

- 21 Which changes describe what happens when hot water is cooled to room temperature?

	arrangement of particles	energy change
A	moving further apart	endothermic
B	moving further apart	exothermic
C	moving closer together	endothermic
D	moving closer together	exothermic

- 22 Samples of tinned apricots, beans, corn and tomatoes were tested for additives using chromatography. The chromatograms were compared with those of three artificial additives, P, Q and R.

The results were shown below.

	o		o				
		o	o				o
o							
		o				o	
o					o		
	o	o					
apricots	beans	corn	tomatoes	P	Q	R	

Which tinned food does not contain any artificial additives?

- A apricots
 B beans
 C corn
 D tomatoes
- 23 Which of the following could be used to measure the volume of dilute hydrochloric acid needed to titrate 25.0 cm³ of aqueous potassium hydroxide?
- I burette
 II pipette
 III measuring cylinder
- A I only
 B II only
 C I and II only
 D I, II and III

- 24 An element, S, has p protons and n neutrons in its nucleus.

Which row gives the correct number of protons, neutrons and electrons in a positive ion of an isotope of S?

	number of protons	number of neutrons	number of electrons
A	p	$n + 1$	$p + 1$
B	p	$n + 1$	$p - 1$
C	$p + 1$	n	$p + 1$
D	$p + 1$	n	$p - 1$

- 25 Elements X and Y form the compound X_3Y . Which of the following is the correct electronic configuration of atoms X and Y?

	electronic configuration of atom X	electronic configuration of atom Y
A	2,1	2,3
B	2,5	2,1
C	2,8,1	2,8,5
D	2,8,5	2,8,3

- 26 The formula of an oxide of an unknown metal, U is UO_2 ?
What is the formula of the corresponding fluoride?

- A UF_2 C UF_4
B U_2F D U_4F

- 27 A chemist discovered four unknown solids W, X, Y and Z during a research trip. He conducted a few experiments to identify the solids. The following are the results of his experiments.

Solid W

Solid W has a constant composition and decomposes into two elements when heated.

Solid X

Solid X is coloured grey and is attracted to a magnet. It cannot be decomposed into anything simpler.

Solid Y

Solid Y is coloured white. Only some parts dissolve in an excess of water.

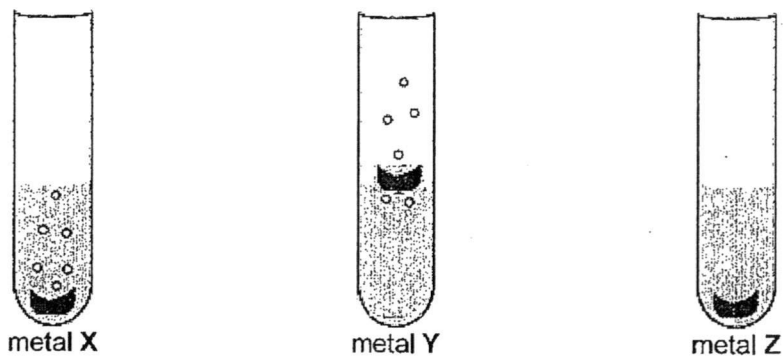
Solid Z

Solid Z is black. It can be formed by strongly heating copper in oxygen.

Which of the above solids can be classified as compounds?

- A W and Y C X and Y
B W and Z D X and Z

- 28 Metal cubes of the same size are made of three different metals, X, Y and Z. They were placed in test tubes containing dilute sulfuric acid.



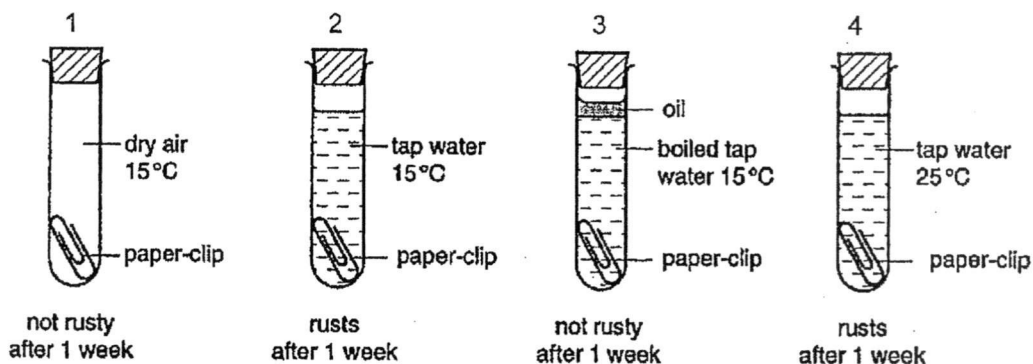
What are the possible identities of X, Y and Z?

	X	Y	Z
A	magnesium	sodium	silver
B	copper	zinc	iron
C	zinc	potassium	calcium
D	iron	magnesium	copper

- 29 Which of the following oxides reacts with both aqueous ammonia and dilute sulfuric acid to form a salt and water only?

- A carbon monoxide C sulfur dioxide
 B iron(II) oxide D lead(II) oxide

- 30 Four experiments on rusting are shown below.



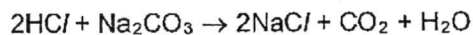
Which two experiments can be used to show that air is needed for rusting?

- A 1 and 2 C 2 and 3
 B 1 and 3 D 3 and 4

31 In which process is energy released to the surrounding?

- A dissolving ammonium nitrate in water
- B reacting hydrochloric acid with sodium hydroxide
- C sublimation of dry ice
- D thermal decomposition of copper(II) carbonate

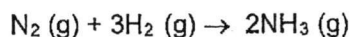
32 The reaction of sodium carbonate and hydrochloric acid is shown below.



