Pasir Ris Secondary School

Name	Class	Register Number

SECONDARY 4 EXPRESS
MID-YEAR EXAMINATION 2018

SCIENCE (CHEMISTRY) 5076

May 2018

1 hour

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
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

There are **ten** questions in this section. 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 the boxes provided on **page 4**.

Section B & C

Answer **all** questions 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 8.

Section	Marks
A	/10
B	/20
C	/10
Total	/40

This document consists of 9 printed pages (inclusive of this page).

Setter: Mr Mohd Riffaii

[Turn over

Section A: Multiple Choice Questions [20 marks]

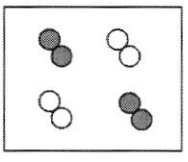
21 A mixture contains an organic liquid **J**, and a dilute solution of potassium chloride.
Liquid **J** boils at 21 °C and is immiscible in water.

Which two methods of separation should be used in sequence to obtain samples of liquid **J** first before solid potassium chloride?

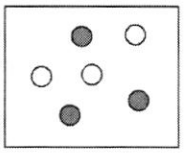
	method 1	method 2
A	use a separating funnel	evaporation
B	evaporation	sublimation
C	distillation	filtration
D	filtration	evaporation

22 Which diagram represents a mixture of diatomic elements?

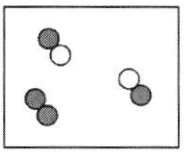
A



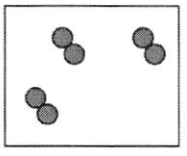
B



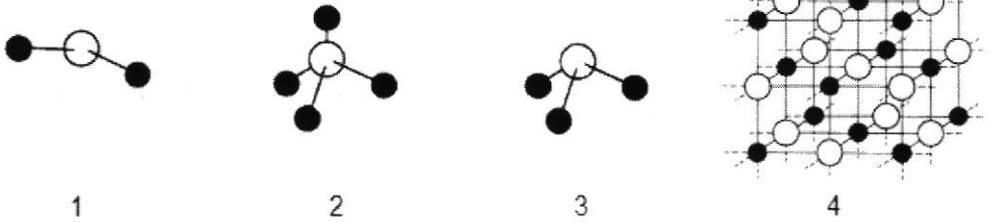
C



D



23 The diagrams represent four different compounds.

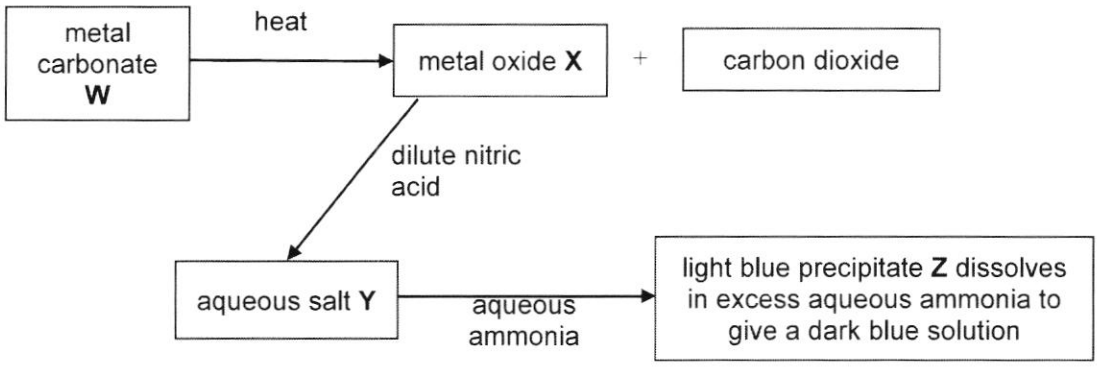


1 2 3 4

In which row are the compounds correctly named?

	1	2	3	4
A	ammonia	sodium chloride	methane	water
B	methane	ammonia	sodium chloride	water
C	water	ammonia	methane	sodium chloride
D	water	methane	ammonia	sodium chloride

24 Study the following reaction scheme.



What is the identity of metal carbonate **W**?

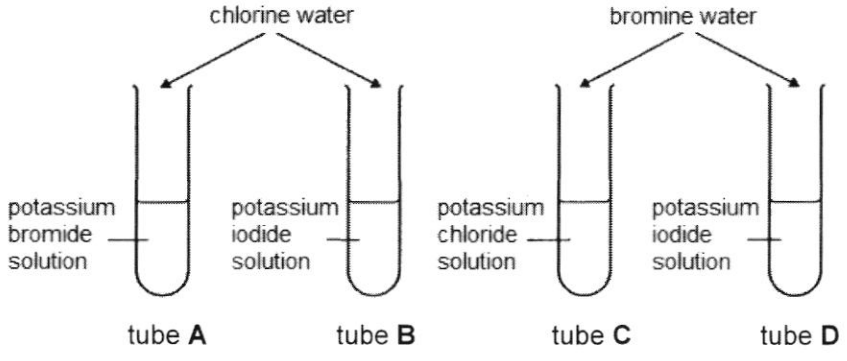
A copper(II) carbonate

B iron(II) carbonate

C iron(III) carbonate

D zinc carbonate

25 The diagrams show a series of experiments carried out using chlorine water and bromine water.



Which test tube, **A**, **B**, **C** or **D** shows no change in colour?

26 Which of the following processes is an endothermic reaction?

A combustion

B freezing

C photosynthesis

D respiration

27 Sulfur undergoes changes when it reacts with air and water.
The substances that sulfur form are represented in the following stages.

