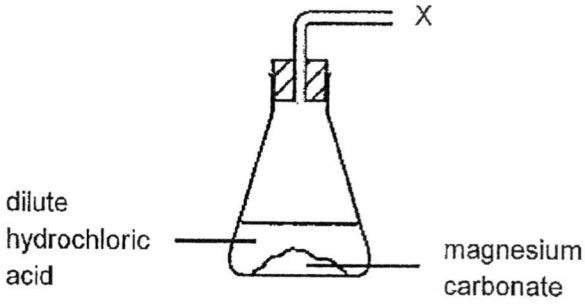
21 Magnesium carbonate was added to a solution of dilute hydrochloric acid, and a chemical reaction occurred.
The diagram shows part of the apparatus used to measure the rate of reaction.



Which piece of apparatus is connected at position X?

A burette
B data logger
C gas syringe
D measuring cylinder

22 A bottle of zinc carbonate has been contaminated by some solid potassium sulfate.

How can the potassium sulfate be **removed** from the zinc carbonate?

A add dilute acid to the mixture and filter
B add water to the mixture and filter
C add water to the mixture and place it in a separating funnel
D heat the mixture and allow it to cool

23 Some turquoise powder is placed in a beaker. Water is added and the contents of the beaker are stirred and filtered. A green solid is left on the filter paper. After evaporating the filtrate, a white precipitate is left.

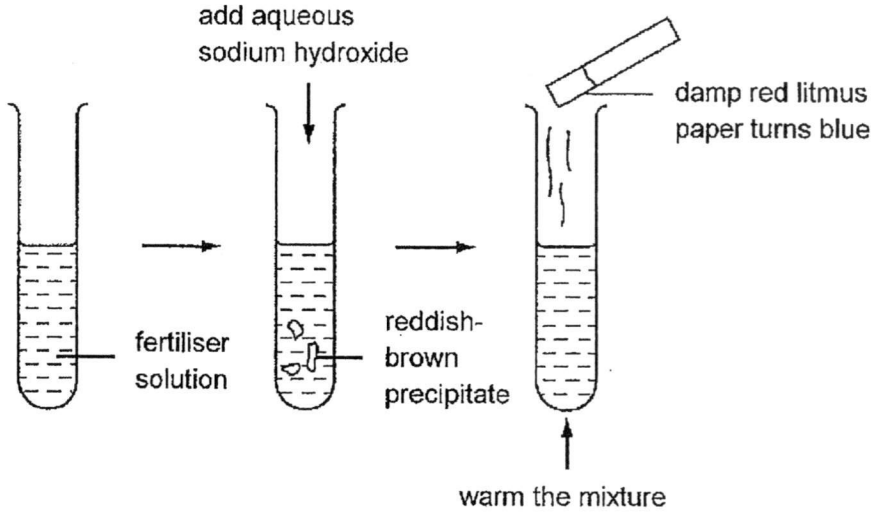
What do these observations suggest?

A The green solid is an element.
B The turquoise powder is a compound.
C The turquoise powder is a mixture.
D The white precipitate is a mixture.

24 Which set of substances contains an element, a compound, and a mixture?

A air, pure water, silver nitrate
B brass, iron(II) sulfate, seawater
C copper, chicken soup, gold
D platinum, petrol, sodium chloride

25 A solution of fertiliser was tested.



Which ions are present in the fertiliser solution?

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

26 An element, D, has p protons and n neutrons in its nucleus.

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

	protons	neutrons	electrons
A	p	n	p + 1
B	p	n + 1	p – 1
C	p + 1	n	p + 1
D	p + 1	n + 1	p – 1

27 An atom of element M is represented by $^{39}_{19}M$.

Which statement about this atom of M is correct?

A It is in Group I of the Periodic Table.
B It is in Group VII of the Periodic Table.
C The number of neutrons is 19.
D The total number of protons and electrons is 39.

28 Element Y has the electronic configuration 2, 2.

Element Z has the electronic configuration 2, 8, 7.

What is the formula of the compound formed between Y and Z?

A YZ
B YZ_2
C Y_2Z
D Y_3Z_2

29 Which change describes what happens when ice is melted?

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

30 In which substance are the particles vibrating about fixed positions at room temperature?

	melting point/°C	boiling point/°C
A	−189	−155
B	−25	28
C	5	79
D	59	174

31 20 g of sodium hydroxide just neutralises 100 cm^3 of dilute sulfuric acid according to the following equation:

$$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$$

What is the concentration of dilute sulfuric acid?

A 0.25 mol/dm^3
B 0.5 mol/dm^3
C 2.5 mol/dm^3
D 5.0 mol/dm^3

32 Which is a reason for recycling aluminium?

A aluminium made by recycling is less pure than that made by extraction
B less energy is needed for recycling than extraction
C recycling aluminium is less expensive than extraction
D to reduce damage to the environment caused by extraction

33 Iron is extracted in the blast furnace using the raw materials haematite, coke and limestone.

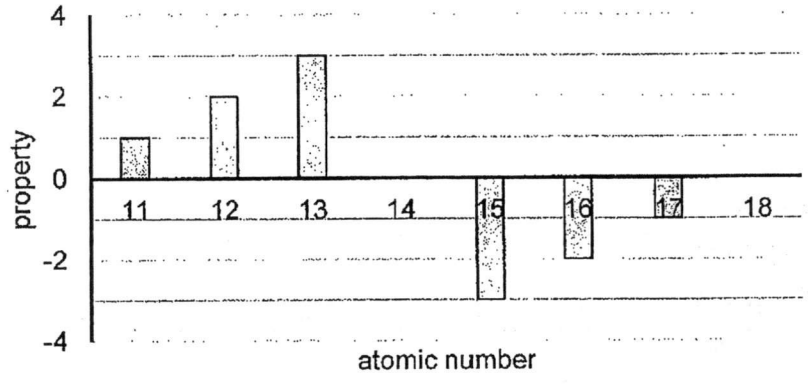
Which substance undergoes thermal decomposition?