What is the volume of 0.2 mol/dm^3 hydrochloric acid required to react completely with 25.0 cm^3 of 0.1 mol/dm^3 aqueous sodium carbonate?

- A 12.5 cm^3
- B 25.0 cm^3
- C 50.0 cm^3
- D 100.0 cm^3

33 Ammonia can be produced by reacting nitrogen gas and hydrogen gas. The chemical equation for the reaction is



If 300 cm^3 of nitrogen gas reacted with 600 cm^3 of hydrogen gas, what is the total volume of gaseous substances remaining after the reaction? (all volumes are measured at r.t.p.)

- A 300 cm^3
- B 400 cm^3
- C 500 cm^3
- D 600 cm^3

34 Small portions of aqueous potassium iodide and acidified aqueous potassium manganate(VII) were added to four solutions. The colour changes were as shown in the table.

Which solution contained only a reducing agent?

	potassium iodide	potassium manganate(VII)
A	no visible reaction	purple to colourless
B	colourless to brown	purple to colourless
C	no visible reaction	no visible reaction
D	colourless to brown	no visible reaction

35 The equations show some reactions involving zinc and its compounds.

- 1 zinc + oxygen → zinc oxide
- 2 zinc carbonate → zinc oxide + carbon dioxide
- 3 zinc oxide + carbon → zinc + carbon monoxide

In which reaction(s) has the underlined substance been reduced?

- A 1
 B 1 and 2
 C 2 and 3
 D 3

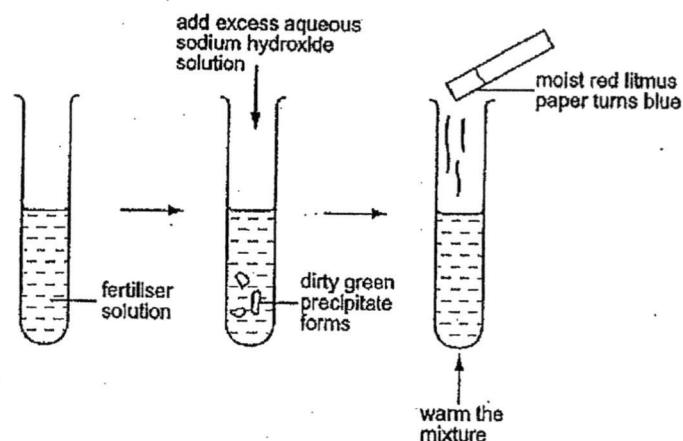
36 Iron is extracted from its ore, haematite, by a reduction process using coke. Which reaction in the blast furnace causes the removal of impurities from the product?

- A $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
 B $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$
 C $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$
 D $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$

37 A gas is evolved when iron(II) carbonate reacts with solution X. A test is carried out to identify the gas evolved. Which of the following identifies solution X and suggests a test that will give a positive result for the gas evolved?

	solution X	test for gas
A	sulfuric acid	limewater
B	sodium hydroxide	moist blue litmus paper
C	sulfuric acid	lighted splint
D	sodium hydroxide	moist red litmus paper

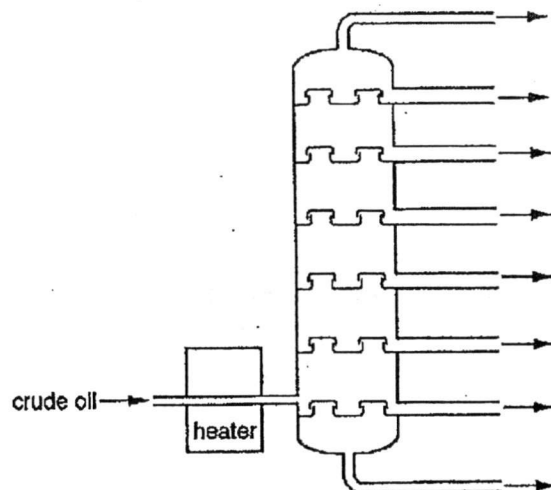
38 A solution of fertiliser was tested as shown below.



Which ions must be present in the fertilizer?

- A NH_4^+ and NO_3^-
 B NH_4^+ and Fe^{2+}
 C Fe^{2+} and NO_3^-
 D Fe^{3+} and NH_4^+

- 39 The diagram shows the apparatus used for the fractional distillation of crude oil.



Which statement about the fractional distillation of crude oil is correct?

- A At each level in the column, only one compound is collected.
 - B The higher up the column, the higher is the temperature.
 - C The molecules at the top of the column have the largest relative molecular mass.
 - D The molecules collected at the bottom of the column are the least flammable.
- 40 Butane undergoes the first substitution reaction with chlorine in the presence of ultraviolet light. A student suggested that the following organic products are formed.

- 1 $\text{CH}_3\text{CHClCH}_2\text{CH}_3$
- 2 $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$
- 3 $\text{CH}_3\text{CHClCH}_2\text{CH}_3$
- 4 $\text{CCl}_3\text{CCl}_2\text{CCl}_2\text{CCl}_3$

Which of these four products are formed during the first substitution reaction?

