Class	O Level Centre/Index Number	Name

新加坡海星中学

MARIS STELLA HIGH SCHOOL

PRELIMINARY EXAMINATION TWO

SECONDARY FOUR

SCIENCE ([redacted], CHEMISTRY) **5076/01**

Paper 1 Multiple Choice **24 August 2017**

Additional Materials:

Optical Test Answer Sheet (OTAS) **1 hour**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Write your name, class and index number on the Answer Sheet.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D.**
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this question paper.

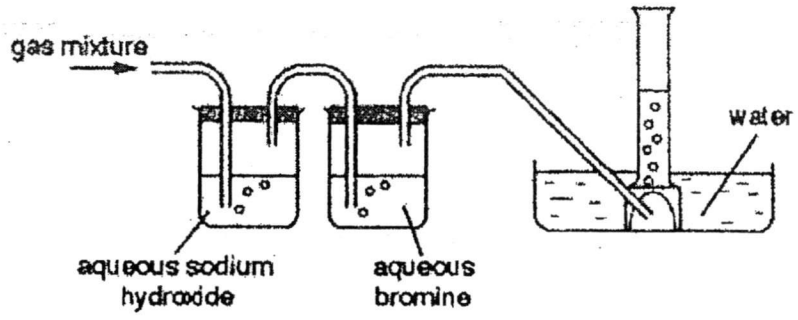
A copy of the Data Sheet is printed on page 17.
A copy of the Periodic Table is printed on page 18.

At the end of the examination, **hand in the following separately**:

1. OTAS
2. Question Booklet

This document consists of **18** printed pages

21 A gaseous mixture of ethene, oxygen and sulfur dioxide is passed through the apparatus shown. Only one of the gases is collected.



What is a property of the gas collected?

A Gas burns with a yellow flame.

B Gas forms a white precipitate with limewater.

C Gas reacts with propane to produce carbon dioxide.

D Gas turns acidified potassium manganate (VII) solution colourless.

22 Which of the following particles contains 12 neutrons, 11 protons and 10 electrons?

A O^{2-} **B** F^{-} **C** Ne **D** Na^{+}

23 Which of the following solutions can be used to distinguish between sodium hydroxide solution and aqueous ammonia?

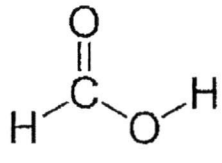
A lead(II) nitrate solution

B iron(II) chloride solution

C iron(III) chloride solution

D zinc sulfate solution

24 What is the total number of shared electrons between carbon and oxygen atoms in the following molecule?



A 4 **B** 6 **C** 8 **D** 10

25 20 cm^3 of oxygen are allowed to react with 20 cm^3 of carbon monoxide according to the following equation:

$$O_2\,(g) + 2CO\,(g) \rightarrow 2CO_2(g)$$

What are the volumes of the gases remaining at the original temperature and pressure?

	volume/ cm^3		
	oxygen	carbon monoxide	carbon dioxide
A	0	0	20
B	0	0	40
C	10	0	20
D	10	10	20

26 When solid potassium chloride is dissolved in water, the temperature of the solution drops. Which conclusion can be made from this observation?

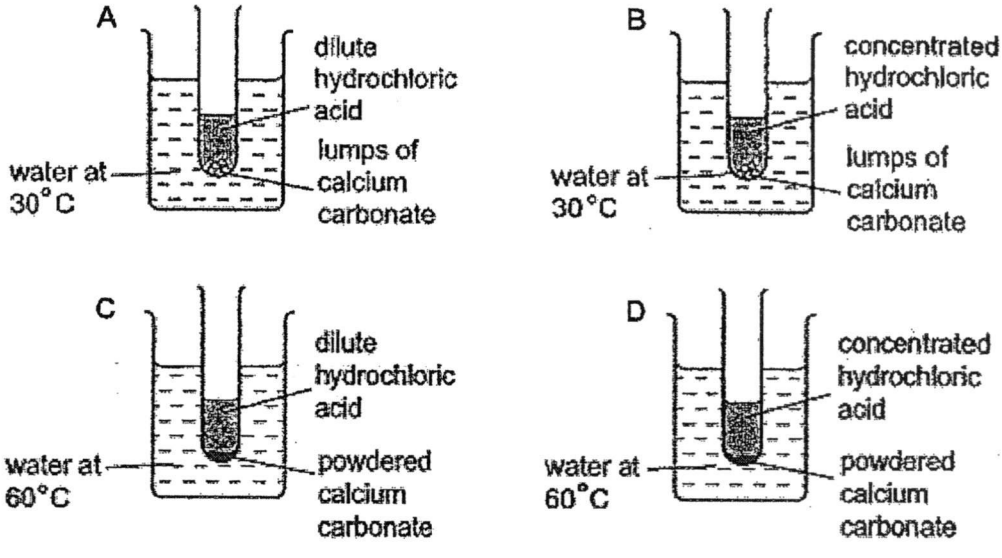
A All solids dissolve with a temperature decrease.