A carbon monoxide
B coke
C haematite
D limestone

34 Which row correctly matches an atmospheric pollutant to its source?

	pollutant	source
A	carbon monoxide	complete combustion of fossil fuels
B	oxides of nitrogen	vehicle exhaust fumes
C	oxides of nitrogen	volcanic eruption
D	sulfur dioxide	lightning activity

35 The graph below shows the trend of a property of the elements in Period 3.



Which is the correct property shown?

A charge of ions
B ease of forming ions
C number of electron shells
D number of valence electrons

36 A student conducted two experiments.

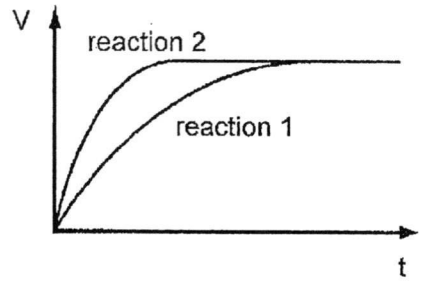
Reaction 1: 20 g of magnesium ribbon with excess 1.5 mol/dm^3 dilute nitric acid.

Reaction 2: 10 g of magnesium powder with excess 1.5 mol/dm^3 dilute nitric acid.

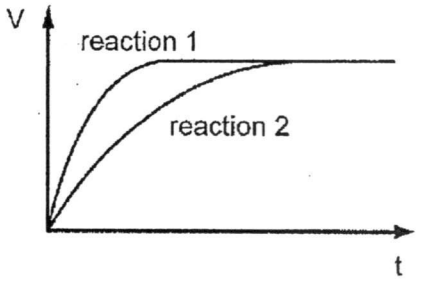
In both experiments, the volume of hydrogen produced, V, is measured against time, t, and the results plotted graphically.

Which set of graphs is correct?

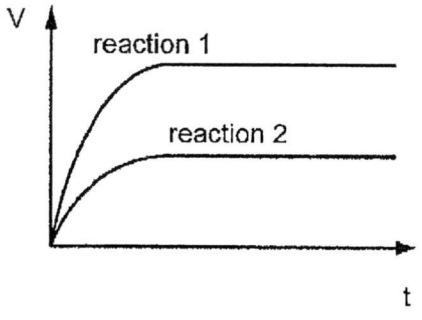
A



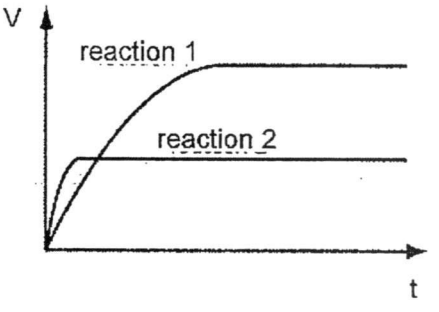
B



C



D



37 Substance Q turns a solution of aqueous potassium iodide from colourless to brown.

What must substance Q be?

A a reducing agent

B an acid

C an alkali

D an oxidising agent

38 The table shows the boiling point of four fractions, T, U, V and W, obtained when crude oil is fractionally distilled.

fraction	T	U	V	W
boiling range/°C	40 – 75	150 – 240	300 – 350	> 350

Which statement is correct?

A Fraction T contains smaller molecules than Fraction V.

B Fraction T has a higher percentage of carbon than Fraction W.

C Fraction U is more flammable than Fraction T.

D Fraction V is more viscous than Fraction W.

39 Which equation represents a cracking process?

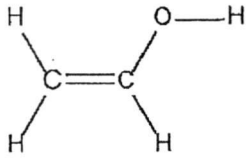
A $C_4H_8 + H_2 \rightarrow C_4H_{10}$

B $C_8H_{18} \rightarrow 2C_3H_6 + C_2H_4 + H_2$

C $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

D $C_4H_9OH \rightarrow C_4H_8 + H_2O$

40 An organic compound is shown below.



What functional groups are present in this compound?

A alkane and carboxyl groups

B alkane and hydroxyl groups

C alkene and carboxyl groups

D alkene and hydroxyl groups

~ End of Paper ~

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
																	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

O	Name	Register Number	Class

GREENRIDGE SECONDARY SCHOOL

Preliminary Examination 2017
Secondary 4 Express / 5 Normal Academic

SCIENCE **5076/5078/03**
Paper 3 Chemistry **25 August 2017**
1 hour 15 minutes

Additional Materials: Nil

Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, register number and class on the question booklet and Answer Sheet in the spaces provided unless this has been done for you.

Section A
Answer **all** questions in the spaces provided.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the Question Paper.

Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
In calculations, you should show all steps in your working, giving your answer at each stage. The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 65.

A copy of the Data sheet is printed on page **14**.
A copy of the Periodic Table is printed on page **15**.

Setter: Ms Lin Liyi

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

Section A [45 marks]

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

A1 A list of oxides is given below.

carbon dioxide	*carbon monoxide*	*iron(II) oxide*
lead(II) oxide	*nitrogen dioxide*	*sulfur dioxide*

Each word can be used once, more than once, or not at all.

Name an oxide which

(a) reacts with both dilute hydrochloric acid and dilute potassium hydroxide,

.....[1]

(b) reacts with dilute hydrochloric acid to form a green solution,

.....[1]

(c) dissolves in water to form a solution of pH 5,

.....[1]

(d) is used as a reducing agent in the blast furnace,

.....[1]

(e) is formed by lightning activity.

.....[1]

A2 Classify each substance in Table 2.1 by placing a tick (√) in one box in each row.

Table 2.1

substance	element	compound	mixture of elements	mixture of compounds	mixture of elements and compounds
air					
bronze					
helium					
copper(II) sulfate solution					

[2]

A3 (a) Fig. 3.1 shows an experimental set-up used to separate pure water from a sample of tap water.