- A 1 and 2
- B 2 and 3
- C 1, 2 and 3
- D 1, 2, 3 and 4

End of paper

DATA SHEET

The Periodic Table of the Elements

Group		I	II	III	IV	V	VI	VII	0
		1 H Hydrogen 1							4 He Helium 2
7	9	3 Li Lithium	4 Be Beryllium						20 Ne Neon
23	24	11 Na Sodium	12 Mg Magnesium						10 Ar Argon
39	40	19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron
85	88	37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium
133	137	55 Cs Caesium	56 Ba Barium	57 La Lanthanum	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium
87	88	87 Fr Francium	88 Ra Radium	89 Ac Actinium					
					59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium
					77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium
					91 Zr Zirconium	92 Nb Niobium	93 Mo Molybdenum	94 Tc Technetium	95 Ru Ruthenium
					101 Rh Rhodium	102 Pd Palladium	103 Ag Silver	104 Cd Cadmium	105 In Indium
					106 Ni Nickel	107 Cu Copper	108 Zn Zinc	109 Ga Gallium	110 Ge Germanium
					115 Sb Antimony	116 Te Tellurium	117 I Iodine	118 Xe Xenon	119 Sn Tin
					127 Br Bromine	128 Se Selenium	129 As Arsenic	130 S Sulfur	131 P Phosphorus
					135 Cl Chlorine	136 O Oxygen	137 N Nitrogen	138 F Fluorine	139 He Helium
					140 Ce Cerium	141 Pr Praseodymium	142 Nd Neodymium	143 Pm Promethium	144 Sm Samarium
					145 Th Thorium	146 Pa Protactinium	147 U Uranium	148 Np Neptunium	149 Pu Plutonium
					150 Am Americium	151 Cm Curium	152 Bk Berkelium	153 Cf Californium	154 Es Einsteinium
					155 Fm Fermium	156 Md Mendelevium	157 No Nobelium	158 Lr Lawrencium	159 Lu Lutetium
					162 Dy Dysprosium	163 Ho Holmium	164 Er Erbium	165 Tm Thulium	166 Yb Ytterbium
					167 Ho Holmium	168 Er Erbium	169 Tm Thulium	170 Yb Ytterbium	171 Lu Lutetium
					172 Lu Lutetium	173 Yb Ytterbium	174 Er Erbium	175 Tm Thulium	176 Lu Lutetium

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

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 dm³ at room temperature and pressure (r.t.p.).

Candidate Name: _____ Class _____ Index No. _____



FUHUA SECONDARY SCHOOL

Secondary Four Express / Five Normal (Academic)

Preliminary Examination 2017

4E/5N

Fuhua Secondary Fuhua Secondary

SCIENCE (CHEMISTRY, PHYSICS)

5076/3

PAPER 3

Additional Materials:
Electronic calculator

DATE 18 August 2017
TIME 1045 – 1200
DURATION 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name, class and index number in the spaces provided on top of this page.
- Write in dark blue or black pen.
- You may use a HB pencil for any diagrams or graphs.
- Do not use staples, paper clips, glue or correction fluid.

Section A (45 marks)

Answer **all** questions.
Write your answers in the spaces provided.

Section B (20 marks)

Answer any **two** questions from this section and write your answers in the spaces provided.

The number of marks is given in brackets [] at the end of each question or part question.
A copy of the Periodic Table is printed on page 11.
The use of an approved scientific calculator is expected, where appropriate.

PARENT'S SIGNATURE	FOR EXAMINER'S USE		
	Section A	Section B	Total
	/45	/20	/65

Setter: Wan Yan Ying

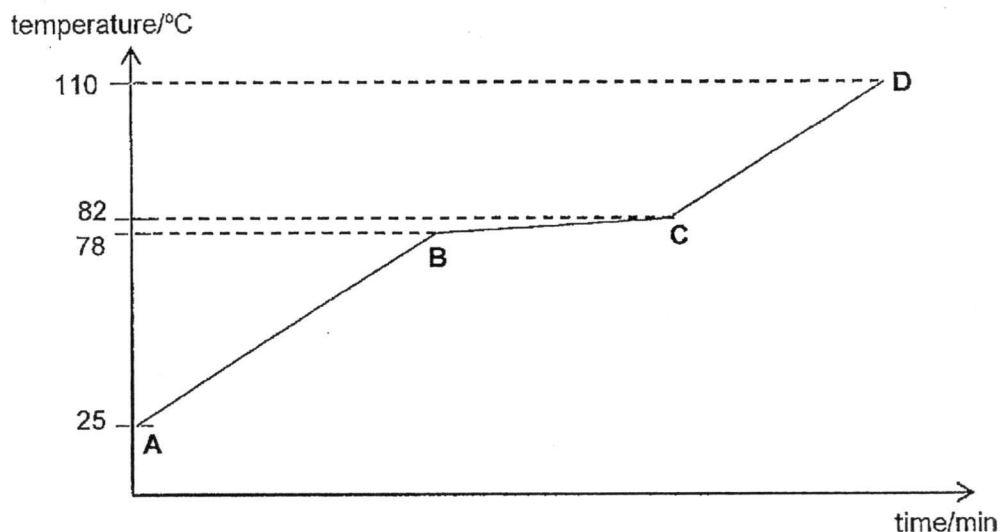
Vetter: Mdm Hia Soo Ching

This question paper consists of **11** printed pages including this page.

Section A: Structured Questions [45 marks]

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

- A1** A sample of solid naphthalene was heated, and its temperature was measured at regular intervals. The figure below shows the graph obtained by the end of the experiment.