B The process is endothermic.

C The process is exothermic.

D Very little potassium chloride dissolves in water.

27 Which experiment shown below is the slowest?



28 A colourless gas is passed into two different solutions. The results are shown in the table.

solution	potassium iodide	acidified potassium manganate (VII)
result	colourless	purple to colourless

What is the colourless gas?

A an acid

B an alkali

C an oxidising agent

D a reducing agent

29 Which substance below will **not** react with aqueous sodium hydroxide but will react with dilute hydrochloric acid to form a salt and water?

A nitrogen dioxide

B zinc oxide

C tartaric acid

D copper(II) oxide

30 Lithium and rubidium are both in Group I of the Periodic Table. Which statement is correct?

A Lithium ions and rubidium ions have the same electronic configuration.

B Lithium atoms are larger than rubidium ions.

C Lithium atoms and rubidium atoms have the same number of valence electrons.

D Rubidium ions are larger than rubidium atoms.

31 Astatine (At) is in Group VII of the Periodic Table. Which of the following is a property of astatine?

A It forms a basic oxide.

B It is a good conductor of electricity.

C It is displaced from aqueous potassium astatide by chlorine.

D It displaces iodine from aqueous potassium iodide.

32 Which statement about the extraction of iron in the blast furnace is correct?

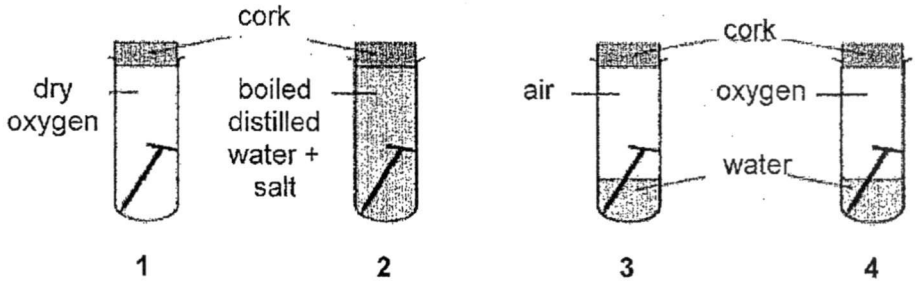
A The oxide of iron is oxidised by carbon monoxide.

B Slag is the basic impurity present in iron ore.

C Slag sinks below molten iron at the base of the furnace.

D The reaction between the oxide of iron and carbon monoxide liberates carbon dioxide.

33 An experiment was set up as shown below to investigate the rate of rusting under different conditions.



Predict the order of the test-tubes in which rust would first appear.

A 1, 2, 3, 4

B 4, 3, 2, 1

C 1, 3, 2, 4

D 4, 2, 3, 1

34 A metal X reacts as follows:

X + dilute acid → salt + hydrogen gas
X + cold water → no reaction
X + copper(II) nitrate solution → copper + nitrate of X

By comparing X with Ca and Cu, we can deduce that the correct order of the metals in decreasing reactivity is:

A Ca Cu X

B Ca X Cu

C X Cu Ca

D Cu Ca X

35 The pH of unpolluted rainwater is about 6.

Which of the following gases is responsible for this?

A methane

B carbon dioxide

C nitrogen dioxide

D carbon monoxide

36 Octane is a fuel that is found in petrol. Which of the following statements is true about octane?

A Combustion of octane is an endothermic process.

B It has a higher boiling point than methane.

C It is an unsaturated compound.

D It undergoes addition reaction with bromine.

37 The gases coming from a car's exhaust contain oxides of nitrogen.

How are these oxides formed?

A Nitrogen reacts with carbon dioxide.

B Nitrogen reacts with carbon monoxide.

C Nitrogen reacts with oxygen.

D Nitrogen reacts with petrol.

38 Which of the following must be the same for compounds in the same homologous series?

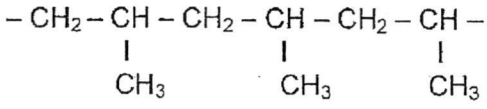
A empirical formula

B functional group

C physical properties

D structural formula

39 A polymer has the structure shown below.



What is the molecular formula of the monomer?