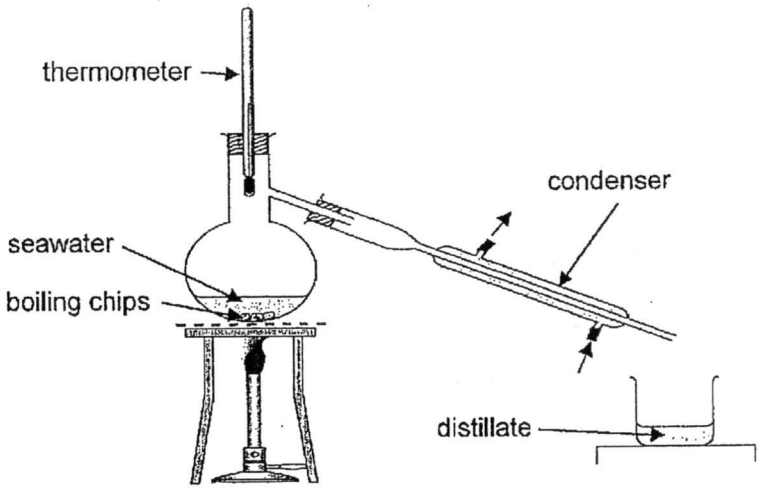


Fig. 3.1

(i) Name this method of separation.

.....[1]

(ii) Predict the reading on the thermometer during the separation.

.....[1]

(iii) State the purpose of the condenser.

.....[1]

(b) The pure water obtained is used to dilute a purple cabbage indicator.

Fig. 3.2 shows the preparation of the coloured solution extracted from purple cabbage.

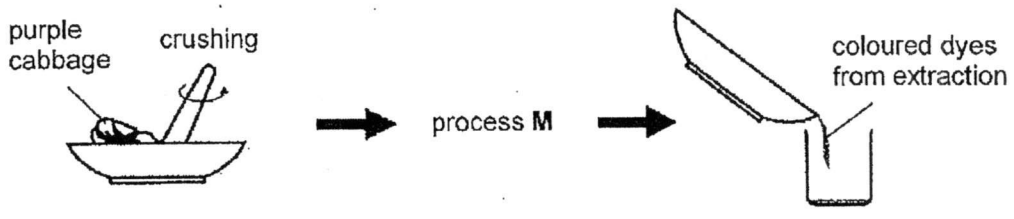


Fig. 3.2

Process **M** is carried out to remove any uncrushed cabbage parts.

Name process **M**.

.....[1]

BP/S4ESC/272

(c) The following substances were tested using the purple cabbage indicator and the resulting colour of the solution is shown in Table 3.3.

Table 3.3

substance	colour of solution
hydrochloric acid	pink
ethanoic acid	violet
distilled water	violet
baking soda	blue
sodium hydroxide	yellow

(i) Using the information from Table 3.3. determine the colour of the solution when the purple cabbage indicator is added to aqueous ammonia.

.....[1]

(ii) Name the limitation of using the purple cabbage indicator to determine the pH of solutions. Suggest another indicator that can be used instead.

.....

.....[2]

A4 (a) Four elements, **P**, **Q**, **R** and **S** are found in the same period of the Periodic Table. The information about these four elements are given below:

Element **P** forms a covalent compound with chemical formula P_2O.

Element **Q** is ductile and malleable, and is a solid at room temperature.

Element **R** reacts explosively with water to form an alkaline solution.

Element **S** exists as an inert gas and is used in vacuum-tubes.

(i) State **one** similarity of the electronic structures of these four elements.

.....

.....[1]

(ii) Arrange these elements in order of increasing atomic number.

.....[1]

(iii) Suggest how element **R** can be extracted from its compounds.

.....[1]

(b) Table 4.1 shows some physical properties of the Group VII elements.

Table 4.1

halogen	melting point / °C	boiling point / °C	colour
fluorine	− 220	− 188	pale yellow
chlorine	− 101	− 35	
bromine	− 7	59	reddish-brown
iodine	114	184	grey-black

(i) Complete Table 4.1 by filling in the colour of chlorine. [1]

(ii) Using the information in Table 4.1, describe the arrangement and movement of bromine at room temperature.

.....

.....

.....[2]

A5 When chlorine gas is bubbled through a solution of sodium bromide, a chemical reaction occurs. The chemical equation of the reaction is stated below:

$$2NaBr\ (aq) + Cl_2\ (g) \longrightarrow 2NaCl\ (aq) + Br_2\ (l)$$

(a) Suggest the expected observation for this reaction.

.....[1]

(b) State the type of reaction that has occurred. Explain your answer.

.....

.....[2]

(c) **(i)** Explain, with reasons, whether bromine in sodium bromide has been oxidised or reduced.

.....

.....[2]

(ii) Identify the reducing agent.

.....[1]

(d) When sodium chloride is reacted with solution **J**, a white precipitate is formed. Suggest an identity for solution **J**.

.....[1]

A6 Equal masses of calcium carbonate was reacted with dilute nitric acid of the same concentration in Experiment **I** and **II**. Nitric acid was added in excess.

Experiment **I**: lumps of calcium carbonate powder was added.
Experiment **II**: powdered calcium carbonate powder was added.

The mass of calcium carbonate was measured and calculated at regular time intervals. The results of the experiments are shown in Fig. 6.1.

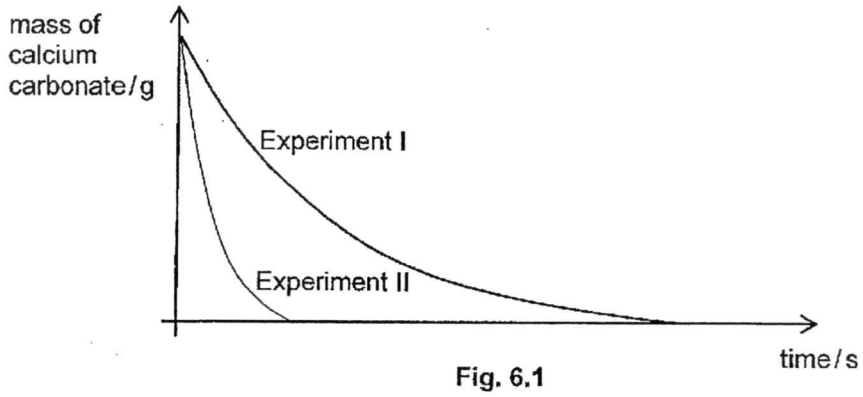


Fig. 6.1

(a) Describe **one** measure to be taken so that a fair experiment is conducted.

