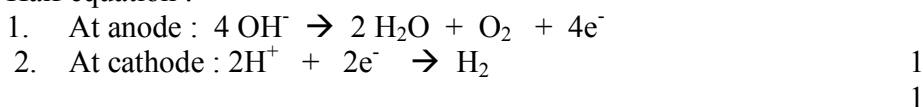
                                         2

(iv) Explanation :

1. At anode / +ve terminal :
   Hydroxide ions is oxidised to form water and oxygen by releasing/ losing/ donating electron   1

2. Electrons released is transferred through the external wires to the cathode /-ve terminal   1   **4**

3. At cathode / -ve terminal : Hydrogen ions is reduced to hydrogen by accepting electrons   1

4. Correct terminals   1

                         20

Question	Rubric	Score
1 (a)	*Able to record all readings accurately to <u>two decimal places.</u>* **Sample answer:**	3

Time (minutes)	Mass of marble chips (g)	
	Large pieces	Small pieces
0.0	63.40	63.40
0.5	62.88	62.76
1.0	62.58	62.48
1.5	62.40	62.30

	Able to record all readings less accurately to <u>one decimal place.</u> **Sample answer:**	2

Time (minutes)	Mass of marble chips (g)	
	Large pieces	Small pieces
0.0	63.4	63.4
0.5	62.9	62.8
1.0	62.6	62.5
1.5	62.4	62.3

	Able to record at least four readings correctly (with or without rounding off) **Sample answer:**	1

Time (minutes)	Mass of marble chips (g)	
	Large pieces	Small pieces
0.0	63	63
0.5	62.9	62.8
1.0	63	62.5
1.5	62.40	62.30

	No responses or wrong response	0

1 (b)	*Able to state all the variables correctly.*
	Sample answer:
	
	   MV : Size of marble chips // Total (exposed) surface area of marble
	      chips
	   RV : Rate of reaction // volume of gas collected per unit time
	   CV : Volume and concentration / type of acid used , initial mass of
	      marble chips, temperature
		3

	*Able to state **two** variables correctly.*	2
	*Able to state **one** variable correctly.*	1
	No responses or wrong response	0

1

Question	Rubric	Score
1 (c)	Able to state the hypothesis accurately between the manipulated variable and the responding variable with direction. **<u>Sample answer:</u>** The smaller / bigger the size of marble chips, the higher / lower the rate of reaction // The smaller / larger the total (exposed) surface area of marble chips, the lower / higher the rate of reaction.	3
	Able to state the hypothesis less accurately or stated in reversed order. **<u>Sample answer:</u>** The smaller / bigger the <u>reactant size</u>, the higher / lower the rate of reaction // The higher the rate of reaction, the smaller the size of marble chips / the larger the total surface area. (reversed order)	2
	Able to give an idea of the hypothesis. **<u>Sample answer:</u>** When the size / total surface area of marble chips changes, the rate of reaction changes. // The size of marble chips affect the rate of reaction.	1
	No responses or wrong response	0

1 (d)	Able to draw graph correctly with: (i) Both axes with correct label, unit and direction (ii) All points plotted accurately (iii) Smooth and continuous curve and passes through all the points. (iv) Uniform scale (v) The size of graph more than 50% of graph paper.	3
	Able to draw graph less correctly with: (i) Both axes with correct label, unit and direction (ii) At least 10 points plotted accurately (iii) Smooth and continuous curve and passes through all the 10 points. (iv) Uniform scale	2
	Able to draw graph less correctly with: (i) Both axes with correct direction and label without unit. (ii) At least 5 points plotted accurately (iii) Curve not smooth . (iv) Uniform scale	1
	No responses or wrong response	0

2

Sample answer:

Graph of Total mass / g against Time / min, showing two curves labelled "Large marble chips" and "Small marble chips"

Question	Rubric	Score
1 (e)	Able to show correctly, both calculations of the overall rate of reaction, with accurate answers and units. **Sample answer:** Overall rate of reaction of large marble chips = $\dfrac{63.40 - 62.20 \text{ g}}{3.0 \text{ min}}$ = 0.40 g min^{-1} Overall rate of reaction of small marble chips = $\dfrac{63.40 - 62.20 \text{ g}}{2.5 \text{ min}}$ = 0.48 g min^{-1}	3
	Both calculations and answers less accurately given <u>to one decimal place or without unit.</u> Large marble chips = 20.73 // 20.7, small marble chips = 24.88 // 24.9	2
	Any <u>one</u> calculation and answer given correctly with or without unit. Large marble chips = 21 or small marble chips = 25	1
	No responses or wrong response	0