A C_3H_8 **B** C_3H_6 **C** C_2H_4 **D** C_2H_6

40 The following useful products were obtained by cracking a long-chained alkane:

product	use
X	used as a fuel
Y	used to make plastics

What could be the products **X** and **Y**?

	X	Y
A	ethanol	propane
B	hydrogen	ethene
C	methane	ethane
D	steam	ethene

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	– Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57 *	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

Key: a / X / b
a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

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新加坡海星中学

MARIS STELLA HIGH SCHOOL

PRELIMINARY EXAMINATION TWO

SECONDARY FOUR

SCIENCE (CHEMISTRY)

Paper 3

No Additional Materials required

5076/03
5078/03
18 August 2017

1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, index number and class on the cover page.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, glue or correction fluid.

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

Section **B**
Answer **Any Two** questions.
Write your answers in the spaces provided on the question paper.

A copy of the Data Sheet is printed on page 13.
A copy of the Periodic Table is printed on page 14.

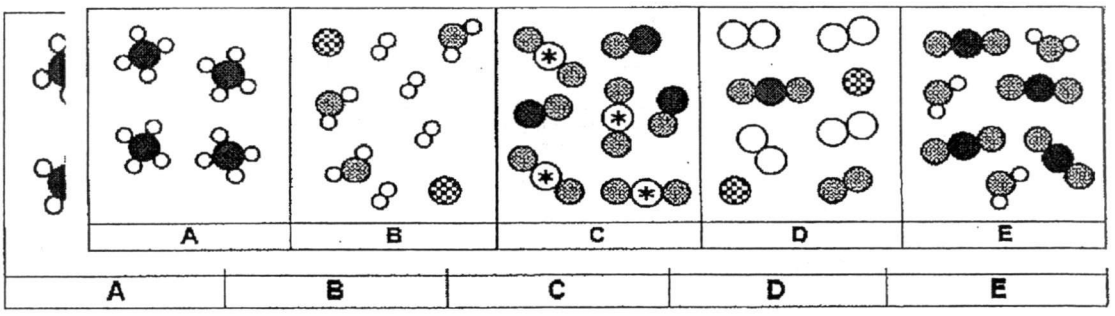
For Examiner's Use	
Sect A	/45
Sect B	/20
Total	/65

This document consists of **14** printed pages

Section A

Answer **all** the questions in this section.

1 The diagrams **A**, **B**, **C**, **D** and **E** represent the particles in five different substances. Each type of atom for the particle is represented by a different symbol.



d once. Which one of the diagrams **A**, **B**, **C**, **D** and **E** best represents

(a) a mixture of compounds formed when methane is burnt with plenty of oxygen, ...

(b) a mixture of two elements and a compound, ...

(c) molecules of methane, ...

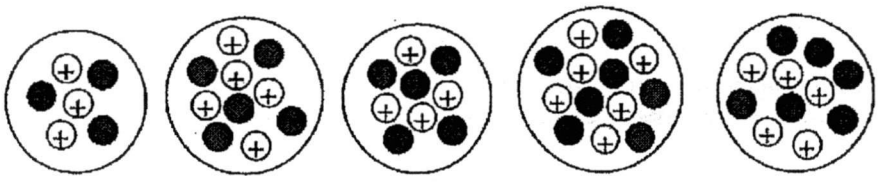
(d) a mixture of gases found in unpolluted air, ...

(e) a mixture of pollutants? .....

[5]

2 The diagrams represent the nuclei of five different atoms, **V**, **W**, **X**, **Y** and **Z**. These letters are **not** the chemical symbols of the elements.

key: ⊕ positively charged sub-atomic particle in the nucleus of an atom



Which of the atoms **V**, **W**, **X**, **Y** and **Z**,

(a) has an atomic number of six, ...

(b) has two electrons in its outermost electron shell, ...

(c) are isotopes of the same element, ...

(d) has a relative atomic mass of six, ...

(e) could form an ion with a charge of 1+? .....

[5]

3 Complete the table below.

	solution	approximate pH	colour of Universal Indicator
(a)	0.1 mol/dm^3 hydrochloric acid		
(b)	0.1 mol/dm^3 sodium hydroxide solution		
(c)	A mixture of 20 cm^3 of **(a)** and 20 cm^3 of **(b)**		

[3]

4 Chromium, Cr, is extracted from a mineral called chromite, $FeCr_2O_4$.

(a) **(i)** Calculate the relative molecular mass of chromite.

[1]

(ii) Calculate the percentage by mass of chromium in chromite.