.....[1]

(b) State the experiment that is faster.

.....[1]

(c) Using your knowledge of collisions between reacting particles, explain your answer in **(b)**.

.....

.....

.....[2]

(d) Write out a balanced chemical equation for this reaction.

.....[2]

(e) If 28.6 g of calcium carbonate was reacted, calculate the volume of gas evolved at room temperature and pressure.

[2]

A7 Fig. 7.1 shows some reactions of a lead(II) salt **W**.

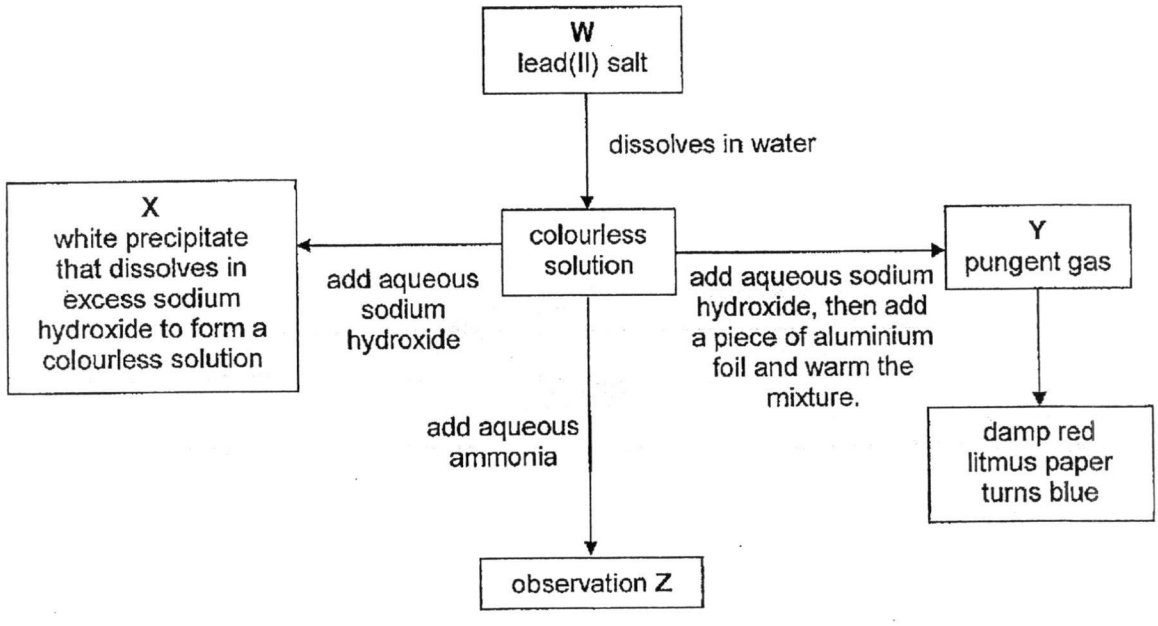


Fig. 7.1

(a) Suggest the identity of substances **W**, **X** and **Y**.

W:.....

X:.....

Y:.....

[3]

(b) State what observation **Z** would be.

.....

.....[1]

(c) Suggest a suitable method to prepare salt **W**. Name the **two** reagents needed to prepare the salt.

method:.....[1]

reagents:.....[1]

A8 (a) A solution of potassium hydroxide, KOH, has a concentration of 0.35 mol/dm^3. 25 cm^3 of KOH was reacted with excess ammonium sulfate as shown in the equation below.

$$2KOH + (NH_4)_2SO_4 \longrightarrow K_2SO_4 + 2NH_3 + 2H_2O$$

Calculate the mass of potassium sulfate formed.

[2]

(b) Another solution of potassium hydroxide was prepared by dissolving 29.5 g of potassium hydroxide in 5 dm^3 of distilled water.

Determine the concentration of the solution in mol/dm^3.

[2]

~End of Section A~

Section B [20 marks]

Answer any **two** questions.

B9 To determine the reactivity series of metals, a series of experiments were conducted with four different solutions. All four solutions contain nitrate ions. The procedures for the experiment are shown below:

1. A piece of magnesium ribbon was added to 25 cm^3 of each solution containing the same concentration.
2. For each experiment, the change in temperature was recorded.

The results of the experiments are listed in Table 9.1.

Table 9.1

solution of	observation	change in temperature / °C
metal **A**	grey-black solid deposited on the magnesium ribbon.	+14
metal **B**	reddish-brown solid deposited on the magnesium ribbon.	+ 42
metal **C**	no visible reaction.	0
metal **D**	grey-black solid deposited on the magnesium ribbon.	+ 32

(a) Name the reaction that causes the change in temperature in Table 9.1.

.....[1]

(b) Explain why there is **no** change in temperature when magnesium ribbon is added to a solution of metal **C**.

.....

.....[2]

(c) Suggest the identity of metal **B**.

.....[1]

(d) State the order of reactivity of the metals, **A**, **B**, **C**, **D** and magnesium, in order of increasing reactivity.

.....[1]

(e) A piece of magnesium ribbon was also added to a solution of dilute hydrochloric acid, and bubbles were seen forming.

Suggest a test, and the expected observation, that would confirm the identity of the gas formed.

test:.....

observation:.....[2]

(f) Pure metals are often too soft to be used widely in the industry, thus, alloys are typically used.

Explain why alloys are harder than pure metals.

.....

.....

.....