3

Question	Rubric	Score
1 (f)	Able to predict the overall average rate of reaction if the experiment is repeated by using 25 cm^3 of 0.5 mol dm^{-3} sulphuric acid and 2.0 g of small marble chips and explain correctly. **Sample answer:** 1. The overall rate of reaction is **higher than 0.48 g min^{-1}.** 2. Sulphuric acid is a diprotic acid and hydrochloric acid is a monoprotic acid. 3. The number of hydrogen ions per unit volume is higher in sulphuric acid // the concentration of hydrogen ion in sulphuric acid is twice / double that of hydrochloric acid	3
	Able to state any **two informations** correctly.	2
	Able to state any **one information** correctly.	1
	No responses or wrong response	0

Question	Rubric	Score
2(a)	*Able to state **three** observations accurately.* **Sample answer:** 1. The iron wool burns with a bright flame // burns rapidly // a brown solid is formed. 2. The iron wool glows brightly // a brown solid is formed. 3. The Iron wool glows dimly // a brown solid is formed.	3
	*Able to state three observations without comparison or **any two** observations correctly .*	2
	*Able to state **any one** observation correctly.*	1
	No responses or wrong response	0

(b)	*Able to give the correct name and the chemical equation accurately.* 1. Iron(III) chloride 2. $3Cl_2 + 2Fe \rightarrow 2FeCl_3$	3
	Able to give the correct name and correct but not balanced chemical equation or give the balanced chemical equation only. Iron(III) chloride, $Cl_2 + Fe \rightarrow FeCl_3$ Or $3Cl_2 + 2Fe \rightarrow 2FeCl_3$ only	2
	Able to give the correct name only or not balanced chemical equation with correct chemical formulae only **Sample answer**: Iron(III) chloride, only Or $Cl_2 + Fe \rightarrow FeCl_3$ only	1
	No responses or wrong response	0

4

Question	Rubric	Score
(c)	*Able to give the operational definition <u>accurately.</u>* **Sample answer**: The <u>brighter the flame **/ glow**</u> produced / <u>more rapid the burning,</u> the <u>more reactive</u> is the halogen <u>when the halogen reacts with heated iron wool.</u> Or The <u>brighter the flame</u> produced / <u>more rapid the burning</u> when <u>the halogen reacts with heated iron wool,</u> the <u>more reactive</u> is the halogen.	3
	Able to give the operational definition <u>correctly.</u> **Sample answer**: The halogen that burns more brightly / burns more rapidly is more reactive.	2
	Able to give <u>an idea</u> of the operational definition. **Sample answer**: Halogens react with different reactivity. or Atomic size becomes bigger.	1
	No responses or wrong response	0

Question	Rubric	Score
(d)	*Able to arrange **<u>all three</u>** elements in **<u>ascending order</u>** of reactivity correctly.* **Sample answer :** Iodine / I_2, bromine / Br_2 , chlorine / Cl_2	3
	*Able to arrange **<u>two</u>** adjacent elements in **<u>ascending order</u>** of reactivity correctly or able to arrange **<u>all three</u>** elements in **<u>reversed order.</u>*** **Sample answer :** <u>Bromine, chlorine,</u> iodine or Chlorine, <u>iodine, bromine,</u> I / Br / Cl or Chlorine, bromine, Iodine (*reversed order*)	2

	Able to place either Iodine or chlorine in the correct position or ionic formulae or names of halides given .
	Sample answer: (least reactive) **<u>Iodine,</u>** chlorine, bromine or
	                                        bromine, iodine, **<u>chlorine</u>** (most reactive)
	              I^- / Br^- / Cl^- (ionic formulae or names of halides given)
		1

	No responses or wrong response	0

Question	Rubric	Score
(e)	*Able to classify **all three** halogens correctly.* <table><tr><th>With bleaching properties</th><th>Without bleaching properties</th></tr><tr><td>**Chlorine** **Bromine**</td><td>**Iodine**</td></tr></table>	3
	*Able to classify any **<u>two</u>** halogens correctly or reversed headings.*	2
	*Able to classify **<u>one</u>** halogen correctly.*	1
	No responses or wrong response	0