[1]

(b) In industry, chromite is changed into chromium(III) oxide, Cr_2O_3. Metallic chromium is formed by heating this oxide in hydrogen gas. The balanced chemical equation for this reaction is

$$Cr_2O_3 + 3H_2 \rightarrow 2Cr + 3H_2O$$

Calculate the mass of chromium that could be formed from 76 g of chromium(III) oxide.

[2]

(c) Reactions such as the one in **(b)** are known as redox reactions.

(i) State the oxidation state of chromium in Cr_2O_3.

.....

[1]

(ii) Which substance in the reaction above is reduced? Explain your answer.

.....

.....

[2]

5 Figure 5.1 shows the reactions of a mixture containing two solids **S** and **X**.

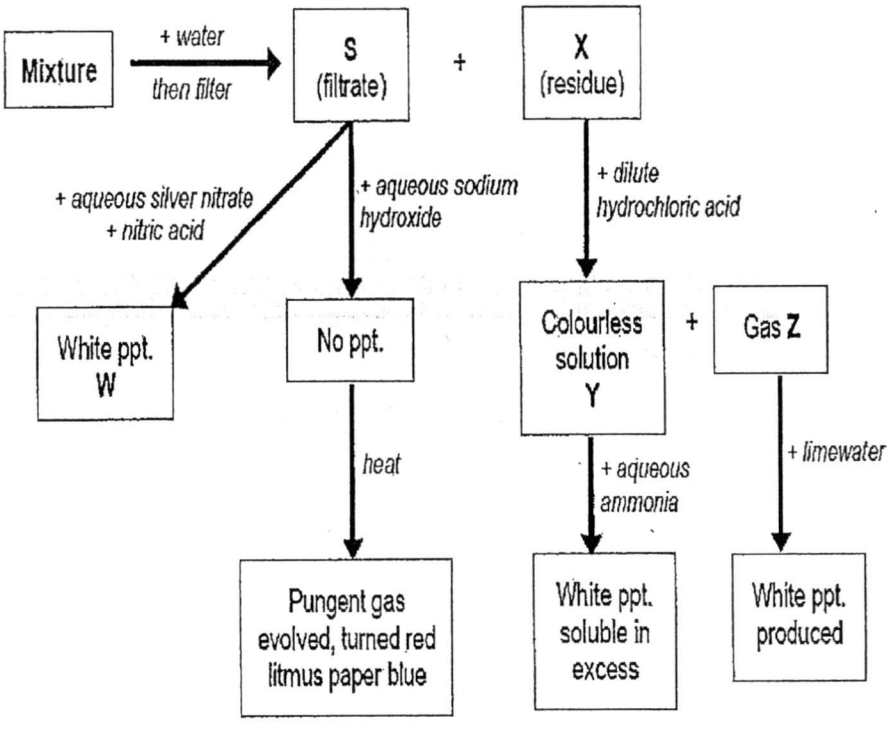


Figure 5.1

(a) Identify substances **S, X, W, Y and Z.**

S .....

X .....

W .....

Y .....

Z .....

[5]

(b) Write a balanced chemical equation for the reaction of **X** with dilute hydrochloric acid.

.....

[2]

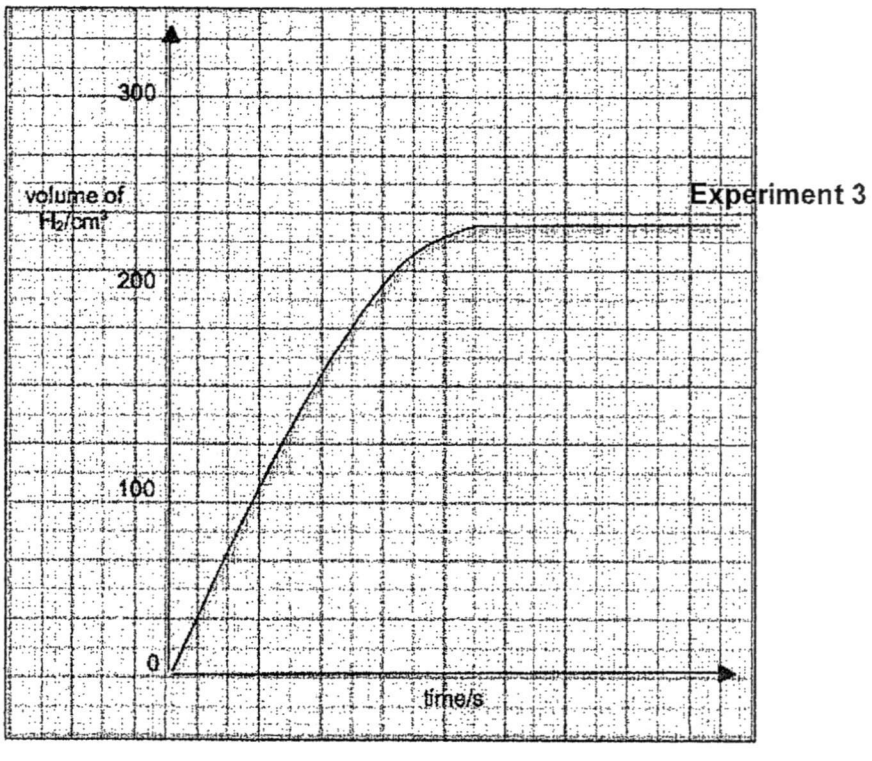
6 A series of experiment were carried out using a data logger to investigate the effect of concentration on the rate of reaction at room temperature.