.....[3]

B10 (a) (i) Draw 'dot and cross' diagrams to show the arrangement of electrons in carbon dioxide and water.
Show only valence electrons.
[Proton numbers: H, 1; C, 6; O, 8]

carbon dioxide:

water:

[4]

(ii) Briefly describe how the bonds are formed in a water molecule, using the 'dot and cross' diagram drawn in **(a)(i)**.

.....

.....

.....[2]

(iii) An isotope of carbon, ^{13}C, also forms a compound with oxygen.

Explain why the chemical compound formed has the same chemical formula as carbon dioxide.

.....

.....[1]

(b) List **three** differences between the physical properties of covalent molecules and ionic compounds.

.....

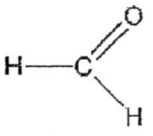
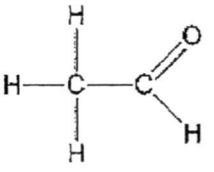
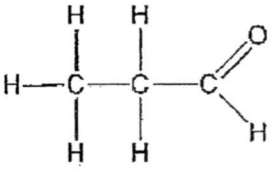
.....

.....

.....[3]

B11 (a) Table 11.1 shows some information about a homologous series of organic compounds called aldehydes.

Table 11.1

name	number of carbon atoms	full structural formula	boiling point / °C
methanal	1		− 19.0
ethanal	2		20.2
propanal	3		48.8

(i) State and explain the trend of the boiling points of the molecules in the aldehyde homologous series.

.....

.....

.....[2]

(ii) Draw the structural formula of butanal, which contains four carbon atoms.

[1]

(iii) Carboxylic acids have a carboxyl functional group, which contains the structure −COOH.

Suggest the structure of the carbonyl functional group of aldehydes.

.....[1]

(b) Fig. 11.2 shows some reactions involving ethene.

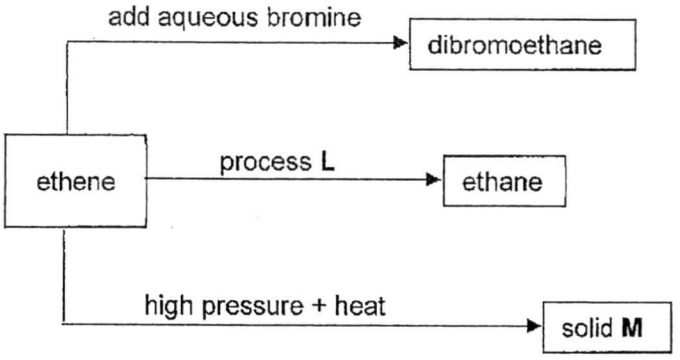


Fig. 11.2

(i) State **one** use of adding aqueous bromine.

.....

.....[1]

(ii) Name process **L** and state the conditions required for this reaction to occur.

process:.....

conditions:.....

.....[2]

(iii) Solid **M** is commonly known as plastic.

State the chemical name of solid **M**, including the structural formula of solid **M**.

name:.....

[2]

(iv) Explain why land pollution can be caused by the increased use of solid **M**.

.....

.....[1]

~ End of Paper ~

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 = 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

O

Candidate Name	Index Number	Class

GREENRIDGE SECONDARY SCHOOL

Preliminary Examination 2017
Secondary 4 Express & 5 Normal Academic

SCIENCE (CHEMISTRY, BIOLOGY) **5078/05**
Paper 5 Practical Test **22 August 2017**
1 hour 30 minutes

Candidates answer on the Question Paper.
Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
The use of an approved calculator is expected, where appropriate.

Answer **both** questions.
You are advised to spend 45 minutes on each question.
Chemistry practical notes for this paper are printed on page 10.

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

:ters: **Ms Lin Liyi & Mdm Clara Wang**

For Examiner's Use Only	
1	
2	
Total	

1 You are provided with three labelled samples of solutions **P**, **Q** and **R**. Two of the solutions contain acid and carbonate.

Carry out the following tests. You should test any gases evolved. Carefully record your observations.

The volumes given below are approximate and should be estimated rather than measured.

		test	observations
(a)	**(i)**	Add about 2 cm^3 of solution **P** into a clean test tube. To this test-tube, add about 2 cm^3 of solution **Q**, with shaking, until no further change is seen.	
	(ii)	To the same test-tube, slowly add about 2 cm^3 of solution **R**, with shaking, until no further change is seen.	[3]
(b)	**(i)**	Add about 2 cm^3 of solution **Q** into a clean test-tube. To this test-tube, add about 2 cm^3 of solution **R** and shake the mixture thoroughly until no further change is seen.	
	(ii)	To the same test-tube, slowly add about 2 cm^3 of solution **P**, with shaking, until no further change is seen.	[2]

(c)	(i)	Add about 2 cm^3 of solution **R** into a clean test-tube. To this test-tube, slowly add about 2 cm^3 of solution **P**, with shaking, until no further change is seen.	
	(ii)	To the same test-tube, add about 2 cm^3 of solution **Q** and shake the mixture thoroughly until no further change is seen.	[2]
	(iii)	Transfer the mixture in **(c)(ii)** into a boiling tube. Using a measuring cylinder, add 3 cm^3 of dilute sodium hydroxide to the mixture.	
		Heat the boiling tube gently until no further changes are seen.	[3]

	test	observations with solution **Q**	observations with solution **R**
(d)	Add about 1 cm^3 of solution **Q** to a clean test-tube. Add 1 cm^3 of dilute nitric acid, followed by 1 cm^3 of silver nitrate solution. Repeat the experiment using solution **R**.		
(e)	Add about 1 cm^3 of solution **Q** to a clean test-tube. Add 1 cm^3 of dilute hydrochloric acid, followed by 1 cm^3 of barium chloride solution. Repeat the experiment using solution **R**.		

[2]

Conclusions

(f) Using your observations, deduce which of the solutions, **P**, **Q** or **R**, contains sulfuric acid. Explain your answer using evidence from your observations.

solution .....

explanation.....

.....

.....

.....[1]

(g) Using your observations in **(a)**, **(b)**, and **(c)**, deduce which of the solutions, **P**, **Q** or **R**, contains carbonate.