- (a) Suggest the state(s) naphthalene can be found at each interval on the graph by putting a tick (✓) in the correct box. You may tick more than one box in each row. [3]

	solid	liquid
between A and B		
between B and C		
between C and D		

- (b) State and explain whether this sample of naphthalene is pure. [1]

- (c) Describe the change in arrangement and movement of particles as naphthalene is heated from 50 °C to 100 °C. [2]

A2 Iron is a metallic element.

- (a) State two properties of iron which are different from those of Group I metals. [2]

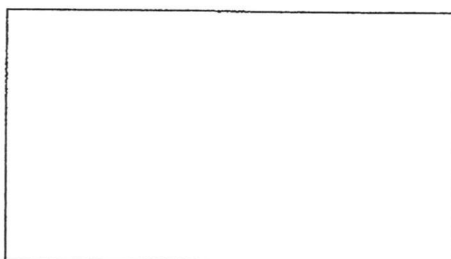
- (b) The symbols for two isotopes of iron are shown below



- (i) How do these two isotopes differ in their atomic structure? [1]

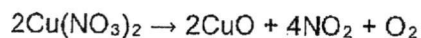
- (ii) How many electrons are there in a Fe^{3+} ion? [1]

- (c) Pure iron is not strong enough to make structures such as bridges. An alloy of iron, such as steel is manufactured to increase the strength of materials for daily uses. Explain, with the aid of a labelled diagram, why steel is stronger than pure iron. [3]



structure of steel

- A3 A sample of 94 g copper(II) nitrate decomposes upon heating according to the equation:



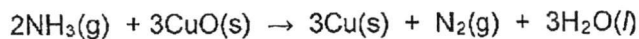
- (a) Calculate the volume of oxygen gas produced at room temperature and pressure. [3]

- (b) The nitrogen dioxide gas produced is an air pollutant which is also formed in car engines.

- (i) Explain, with suitable chemical equations, how nitrogen dioxide is formed in a car engine. [2]

- (ii) State two harmful effects of nitrogen dioxide, one on health and one on the environment. [2]

A4 Ammonia reacts with copper (II) oxide according to the following redox reaction.



- (a) Name the reducing agent in this reaction. Explain your answer. [2]

- (b) What is the change in oxidation state of nitrogen in the reaction? [1]

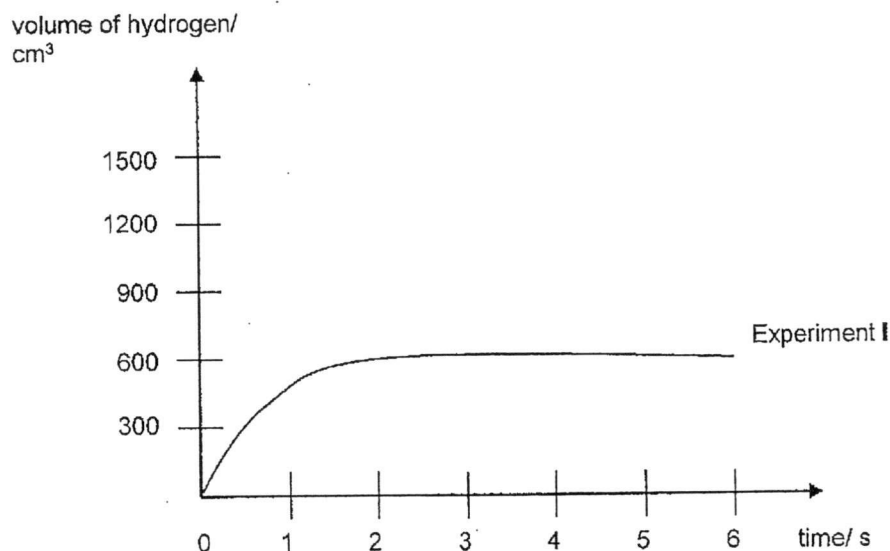
- (c) Ammonia gas dissolves in water to form aqueous ammonia. Aqueous ammonia reacts with dilute sulfuric acid to produce a salt and water.

- (i) Write the name and chemical formula of the salt produced. [1]

- (ii) State the name of the reaction between aqueous ammonia and sulfuric acid. [1]

- (iii) Write the ionic equation for the reaction between aqueous ammonia and sulfuric acid. [1]

A5 In Experiment I, 6.00 g of magnesium powder is reacted with excess dilute hydrochloric acid at room temperature and pressure. The following shows how the total volume of hydrogen evolved changed with time.



- (a) Write a balanced chemical equation for the reaction between magnesium and hydrochloric acid. [2]

- (b) Two further reactions were carried out.

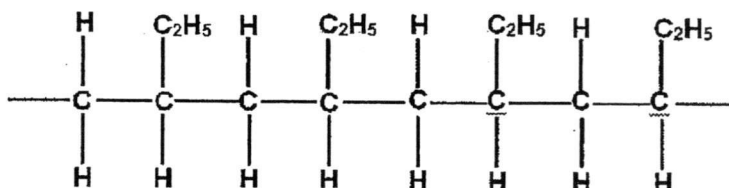
Conditions for Experiment II were the same as Experiment I, except that 15.0 g of magnesium was used.

Conditions for Experiment III were the same as Experiment I, except that the concentration of hydrochloric acid was doubled.

Sketch the graphs for Experiment II and Experiment III on the same axes above. Label your graphs clearly. [2]

- (c) Explain, in terms of collisions between particles, the graph that you have drawn for Experiment III in part (b). [2]

- A6 A monomer undergoes addition polymerisation to form a polymer. Part of the structure of polymer is shown below.