$$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$$

In each experiment, the volumes of hydrogen produced were measured at regular time intervals.

Experiment	Mass of Mg used / g	Volume of H_2SO_4 used / cm^3	Concentration of H_2SO_4 used / mol/dm^3
1	0.24	20	2.0
2	0.24	20	1.0
3	0.24	20	0.5
4	0.24	20	0.25

The results obtained for **Experiment 3** are shown in the graph below.



(a) **(i)** Draw on the graph above, the results you would expect in **Experiment 2**. Label your graph as **Experiment 2**. [1]

(ii) Use ideas of collisions between particles to explain how increasing concentration of dilute sulfuric acid affect the speed of reaction.

.....

.....

.....

.....

[2]

(b) Using the data given for **Experiment 4**,

(i) calculate the number of moles of magnesium used.

[1]

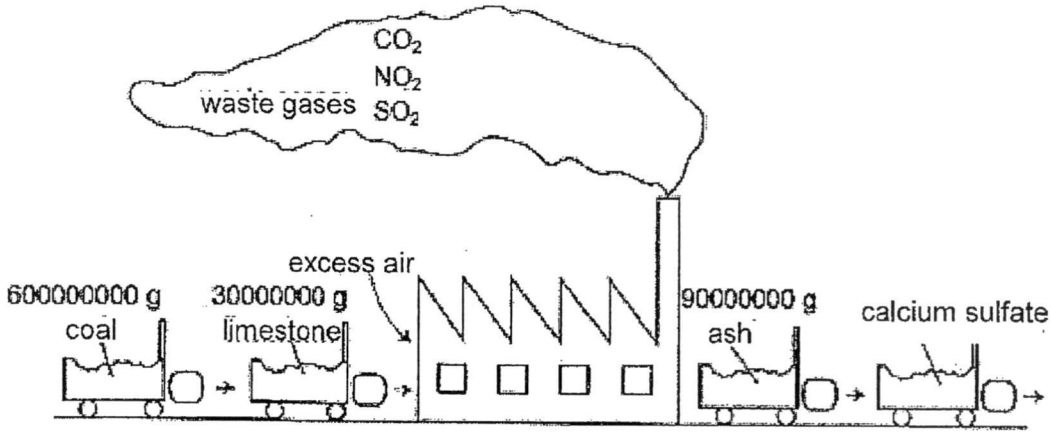
(ii) calculate the number of moles of sulfuric acid used.

[1]

(iii) Based on your calculations, determine the limiting reactant and hence calculate the volume of hydrogen produced.

[2]

7 Some power stations use coal as fuel. Coal contains sulfur impurities. On combustion, sulfur is oxidized to sulfur dioxide. Before the waste gases are released into the atmosphere, the sulfur dioxide is removed by limestone. The diagram shows the amounts of substances used and produced by a coal-fired power station in a day.



(a) Write a balanced chemical equation for the combustion of sulfur to sulfur dioxide.

.....

[1]

(b) State a harmful effect of sulfur dioxide.

.....

[1]

(c) Limestone removes sulfur dioxide from the waste gases, as shown in the equation below.

$$CaCO_3\,(s) + SO_2\,(g) \rightarrow CaSO_3\,(s) + CO_2\,(g)$$

Calculate the maximum volume of carbon dioxide produced from 30000000 g (30 tonnes) of limestone.

[3]

(d) When the limestone was first used in the power stations, some scientists claimed they 'solved all pollution problems at the power stations'.

Explain why this is not true.

.....

.....