Explain your answer using evidence from your observations in **(a)**, **(b)**, and **(c)**.

solution .....

explanation.....

.....

.....

.....[1]

(h) Suggest the identity of the last solution.

.....[1]

4E/5NA Sc(Chemistry) Prelims 2017 Answer Scheme

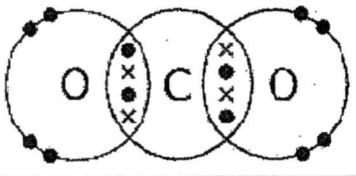
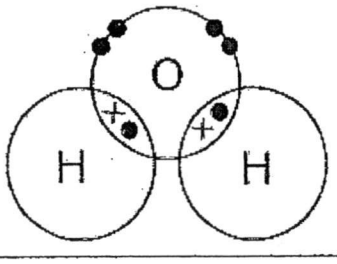
Paper 1 (5076)

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

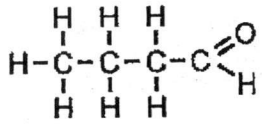
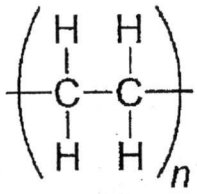
Paper 3

A1(a)	lead(II) oxide	[1]
(b)	iron(II) oxide	[1]
(c)	carbon dioxide	[1]
(d)	carbon monoxide	[1]
(e)	nitrogen dioxide	[1]
A2	air (mixture of elements and compounds) bronze (mixture of elements) helium (element) copper(II) sulfate (compound)	[2] Every two correct, 1 mark awarded
A3(a)(i)	Simple distillation	[1]
(a)(ii)	100 °C	[1]
(a)(iii)	It is to **cool and condense vapour into liquid.**	[1]
(b)	Filtration	[1]
(c)(i)	blue	[1]
(c)(ii)	It cannot differentiate between **weakly acidic and neutral** (uric acid and distilled water). Use universal indicator instead. [Note: litmus paper not accepted]	[1] [1]
A4(a)(i)	They all have the **same number of electron shells.**	[1]
(a)(ii)	R, Q, P, S	[1]
(iii)	It can be extracted using **electrolysis**.	[1]
(b)(i)	greenish-yellow / yellow	[1]
(ii)	At room temperature, bromine is a liquid, thus, it has a **disorderly arrangement** and is less closely packed than in the solid. Particles can **slide over one another over a short distance**	[1] [1]

A5(a)	Colourless solution turns **reddish-brown/brown**	[1]
(b)	**Displacement reaction**. Chlorine is **more reactive than bromine**, thus will **displace bromine**	[1] [1]
(c)(i)	Bromine is **oxidised**. In the reaction, the oxidation state of bromine changes from **– 1 in NaBr to 0 in Br_2.**	[1] [1]
(ii)	The reducing agent is **sodium bromide / NaBr**	[1]
(d)	Silver nitrate / lead(II) nitrate	[1]
A6(a)	Ensure **temperature remains constant** for both experiments.	[1]
(b)	Experiment **II**	[1]
(c)	In Experiment **II**, powdered calcium carbonate is used. The smaller particle size leads to an **increase in total surface area**, thus more surfaces exposed. Collision between particles increases, leading to **increase in frequency/rate of effective collision**, thus, faster speed of reaction.	[1] [1]
(d)	$CaCO_3 + 2HNO_3 \rightarrow Ca(NO_3)_2 + CO_2 + H_2O$ **[1 mark for balanced equation, 1 mark for correct chemical formula]**	[2]
(e)	No. of moles of $CaCO_3$ = 28.6 /(40+12+3(16)) = 0.286 mol Mole ratio of $CaCO_3$: CO_2 = 1 : 1 Thus, no. of mole of HCl = 0.286 mol Volume of HCl = 0.286 x 24 = 6.864 dm^3	[1] [1]
A7(a)	**W**: lead(II) nitrate **X**: lead(II) hydroxide **Y**: ammonia gas	[1] [1] [1]
(b)	**White precipitate**; **insoluble** in excess sodium hydroxide.	[1]
(c)	Method: **Acid reaction with metal, base, carbonate** Reagents: nitric acid / lead(II) carbonate / lead(II) oxide	[1] [1]
A8(a)	No. of moles of KOH = 0.35 x (25/1000) = 0.00875 mol Mole ratio of KOH : K_2SO_4 = 2 : 1 Thus, no. of mole of K_2SO_4 = 0.004375 mol Mass of K_2SO_4 = 0.004375 x (2(39) + 32 + 4(16)) = 0.76125 g	[1] [1]
(b)	No. of moles of KOH = 29.5 / (39+16+1) = 0.5267857143 mol (leave to 5 d.p.) Concentration = 0.52679 / 5 = 0.1053571429 mol/dm^3 ≈ 0.105 mol / dm^3	[1] [1]
B9(a)	Exothermic reactions **[MR: endothermic reaction, displacement reaction (not considering the change in temperature)]**	[1]