- (a) Draw the structure of the monomer from which the polymer is formed. [1]

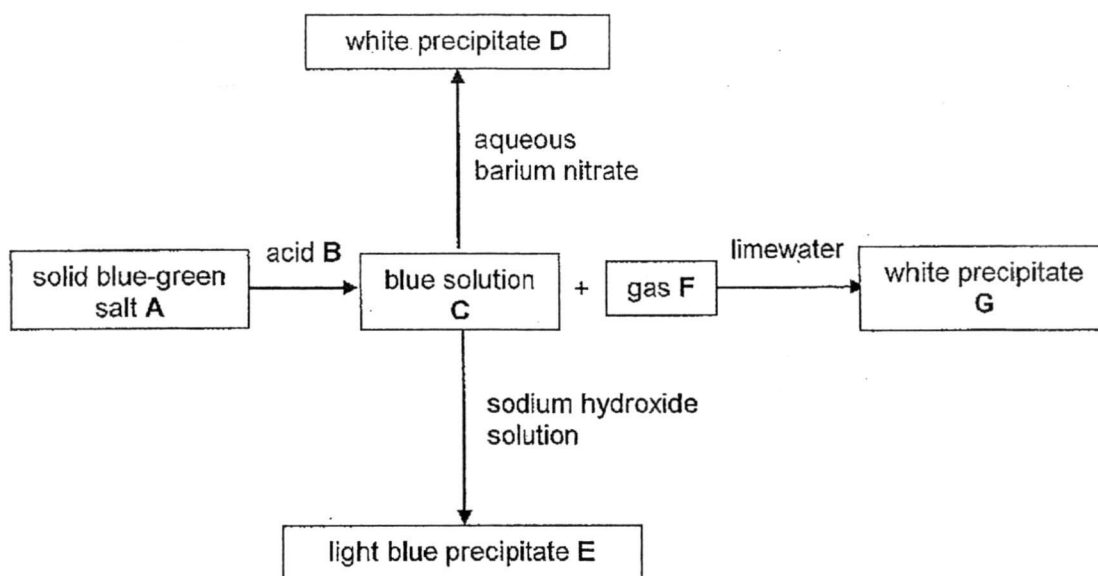
- (b) What change would you expect to see when a sample of the monomer is shaken with aqueous bromine? [1]

- (c) The monomer can be made by cracking tetradecane, $C_{14}H_{30}$ in industry. One other product is formed at the same time.

- (i) Write a chemical equation for the reaction. [1]

- (ii) State the conditions necessary for the reaction to take place. [1]

A7 The figure below describes reactions involving a blue-green salt, A.



(a) Name the substances A to G.

[7]

- A _____
B _____
C _____
D _____
E _____
F _____
G _____

(b) Write a chemical equation, with state symbols, for the reaction between A and B.

[2]

Section B: Free Response Questions [20 marks]

Answer any **two** questions from this section and write your answers in the spaces provided.

B1 A soluble salt, sodium phosphate, Na_3PO_4 , is used in washing powder as a water softener. It is made by reacting dilute phosphoric acid, H_3PO_4 , with an alkali.

(a) (i) Give the formula of the ions present in sodium phosphate. [1]

(ii) Name the alkali used to react with phosphoric acid to obtain sodium phosphate. [1]

(iii) Write a balanced chemical equation for the reaction. [2]

(b) Describe the steps involved in preparing a pure and dry sample of sodium phosphate salt by reacting dilute phosphoric acid and the alkali. [6]

B2 Fluorine, chlorine, bromine and iodine are called halogens and are found in Group VII of the Periodic Table.

(a) Describe the trend in colour and physical state (at room temperature and pressure), as the atomic number of the elements increases. [2]

(b) You are provided with the following substances.

aqueous chlorine	aqueous bromine
aqueous potassium chloride	aqueous potassium bromide

Use the substances from the list to show that bromine is less reactive than chlorine. You may include details of observation and chemical equation(s) for the reaction(s). [3]

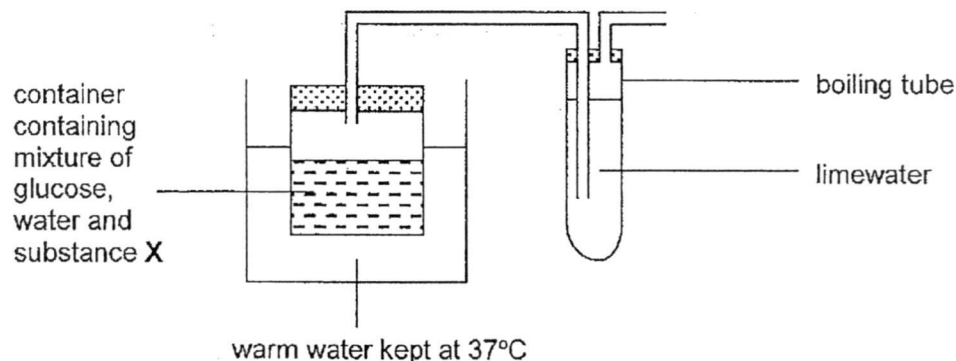
(c) Draw 'dot and cross' diagrams to show the bonding in potassium chloride and chlorine molecule. Show only the outer electrons in your diagrams. [4]

potassium chloride

chlorine

(d) Suggest whether aqueous potassium chloride is a conductor of electricity. Explain your answer. [1]

- B3** Ethanol can be made from glucose, $C_6H_{12}O_6$, by fermentation. Using the apparatus shown below, a student conducted a fermentation experiment in the laboratory.