[2]

8 The table shows some information about the homologous series of organic compounds called esters. Esters are formed when a carboxylic acid reacts with an alcohol.

carboxylic acid + alcohol → ester + water

The table shows the different esters produced when different carboxylic acids react with an alcohol (ethanol).

carboxylic acid	alcohol	name of ester formed	molecular formula of ester formed
methanoic acid $HCOOH$	ethanol C_2H_5OH	ethyl methanoate	$HCOOC_2H_5$
ethanoic acid CH_3COOH	ethanol C_2H_5OH		
propanoic acid C_2H_5COOH	ethanol C_2H_5OH	ethyl propanoate	$C_2H_5COOC_2H_5$
butanoic acid C_3H_7COOH	ethanol C_2H_5OH	ethyl butanoate	$C_3H_7COOC_2H_5$

(a) Complete the table to show the name and molecular formula of the ester formed when ethanoic acid reacts with ethanol.

[2]

(b) **(i)** Explain using the formulae given in the table to show that esters are an example of a homologous series.

.....

[1]

(ii) Suggest one difference, in terms of their physical property, between ethyl methanoate and ethyl butanoate.

.....

[1]

Section B
Answer any **two** questions.

9 **(a)** When atoms combine with other atoms, they either gain, lose or share electrons. Describe in terms of the number of electrons gained, lost or shared when

(i) a carbon atom combines with oxygen atom(s),

.....

.....

.....

[2]

(ii) a sodium atom combines with chlorine atom(s).

.....

.....

.....

[2]

(b) Draw a "dot and cross" diagram for either **one** of the substances formed in **(ai)** or **(aii)**.

[2]

(c) Explain in terms of bonding and structures the difference in the melting points of the substances formed in **(ai)** and **(aii)**.

.....

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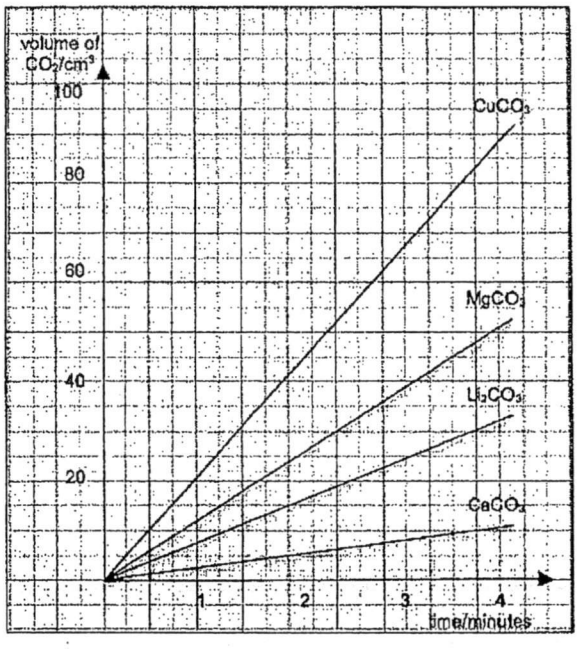
[4]

10 (a) When equal number of moles of some metal carbonates are heated strongly, they decompose to produce carbon dioxide.

The graph below shows the results of an investigation of the rate of decomposition of 0.010mole of four carbonates. The volume of carbon dioxide produced is measured every minute.



(i) Name the carbonate that decomposed at the fastest rate.

.....

[1]

(ii) The more reactive the metal, the higher the temperature needed to decompose its compound.
Based on the information given from the graph, arrange the 4 metals in descending order of their reactivity (the most reactive first). Explain your answers.

.....

.....

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.....

.....

[3]

(iii) How could you tell from the graph that the decomposition of the carbonates was not complete?

.....

[1]

(b) Describe how the reactions of magnesium, copper and iron with dilute hydrochloric acid may be used to place them in an order of reactivity. Write a balanced chemical equation for any one of the reactions you describe.

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[5]

11 **(a)** **E** is a hydrocarbon with the formula C_2H_6 and **F** is a hydrocarbon with the formula C_2H_4.

(i) Draw the structural formulae of **E** and **F**.

[2]

(ii) Compare and contrast the chemical properties of **E** and **F** with reference to aqueous bromine and complete combustion reactions. Write chemical equations for all the reactions that you have mentioned.

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[5]

(b) Ethanol is a very important substance because it is used as a fuel in many countries. One of the productions of ethanol is by the process of fermentation.

(i) Starting from cane sugar, describe briefly how it is converted into ethanol during this process.

.....

.....

.....

.....

[2]

(ii) Write an equation to represent this process.

.....