(b)	Metal **C** is <u>more reactive than</u> magnesium. Thus, magnesium will <u>not displace</u> metal C. **[MR: many students wrote that metal C is not reactive at all, thus, displaying a lack of understanding of the reaction taking place. Some students also merely wrote that no reaction has taken place, which is too vague]**	[1] [1]
(c)	<u>Copper</u> **[MR: iron(III), iron(III) hydroxide/oxide, copper(II) – Lack of understanding that sodium hydroxide/aqueous ammonia is necessary for iron(III) hydroxide/oxide to be formed.]**	[1]
(d)	**B, D, A,** magnesium, **C** **[MR: Many students missed out magnesium as one of the metals to write in. Some students also wrote the answer in decreasing reactivity instead]**	[1]
(e)	test: place a <u>**lighted splint**</u> near the mouth of the test-tube. **[accept: insert lighted splint into test-tube/place lighted splint near the reaction BUT not place into reaction]** **[MR: many students simply wrote lighted splint test/use a lighted splint/insert lighted splint]** observation: lighted splint <u>**extinguished with a 'pop' sound**</u>.	[1] [1]
(f)	In an alloy, the atoms of the different metals or elements have <u>**different sizes**</u>, thus it <u>**disrupts the regular arrangement of atoms in the pure metal**</u>. **[accept: various sizes of atoms]** **[marks awarded as long as students show awareness that pure metals have a regular/orderly/neat arrangement]** **[MR: many students were missing key words, such as the different sized atoms, or that the regular/orderly arrangement was disrupted.]** Thus, <u>**atoms cannot slide over each other easily**</u>. **[accept: harder/more difficult for atoms to slide over each other]** **[MR: many students wrote that it prevents atoms from sliding over each other – NOT true as it merely makes it more difficult!]** In a pure metal, layers of <u>**atoms slide over one another easily.**</u> **[MR: some students only wrote that atoms can slide over one another]** **[In general: some students wrote about MOLECULES instead of atoms/particles, which is incorrect!]**	[1] [1] [1]
B10(a)(i)	carbon dioxide  water  	[4] 2 marks for each correct compound drawn

	[correct number of bonding electrons [1]; correct number of non-bonding electrons (only if number of bonding electrons is correct) [1]] [MR: a few students drew carbon dioxide molecule as an ionic compound; quite a few students did not pair up the non-bonding electrons in O, or drew only one covalent bond between C and O.] [MR: water molecule was generally well-drawn; some students confused the chemical formula to be HO_2 instead]	
(a)(ii)	Water molecules are formed by covalent bonds, where **oxygen atom shares one electron each with a hydrogen atom** [MR: majority of students gave generic answers (covalent bonding, share electrons etc.) without reference to the water molecule. Many of them also did not state accurately how many electrons were shared between oxygen and each hydrogen atom] to form a **stable noble gas configuration**. [mark awarded here only if students show awareness of covalent compounds = sharing of electrons] [in general: many students started talking about the weak intermolecular forces of attraction between molecules, instead of referring to the 'dot and cross' diagram.]	[1] [1]
(a)(iii)	Isotopes have **the same proton and electron number/same number of valence electrons** but different number of neutrons. [MR: many students only talked about the number of protons being the same or that they have similar chemical properties or stated the definition of isotopes only]	[1]
(b)	Ionic compounds have **high melting points**, while covalent compounds have **low melting points**. [MR: some students wrote about why the compounds have high melting/boiling points which was not necessary!] Ionic compounds are generally **soluble in water and insoluble in organic solvents**, while covalent compounds are generally **soluble in organic solvents and insoluble in water.**. [MR: some students mixed up between ionic compound solubility and covalent compound solubility] [accept: soluble in water and insoluble in organic solvent, while covalent compound is opposite (meaning is same)] Ionic compounds can **conduct electricity in molten/liquid and aqueous states**, while covalent compounds **cannot conduct electricity in any state/non-conductors of electricity.** [MR: many students were not specific (e.g. ionic compounds conduct electricity while covalent compounds do not; conduct only in aqueous state etc.)] [In general: some students confused the physical properties with chemical properties (sharing/giving away electrons); some students also mixed up the physical properties with that of metals/non-metals (e.g. density, hard, ductile, malleable, solid at r.t.p etc.)]	[1] [1] [1]

B11(a)(i)	As the number of carbon atoms increases, **boiling point increases**. As the **molecular size increases**, the **forces of attractions between the molecules increase**, thus **more energy is needed to overcome the forces of attraction.** [accept: intermolecular forces of attraction increases] **[MR: explanation was not well done – many students missing out key points (e.g. only talking about forces of attraction increasing, or molecular size increasing, but not both); some students also talked about the percentage of carbon (related to flammability)]**	[1] [1]
(ii)	 **[MR: generally well done]**	[1]
(iii)	-CHO / - COH **[MR: some students did not understand the question, either restating the question, or attempting to write the general formula]**	[1]
(b)(i)	To **distinguish** between saturated and unsaturated hydrocarbons / alkanes and alkenes. [accept: to identify/to test if it is alkane or alkene] **[MR: a number of students wrote ethene and ethane specifically; some students also wrote about converting alkenes to alkanes]**	[1]
(b)(ii)	process: hydrogenation/addition of hydrogen **[MR: some students wrote cracking instead]** conditions: high temperature of 200 °C, nickel catalyst [accept: if students wrote process as addition] **[MR: no marks awarded if process is wrong but conditions is correct; some students spelt nickel as nickle]**	[1] [1]
(b)(iii)	name: polyethene / poly(ethene) 	[1] [1] At least 3 repeating units
(iv)	**[MR: a number of students did not put the *n* at the bottom; some students drew the monomer]** Plastics are **non-biodegradable/do not decompose**, thus, will not break down. [accept: hard to break down, difficult/long time to decompose] [do not accept: decay] **[MR: some students spelt non-biodegradable as non-biodegrable]**	[1]

O

Candidate Name	Index Number	Class

GREENRIDGE SECONDARY SCHOOL

Preliminary Examination 2017
Secondary 4 Express & 5 Normal Academic

SCIENCE (PHYSICS, CHEMISTRY)
5076/05
Paper 5 Practical Test

22 August 2017
1 hour 30 minutes

Candidates answer on the Question Paper.
Additional Materials: As listed in the Confidential Instructions.

GREENRIDGE SECONDARY SCHOOL GREENRIDGE SECONDARY SCHOOL GREENRIDGE SECONDARY SCHOOL GREENRIDGE SECONDARY
GREENRIDGE SECONDARY SCHOOL GREENRIDGE SECONDARY SCHOOL GREENRIDGE SECONDARY SCHOOL GREENRIDGE SECONDARY
GREENRIDGE SECONDARY SCHOOL GREENRIDGE SECONDARY SCHOOL GREENRIDGE SECONDARY SCHOOL GREENRIDGE SECONDARY
GREENRIDGE SECONDARY SCHOOL GREENRIDGE SECONDARY SCHOOL GREENRIDGE SECONDARY SCHOOL GREENRIDGE SECONDARY

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **both** questions.
You are advised to spend 45 minutes on each question.
Chemistry practical notes for this paper are printed on page 9.