- (a) Name the substance **X** that the student must add to the glucose solution in order to produce ethanol in the container. [1]
- _____
- (b) Explain why the temperature for the fermentation mixture must be kept below $40^\circ C$. [1]
- _____
- (c) Describe and explain the changes that would occur in the boiling tube after 2 hours. [2]
- _____
- _____
- (d) Ethanol can be used as a fuel when burnt in excess air.
- (i) Write a balanced chemical equation for the reaction. [2]
- _____
- (ii) Suggest whether the reaction is exothermic or endothermic. Explain your answer. [1]
- _____
- (e) Ethanol is oxidised in air to form another organic compound.
- (i) State the name and draw the structural formula of the organic compound formed. [2]
- Name of organic compound: _____
- Structural formula: _____
- (ii) If a few drops of Universal Indicator are added to the organic compound formed, what would be the colour observed? [1]
- _____

DATA SHEET

Colours of some common metal hydroxides

Hydroxide	Colour
Aluminium hydroxide	White
Calcium hydroxide	White
Copper(II) hydroxide	Light blue
Iron(II) hydroxide	Green
Iron(III) hydroxide	Red-brown
Lead(II) hydroxide	White
Zinc hydroxide	White

DATA SHEET

The Periodic Table of the Elements

		Group																								
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	I	II													
7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1										4 He Helium 2	20 Ne Neon 10	36 Ar Argon 18												
23 Na Sodium 11	24 Mg Magnesium 12	11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18	54 Xe Xenon 54	86 Rn Radon 86														
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	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	101 Ru Ruthenium 44	106 Rh Rhodium 45	108 Ag Silver 47	115 In Indium 49	119 Sn Tin 50	127 I Iodine 53	131 Xe Xenon 54	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86										
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	197 Au Gold 79	195 Pt Platinum 78	201 Hg Mercury 80	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86											
87 Fr Francium	88 Ra Radium	89 Ac Actinium											175 Lu Lutetium 71	177 Yb Ytterbium 70	179 Tm Thulium 69	181 Er Erbium 68	183 Fm Fermium 100	185 Es Einsteinium 99	187 Cf Californium 98	189 Bk Berkelium 97	191 Cm Curium 96	193 Am Americium 95	195 Pu Plutonium 94	197 Np Neptunium 93	199 Pa Protactinium 91	201 Th Thorium 90

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

Key

a	X	b
X		b

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

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

Index
Class Number

--	--

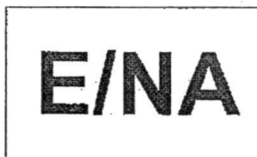
Candidate Name _____



FUHUA SECONDARY SCHOOL

Secondary Four Express & Five Normal (A)

Preliminary Examination 2017



*Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary
Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary
Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary Fuhua Secondary*

Science (Chemistry)

5076/05

Paper 5 Practical Examination

DATE 29 August 2017

DURATION 45 min

No Additional Material is required.

INSTRUCTIONS TO CANDIDATES

Write your name and register number in the spaces provided on top of this page.

Write in dark blue/black pen in the spaces provided on the question paper.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions in this paper. Write your answers in the space provided in the question paper.

The Chemistry Practical Note is attached on page 4 for your reference during the practical examination.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question.

You are advised **not** to spend more than 45 minutes on this chemistry practical.

PARENT'S SIGNATURE	FOR EXAMINER'S USE
	/ 15

Setter: Mr Wan Yan Ying

Vetter: Ms Hia Soo Ching

This question paper consists of 4 printed pages including this page.

1. You are provided with two solids **P** and **R**, and an acid **Q**. **P** and **R** contain the same cation.

Carry out the following experiments and test any gases evolved. Carefully record your observations.

The volumes given below, unless referring to drops of solution, are approximate and should be estimated rather than measured.

	test	observations
(a)	Use a spatula to transfer P into a boiling tube. Add 3 cm ³ of Q into the boiling tube. Withdraw several samples of gas from inside the boiling tube using a teat pipette and bubble the gas through limewater.	[2]
(b)	To the boiling tube containing the products from part (a) , add distilled water until about half full. Stopper and shake the boiling tube thoroughly. Use the solution for tests in parts (c) – (f) .	
(c)	Place 2 cm ³ of the solution from part (b) in a clean test-tube. To this test-tube, add dilute sodium hydroxide solution dropwise, with shaking, until no further change is observed.	[1]
(d)	Place 2 cm ³ of the solution from part (b) in a clean test-tube. To this test-tube, add aqueous ammonia solution dropwise, with shaking, until no further change is observed.	[1]
(e)	Place 2 cm ³ of the solution from part (b) in a clean test-tube. To this test-tube, add 1 cm ³ of barium nitrate solution.	[1]
(f)	Place 2 cm ³ of the solution from part (b) in a clean test-tube. To this test-tube, add 1 cm ³ of silver nitrate solution.	[1]

	test	observations
(g)	<p>Use a spatula to transfer half of R into a dry hard-glass test-tube.</p> <p>Heat R gently and then strongly. Continue to heat strongly until no further change is observed.</p> <p>While heating, test any gases evolved using litmus paper and a glowing splint.</p>	[4]
(h)	<p>Transfer the remainder of R into a dry hard-glass test-tube and dissolve with 2 cm³ of distilled water, stirring with a glass rod if necessary.</p> <p>To this test-tube, add 2 cm³ of dilute sodium hydroxide solution followed by 2 pieces of aluminium foil and warm gently.</p>	[2]