[1]

Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	– Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
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– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

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†90-103 Actinoid series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

Key: a / X / b
a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

Maris Stella High School
Secondary Four Science Chemistry
Preliminary Examination 2
Mark Scheme 2017

Paper 1

21 C	22 D	23 A	24 B	25 C	26 B	27 A	28 D	29 D	30 C
31 C	32 D	33 B	34 B	35 B	36 B	37 C	38 B	39 B	40 B

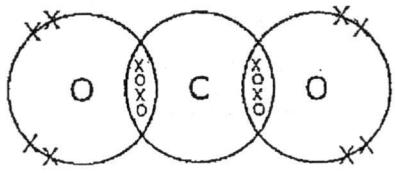
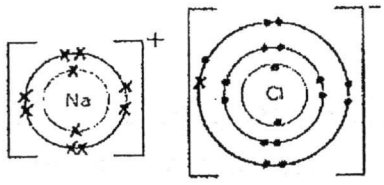
Paper 3
Section A

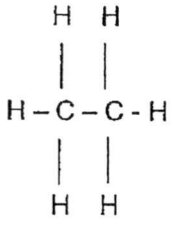
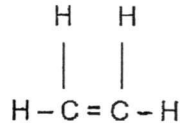
<table>
<tr><th>Qn No.</th><th>Answer</th></tr>
<tr><td>1a</td><td>E</td></tr>
<tr><td>b</td><td>B</td></tr>
<tr><td>c</td><td>A</td></tr>
<tr><td>d</td><td>D</td></tr>
<tr><td>e</td><td>C</td></tr>
<tr><td></td><td></td></tr>
<tr><td>2a</td><td>Y</td></tr>
<tr><td>b</td><td>X</td></tr>
<tr><td>c</td><td>W and Z</td></tr>
<tr><td>d</td><td>V</td></tr>
<tr><td>e</td><td>V</td></tr>
<tr><td></td><td></td></tr>
<tr><td>3</td><td>
<table>
<tr><th colspan="2">solution</th><th>approximate pH</th><th>colour of Universal Indicator</th></tr>
<tr><td>(a)</td><td>0.1M HCl</td><td>1</td><td>red</td></tr>
<tr><td>(b)</td><td>0.1M NaOH</td><td>14</td><td>violet</td></tr>
<tr><td>(c)</td><td>20cm^3 of (a) and 20cm^3 of (b)</td><td>7</td><td>green</td></tr>
</table>
</td></tr>
<tr><td></td><td></td></tr>
<tr><td>4ai</td><td>M_r of $FeCr_2O_4$ = 56 + 2(52) + 4(16)
= 224</td></tr>
<tr><td>ii</td><td>Percentage of Cr in $FeCr_2O_4$ = 2(52) □224 x 100
= 46.4 %</td></tr>
<tr><td>b</td><td>No of moles of Cr_2O_3 = 76 □[2(52) + 3(16)]
= 0.5 mol
From eqn,
1 mole Cr_2O_3 produces 2 moles Cr
0.5 mole Cr_2O_3 produces 1 mole Cr

Mass of chromium produced = 1 x 52g =52g</td></tr>
<tr><td>ci</td><td>Oxidation state of chromium = +3</td></tr>
<tr><td>ii</td><td>Chromium (III) oxide is reduced.
Oxidation state of chromium decreases from +3 in Cr_2O_3 to 0 in Cr</td></tr>
<tr><td></td><td></td></tr>
</table>

Qn No.	Answer
5a	S – ammonium chloride X – zinc carbonate W – silver chloride Y – zinc chloride Z – carbon dioxide
b	$ZnCO_3 + 2HCl \rightarrow ZnCl_2 + CO_2 + H_2O$
6ai	Graph showing steeper gradient and same volume of H_2
ii	Increasing concentration causes the **number of sulfuric acid particles per unit volume** to **increase. Frequency of collisions** to increase. **Chance of effective collisions increases** resulting in **speed of reaction** to **increase.**
bi	Number of moles of magnesium used = 0.24 □24= 0.0100 mole
ii	Number of moles of sulfuric acid used = $0.02dm^3 \times 0.25mol/dm^3$ = 0.00500 moles
iii	From eqn, 1 mole Mg reacts with 1 mole of H_2SO_4 0.01 mole H_2SO_4 needed to react with 0.01 mole Mg but only 0.005 moles H_2SO_4 is present. Therefore is H_2SO_4 the limiting reagent. 1 mole H_2SO_4 produces 1 mole H_2 0.005 mole H_2SO_4 produces 0.005 mole H_2 Volume of hydrogen produced = $0.005 \times 24 = 0.120dm^3$
7a	$S + O_2 \rightarrow SO_2$
b	Formation of acid rain, which destroys buildings and kill plants/eyes irritation/breathing difficulties
c	No. of moles of $CaCO_3 = \frac{30000000}{40+12+(16\times3)}$ = **300000 mol** From eqn, 1 mole $CaCO_3$ produces 1 mole of CO_2 300000 moles $CaCO_3$ produce **300000 moles CO_2** Volume of CO_2 = 300000 × $24dm^3$ = **7200000 dm^3**
d	Carbon dioxide is produced which causes global warming. Nitrogen dioxide is produced which causes acid rain.
8a	Ethyl ethanoate $CH_3COOC_2H_5$
bi	Each member differs from the next by a **$-CH_2-$** group Molecular formula of ethyl propanoate $C_2H_5COOC_2H_5$ differs from ethyl butanoate $C_3H_7COOC_2H_5$ by a **$-CH_2-$** group
ii	Ethyl butanoate has a higher melting point/boiling point/density /viscosity than ethyl methanoate.