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

Setters: Mr Goh Weibeng
Ms Lin Liyi

For Examiner's Use Only	
1	
2	
Total	

2 You are provided with three labelled samples of solutions **P**, **Q** and **R**. Two of the solutions contain acid and carbonate.

Carry out the following tests. You should test any gases evolved. Carefully record your observations.

The volumes given below are approximate and should be estimated rather than measured.

		test	observations
(a)	(i)	Add about 2 cm^3 of solution **P** into a clean test tube. To this test-tube, add about 2 cm^3 of solution **Q**, with shaking, unitl no further change is seen.	Pale blue / light blue / bluish-green ppt formed [1] **[MR: students try to write too much, making it difficult to find the key points]**
	(ii)	To the same test-tube, slowly add about 2 cm^3 of solution **R**, with shaking, until no further change is seen.	Pale blue ppt dissolves to form a pale blue solution [1] **[accept: ppt dissolved/soluble]** **[MR: many students did not write this accurately – a number of students missing out key words "dissolves"]** Bubbles observed. White ppt formed in limewater [1] **[MR: many students did not test for gas. A number of them forgot to write that there were bubbles produced and a few still wrote limewater forms white ppt]** [3]
(b)	(i)	Add about 2 cm^3 of solution **Q** into a clean test-tube. To this test-tube, add about 2 cm^3 of solution **R** and shake the mixture thoroughly until no further change is seen.	No visible reaction [1] **[accept: no visible change/observation]** **[MR: Some students wrote that blue solution turned light blue]**
	(ii)	To the same test-tube, slowly add about 2 cm^3 of solution **P**, with shaking, until no further change is seen.	Bubbles observed. White ppt formed in limewater [1] **[MR: some students did not test for gas here, or tested for ammonia/H_2 gas or**

			simply stated the gas present without the observations] [2]
(c)	(i)	Add about 2 cm^3 of solution **R** into a clean test-tube. To this test-tube, slowly add about 2 cm^3 of solution **P**, with shaking, until no further change is seen.	Bubbles observed. White ppt formed in limewater [1] **[MR: some students did not test for gas here; a number wrote that damp blue litmus paper turned red]**
	(ii)	To the same test-tube, add about 2 cm^3 of solution **Q** and shake the mixture thoroughly until no further change is seen.	No visible reaction [1] OR colourless solution turns light blue / blue [1] **[MR: many students simply wrote that solution turned blue instead of colourless solution turning blue/the word clear was used instead]** [2]
	(iii)	Transfer the mixture in **(c)(ii)** into a boiling tube. Using a measuring cylinder, add 3 cm^3 of dilute sodium hydroxide to the mixture.	Blue/dark blue ppt formed. [1] **[do not accept: light blue ppt]** **[MR: a number of students wrongly identified this as a solution]**
		Heat the boiling tube gently until no further changes are seen.	Bubbles observed. A pungent gas is formed. Damp red litmus paper turns blue [1] **[accept if students did not write bubbles observed; do not accept if the word damp is missing]** **[MR: many students did not test for this]** black ppt formed in colourless solution/ black ppt formed/blue ppt turns black [1] OR pale / green ppt formed in colourless solution/blue ppt turned green **[MR: many students missed out this observation]** [3]

	test	observations with solution **Q**	observations with solution **R**
(d)	Add about 1 cm^3 of solution **Q** to a clean test-tube. Add 1 cm^3 of dilute nitric acid, followed by 1 cm^3 of silver nitrate solution. Repeat the experiment using solution **R**.	White ppt formed. [1] **[MR: quite a number of students wrote that a light blue ppt was formed instead of white; a small number wrote that white solution was formed]**	No visible reaction. **[accept: no visible observations/no changes observed** **Do not accept: no changes/no observations]** **[MR: students have a tendency to write that no ppt formed etc., or give too many details about what happens when each solution is added]**
(e)	Add about 1 cm^3 of solution **Q** to a clean test-tube. Add 1 cm^3 of dilute hydrochloric acid, followed by 1 cm^3 of barium chloride solution. Repeat the experiment using solution **R**.	No visible reaction. **[accept: no visible observations/no changes observed** **Do not accept: no changes/no observations]** **[MR: a number of students wrote that the blue solution turned light blue etc.]**	White ppt formed. [1] **[MR: generally well done]**

[2]

Conclusions

(f) Using your observations, deduce which of the solutions **P, Q** or **R**, contains sulfuric acid. Explain your answer using evidence from your observations.

solution R

explanation In (e), white ppt of $BaSO_4$ formed when acidified barium chloride solution is added.

[accept: students not writing the part, but describing the test properly; white ppt formed when barium chloride solution added]

[MR: most students were able to correctly identify R as H_2SO_4 and could give a good explanation.]

.....[1]

(g) Using your observations in **(a)**, **(b)**, and **(c)**, deduce which of the solutions **P, Q** or **R**, contains carbonate.

Explain your answer using evidence from your observations in **(a)**, **(b)**, and **(c)**.

solution P

explanation In (a), (b) and (c), carbon dioxide is produced, as shown by the white ppt formed in limewater.

[accept: students only writing one part of the question; only writing that white ppt formed in limewater; do not accept: limewater turns chalky]

[MR: some students only wrote that bubbles were produced]

.....[1]

(h) Suggest the identity of the last solution.

Copper(II) chloride [1]

[MR: many students could identify that the solution contained copper(II) or chloride ions, although some of them could not piece them together.]

~ End of Paper ~

NOTES FOR QUALITATIVE ANALYSIS

Test for anions

anion	test	test result
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [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

cation	effect of aqueous sodium hydroxide	effect of aqueous ammonia
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

gas	test and test result
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