(i) Suggest the name of P, Q and R, giving evidence to support your answer. [3]

(i) P: _____

Evidence: _____

(ii) Q: _____

Evidence: _____

(iii) R: _____

Evidence: _____

CHEMISTRY PRACTICAL NOTES

Test for anions

<i>anion</i>	<i>test</i>	<i>test result</i>
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (<i>Cl</i>) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

Test for aqueous cations

<i>cation</i>	<i>effect of aqueous sodium hydroxide</i>	<i>effect of aqueous ammonia</i>
ammonium (NH_4^+)	ammonia produced on warming	-
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt.
copper(II) (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
lead(II) (Pb^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

Test for gases

<i>gas</i>	<i>test and test result</i>
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	gives white ppt. with limewater (ppt. dissolves with excess CO_2)
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	'pops' with a lighted splint
oxygen (O_2)	relights a glowing splint
sulfur dioxide (SO_2)	turns aqueous acidified potassium manganate(VII) from purple to colourless

Apparatus and Chemical List**Preparation List**

Apparatus	Quantity (per student)
Dry hard glass test-tube	8
Boiling tube	1
Wooden splint	1
Glass rod	1
Bunsen burner	1
Lighter	1
Rubber stopper for boiling-tube	1
Teat pipette (dropper)	2

Chemicals	Quantity (per student)
P (zinc carbonate)	1 spatula placed in a plastic bottle labeled P
Q (dilute sulfuric acid)	4 cm ³ placed in a plastic bottle labeled Q
R (zinc nitrate)	2 spatula placed in a plastic bottle labeled R

Common Bench Reagents

Chemicals	Quantity (per bench to share)
Aqueous ammonia	1 bottle
Dilute nitric acid	1 bottle
Barium nitrate solution	1 bottle
Silver nitrate solution	1 bottle
Aqueous sodium hydroxide	1 bottle
Red litmus paper	3 pieces
Blue litmus paper	3 pieces
Aluminium foil	2 piece
Limewater	1 bottle

Fuhua Secondary School
Sec 4Exp / 5NA Science (Chem)
Preliminary Examination 2017
MARK SCHEME

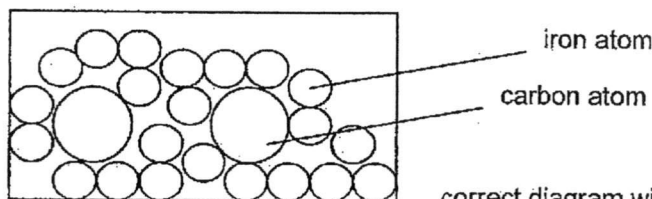
PAPER 1 [20m]

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

PAPER 3 [65m]

- A1. (a) between A and B - solid [1]
 between B and C - solid and liquid [1]
 between C and D - liquid [1]
- (b) The sample of naphthalene is not pure as it melts over a range of temperatures. [1]
- (c) The particles will change from closely packed in orderly arrangement to less closely packed in disorderly arrangement [1]
 The particles will change from vibrating about fixed positions to being able to slide pass one another [1]

- A2. (a) high melting / boiling point; high density; form coloured compounds; form ions of more than one charge etc [any 2 - 1 mark each]
- (b) (i) The number of neutrons or nucleon number in Fe-54 is 3 less than in Fe-57. [1]
 (ii) 23 [1]
- (c)



correct diagram with labeling [1]

When atoms of different atomic sizes are added to the metal, it disrupts the orderly arrangement of the metal atoms. [1] The layers of atoms cannot slide over one another easily, therefore this makes steel stronger than pure iron. [1]

- A3. (a) No. of moles of $\text{Cu}(\text{NO}_3)_2 = 94 / 188 = 0.5 \text{ mol}$ [1]
 No. of moles of $\text{O}_2 = 0.5 / 2 = 0.25 \text{ mol}$ [1]
 Volume of $\text{O}_2 = 0.25 \times 24 = 6.00 \text{ dm}^3$ [1]
- (b) (i) At high temperatures, nitrogen combines with oxygen to form nitrogen monoxide
 $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}(\text{g})$ [1]
 Nitrogen monoxide reacts with oxygen to produce nitrogen dioxide
 $2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}_2(\text{g})$ [1]

Fuhua Secondary School
Secondary 4E / 5N(A) Preliminary Examination 2017
Paper 5 - Practical Examination
Answer Key

- (a) *Observations:* Gas gives a white ppt with limewater. [1]
 A colourless solution remains behind. [1]
- (c) *Observations:* White ppt dissolves in excess sodium hydroxide solution [1]
 to form a colourless solution.
- (d) *Observations:* White ppt dissolves in excess aqueous ammonia to form a [1]
 colourless solution.
- (e) *Observations:* A white ppt is formed. [1]
- (f) *Observations:* No visible reaction is observed. [1]
- (g) *Observations:* A pungent, brown gas is evolved. [Any 4 – 1 mark each]
 Gas turns moist blue litmus paper red.
 Gas relights a glowing splint.
 The residue is yellow when hot.
 The residue becomes white / pale yellow when cooled.
- (h) *Observations:* A white ppt is formed. [1]
 Gas turns moist red litmus paper blue. [1]
- (i) Both name and evidence must be correct to score 1 mark. Otherwise, zero mark.
- (i) **P** is zinc carbonate.
 Evidence: From part (a), carbon dioxide is evolved with an acid showing presence of carbonate ion.
 From parts (c) and (d), white ppt soluble in excess sodium hydroxide and aqueous ammonia show presence of zinc ion. [1]
- (ii) **Q** is sulfuric acid.
 Evidence: From part (e), white ppt is formed with barium nitrate shows presence of sulfate ion. [1]
- (iii) **R** is zinc nitrate.
 Evidence: From part (h), ammonia gas is evolved showing presence of nitrate ion. It is also given that cation in **P** and **R** is the same. [1]