Section B

Qn No.	Answer
9ai	Carbon: 2, 4 Oxygen: 2, 6 Each carbon atom **shares 1 pair of electrons/2 electrons** each with **2 oxygen atoms** to have stable octet configuration/noble gas structure.
ii	Na: 2, 8, 1 Chlorine: 2, 8, 7 Each sodium atom **loses 1 electron** to 1 chlorine atom to form Na^+ (2, 8) with stable octet/noble gas structure Each chlorine atom **gains one electron** to form Cl^- (2, 8, 8) with octet/noble gas structure.
b	 CO_2 correct no. of valence electrons correct no. of shared electrons  NaCl correct no. of valence electrons correct charge
c	Sodium chloride is an **ionic compound**. Sodium ions and chloride **ions** are **held** together **by strong electrostatic forces of attraction**. Sodium chloride has **high melting point** because **a lot of heat** is required **to overcome these forces of attraction**. Atoms in carbon dioxide molecules are held by **covalent bonds**. **Molecules are held by weak forces of attraction**/weak intermolecular forces of attraction. Carbon dioxide has **low melting point** because **little heat** is required to **overcome the weak intermolecular forces of attraction.**
10ai	Copper(II) carbonate
	Calcium, lithium, magnesium and copper **Gradient for** the decomposition of **calcium carbonate** is the **least steep**, followed by lithium carbonate, magnesium carbonate and copper(II) carbonate. When **gradient** is the **least steep**, the **rate of decomposition** is the **lowest**. Amount of heat required to decompose calcium carbonate is the **steepest** therefore calcium is the most reactive. OR Gradient for the decomposition of copper(II) carbonate is the highest, hence the rate of decomposition is the highest. Copper is the least reactive.
iii	The volume of carbon dioxide produced has not become constant after 4 minutes. OR the volume of carbon dioxide is still increasing. OR the gradient of graph is not zero.

<table>
<tr><th>Qn No.</th><th>Answer</th></tr>
<tr><td>b</td><td>Magnesium reacts vigorously with dilute hydrochloric acid to produce magnesium chloride and hydrogen gas.
Iron reacts slowly with dilute hydrochloric acid to form iron(II) chloride and hydrogen gas.
Copper does not react with acids.
Hence magnesium is the most reactive, followed by iron and copper.
Any one of the chemical equations
$Mg + 2HCl \rightarrow MgCl_2 + H_2$
$Fe + 2HCl \rightarrow FeCl_2 + H_2$</td></tr>
<tr><td></td><td></td></tr>
<tr><td>11ai</td><td> 
E
 
F</td></tr>
<tr><td>ii</td><td>
<table>
<tr><th></th><th>E</th><th>F</th></tr>
<tr><td>bromine</td><td>Reacts with bromine in the presence of ultra violet light to form bromoethane and hydrogen bromide.

$C_2H_6 + Br_2 \rightarrow C_2H_5Br + HBr$</td><td>Reacts with bromine water to form <u>dibromoethane</u>.

$C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$</td></tr>
<tr><td>complete combustion</td><td colspan="2">Both react with oxygen to form carbon dioxide and water. F burns with a smokier flame.

$2C_2H_6 + 7O_2 \rightarrow 6H_2O + 4CO_2$
$C_2H_4 + 3O_2 \rightarrow 2H_2O + 2CO_2$</td></tr>
</table>
</td></tr>
<tr><td>bi</td><td>Cane sugar (glucose) solution is mixed with yeast and the mixture is kept at about 37°C in the absence of oxygen.
Sugar is converted to ethanol and carbon dioxide.</td></tr>
<tr><td>ii</td><td>$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$</td></tr>
<tr><td></td><td></td></tr>
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