5

Question	Rubric	Score
3 (a)	*Able to give the statement of problem correctly.* **Sample answer:** How do different types of metals **in contact with iron** affect rusting ?	2
	Able to give the statement of problem less correctly or give an idea about the statement of problem or give the aim of the experiment. **Sample answer:** How do different metals affect rusting (of iron) ?　or To investigate the effect of different types of metals in contact with iron on rusting.	1
	No responses or wrong response	0

Question	Rubric	Score
3 (b)	*Able to state **all three** variables correctly* **Sample answer:** Manipulated variable : Different metals in contact with iron // (names of metals) Responding variable : Presence of blue colouration // rusting of iron Controlled variable : Size / clean iron nails // Volume and medium in which iron nails are kept // Temperature	3
	*Able to state any **two** variables above correctly*	2
	*Able to state any **one** variable above correctly*	1
	No responses or wrong response	0

Question	Rubric	Score
3 (c)	*Able to state the hypothesis <u>completely</u> in <u>correct order</u> with <u>direction</u>.* **Sample answer:** When a more electropositive metal than iron is in contact with iron, the metal inhibits rusting. When a less electropositive metal than iron is in contact with iron, the metal speeds up rusting.	3
	Able to state the hypothesis less correctly or reversed order of variables **Sample answer:** When a more / less electropositive metal than iron is in contact with iron, the metal inhibits / speeds up rusting. Or The rate of rusting is higher if a less electropositive metal than iron is in contact with iron.	2
	Able to give an idea about the hypothesis **Sample answer:** Different metals in contact with iron affect rusting	1
	No responses or wrong response	0

6

Question	Rubric	Score
3 (d)	*Able to give the list of substances and apparatus completely with **three** metals: iron, at least one metal <u>more electropositive (*)</u> than iron, at least one metal <u>less electropositive (**)</u> than iron,* **Sample answer:** S<u>ubstances (at least 5 items)</u>: Iron nails, * magnesium ribbon, ** copper strip, hot jelly solution containing a little potassium hexacyanoferrate(III) solution and sandpaper. <u>Apparatus (2 items)</u>: Test tubes and test tubes rack. (any suitable container),	3
	Able to list basic substances and apparatus. **Sample answer:** S<u>ubstances (4 items)</u> : Iron nails, * magnesium ribbon, ** copper strip and hot jelly solution containing a little potassium hexacyanoferrate(III) solution. <u>Apparatus (1 item)</u> : Test tubes (any suitable container)	2
	Able to give an idea of the list of materials and apparatus **Sample answer:** S<u>ubstances (3 items)</u> : Iron, any one metal and hot jelly solution containing potassium hexacyanoferrate(III) solution <u>Apparatus :</u> Any suitable container	1
	No responses or wrong response	0

Question	Rubric	Score
3 (e)	Able to state all steps in the procedure correctly. **Sample answer:** 1. All the [three – five] iron nails, * magnesium ribbon and **copper strip are cleaned with sandpaper. 2. The iron nails are coiled tightly with *magnesium ribbon and **copper, strip each. 3. All the iron nails are placed in separate test tubes and labelled. 4. The same volume of hot jelly solution containing potassium hexacyanoferrate(III) solution is poured into test tubes to completely cover all the nails. 5. The test tubes are kept in a test tube rack and left aside for a day. Any changes are observed and recorded.	3
	Able to state steps 1, 2, 4 and 5 correctly.	2
	Able to state steps 2 and 4 correctly.	1
	No responses or wrong response	0

Question	Rubric	Score

3 (f)	*Able to present a table to record the following items correctly.*
	    1. *Table of 2 columns x 4 rows. Column with test tube / pair of metals and observation / intensity of blue colouration.*
	    2. *Column for manipulated variable is filled with at least* **three** *data.*
	<u>Sample answer:</u>
	
	| Pair of metals
		Intensity of dark blue colouration

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Iron only	
Iron coiled with magnesium	
Iron coiled with copper strip	| Or | Test tube	Observation
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A	
B	
C			3

	Able to present a table to record data and showing
	    1. *a table of 2 columns x 3 rows with <u>correct headings</u> for column*
	    2. *column for manipulated variable is filled with at least* **two** *data.*
	<u>Sample answer:</u>
	
	| Pair of metals
		Intensity of dark blue colouration

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Iron coiled with magnesium	
Iron coiled with copper strip			2
	Able to give an idea on tabulation of data with *2 columns x 2 rows with <u>one correct heading.</u>* | Test-tube	
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	| *Or* |	Observation
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			1
	No responses or wrong response	0

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