- (ii) - Causes eye and lung irritation / inflammation of the lungs / breathing difficulties
 - Combines with oxygen and rainwater to acid rain, corroding buildings and harming aquatic life
 [Any 2 – 1 mark each]

- A4. (a) Ammonia [1] because ammonia removes oxygen from copper(II) oxide / oxidation state of nitrogen increased from -3 in NH_3 to 0 in N_2 , causing oxidation to occur / ammonia loses hydrogen atoms to form nitrogen, causing oxidation to occur.
 [any one reason – 1 mark]
- (b) from -3 in NH_3 to 0 in N_2 [1]
- (c) (i) ammonium sulfate, $(\text{NH}_4)_2\text{SO}_4$ [1]
 (ii) neutralization [1]
 (iii) $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$ [1]
- A5. (a) $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$ [formula:1, balancing:1]
- (b) Experiment II – gradient steeper than I and volume of gas ends at 1500 cm^3 [1]
 Experiment III – gradient steeper than I and volume of gas ends at 600 cm^3 [1]
- (c) There are more particles in a given volume of more concentrated hydrochloric acid [1] and therefore the frequency of effective collisions increases between the particles [1] leading to higher rate of reaction.
- A6. (a)
$$\begin{array}{cc} \text{H} & \text{C}_2\text{H}_5 \\ | & | \\ \text{C} = & \text{C} \\ | & | \\ \text{H} & \text{H} \end{array}$$
 [1]
- (b) Aqueous bromine will decolourise rapidly in the monomer. [1]
- (c) (i) $\text{C}_{14}\text{H}_{30} \rightarrow \text{C}_4\text{H}_8 + \text{C}_{10}\text{H}_{22}$ [1]
 (ii) Condition: high temperature and with suitable catalyst [1]
- A7. (a) A copper(II) carbonate
 B sulfuric acid
 C copper(II) sulfate
 D barium sulfate
 E copper(II) hydroxide
 F carbon dioxide
 G calcium carbonate [one mark each – total 7]
- (b) $\text{CuCO}_3(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{CuSO}_4(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
 [formula:1, state symbol:1]

Section B [20 m]

- B1. (a) (i) Na^+ and PO_4^{3-} [1]
 (ii) sodium hydroxide [1]
 (iii) $3\text{NaOH} + \text{H}_3\text{PO}_4 \rightarrow \text{Na}_3\text{PO}_4 + 3\text{H}_2\text{O}$ [formula:1, balancing:1]

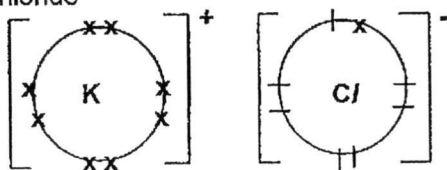
- (b) Steps :
1. Pour phosphoric acid into the burette and note its volume.
 2. Pipette 25 cm^3 of sodium hydroxide into a conical flask.
 3. Add a few drops of methyl orange to the alkali in the flask.
 4. Titrate the alkali in the flask with the acid until the indicator changes colour to orange.
 5. Take note of the volume of acid- $x \text{ cm}^3$.
 6. Repeat the experiment without adding the indicator.
 7. Add $x \text{ cm}^3$ of acid from the burette to 25 cm^3 of alkali in the conical flask without the indicator.
 8. Swirl the flask and pour the sodium phosphate solution into and evaporating dish.
 9. Heat the solution until saturated.
 10. Cool the solution to obtain sodium phosphate crystals.
 11. Filter to obtain the crystals.
 12. Dry the crystals by pressing between filter papers. [$\frac{1}{2}$ mark for each step]

- B2. (a) As the atomic number of the elements increase, the colour becomes darker [1] and the elements change from gas to liquid to solid. [1]

- (b) Pour aqueous chlorine into potassium bromide and colourless potassium bromide turns reddish-brown. [1]
 $\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$ [1]
 {Bromine is displaced from the solution and this shows that chlorine is more reactive than bromine.- no marks given as this is for explanation}

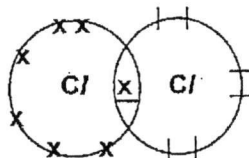
If aqueous bromine is poured into potassium chloride, no visible reaction is observed/ the solution remains brown. [1]

- (c) potassium chloride



cation [1]
 anion [1]

chlorine



bonding electrons [1]
 unbonded electrons [1]

- (d) It is a conductor of electricity as it contains mobile ions. [1]

- B3. (a) Yeast [1]
- (b) At high temperature, the yeast will be denatured and the reaction stops. [1]
- (c) White precipitate will be formed / effervescence observed [1]
due to the carbon dioxide produced. [1]
- (d) (i) $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ [formula:1, balancing:1]
(ii) Exothermic because heat is given out during the reaction. [1]
- (e) (i) Ethanoic acid [1]
- $$\begin{array}{c}
 \text{H} \quad \text{O} \\
 | \quad || \\
 \text{H} - \text{C} - \text{C} - \text{O} - \text{H} \\
 | \\
 \text{H}
 \end{array}
 \quad [1]$$
- (ii) orange [1]