Stage 1	Stage 2	Stage 3	Stage 4
S	SO_2	SO_3	H_2SO_4

Which of the following shows the correct change in oxidation states of sulfur in each stage of the process?

	S	SO_2	SO_3	H_2SO_4
A	0	+2	+6	+8
B	0	+4	+6	+6
C	+2	0	+6	+6
D	+6	+6	+2	0

28 Which statements about the pollutant carbon monoxide are correct?

1 It is a colourless and odourless gas.
2 It is formed by the complete combustion of natural gas.
3 It reacts with the haemoglobin in the blood and reduce the transport of oxygen.

A 1 and 2 only

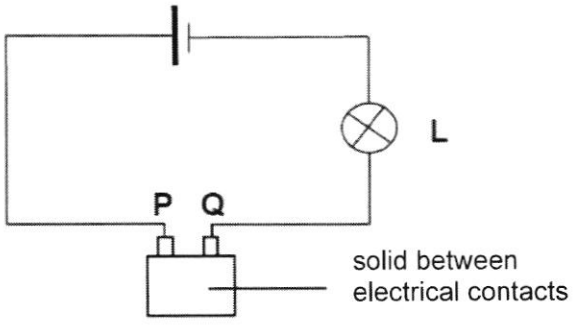
B 2 and 3 only

C 1 and 3 only

D 1, 2 and 3

29 The diagram shows a complete circuit.

Which solid, when placed between **P** and **Q**, would cause the light bulb **L** to light up?



A copper

B hydrogen fluoride

C sodium chloride

D sulphur

30 In the preparation of salts, which of the following would require the use of a burette and pipette?

A calcium sulfate

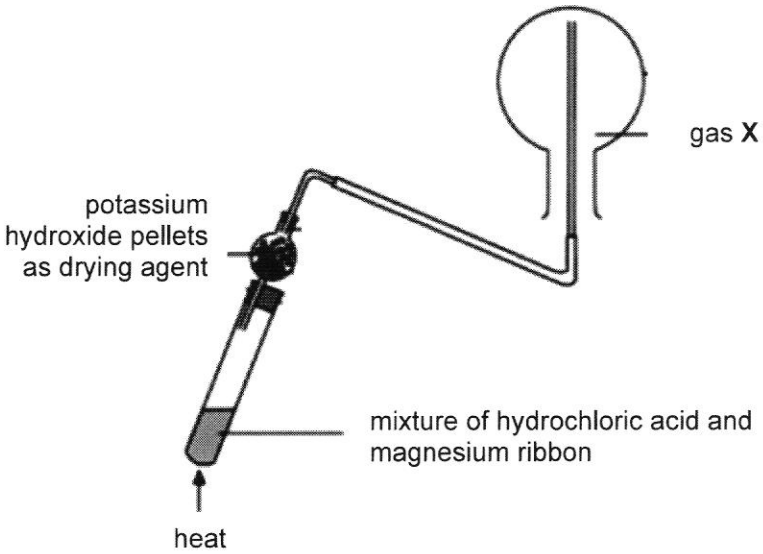
B sodium sulfate

C silver sulfate

D zinc sulfate

31 The diagram shows an upward delivery method for gas **X**.

What is the nature of the gas?



A The gas is soluble in water and denser than air.

B The gas is soluble in water and less dense than air.

C The gas is insoluble in water and denser than air.

D The gas is insoluble in water and less dense than air.

32 Which ionic equation represents the neutralisation of dilute sulfuric acid with aqueous sodium hydroxide?

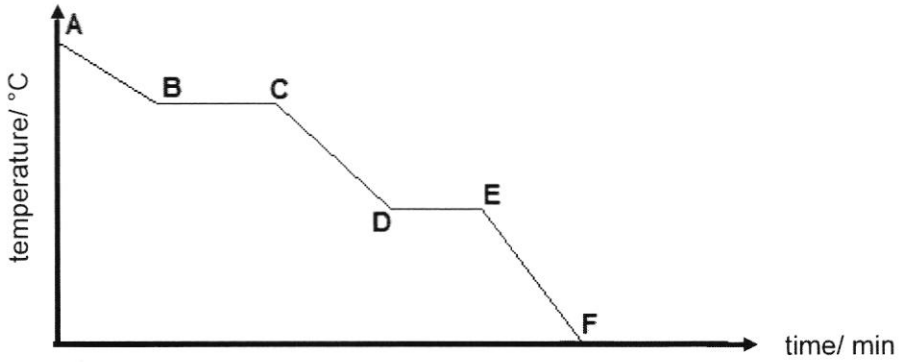
A $H^+ + OH^- \rightarrow H_2O$

B $NaOH + H^+ \rightarrow Na^+ + H_2O$

C $H_2SO_4 + 2OH^- \rightarrow SO_4^{2-} + 2H_2O$

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

33 The diagram shows a cooling curve of steam.



Which of the following options correctly describes the changes that occur between points **C** to **D**?

	separation of particles	energy of particles	attractive forces between particles
A	decreases	increases	decreases
B	decreases	decreases	increases
C	increases	increases	decreases
D	increases	decreases	increases

34 An element has an atomic number of 4.

Which statement about this element is correct?

A It forms ions by losing electrons.

B It has four occupied electron shells in each of its atoms.

C It is an unreactive gas at room temperature and pressure.

D It is found in Group IV of the Periodic Table.

35 An element X forms an ion of X^{2+}.

Which group of the Periodic Table is this element found in?

A Group I

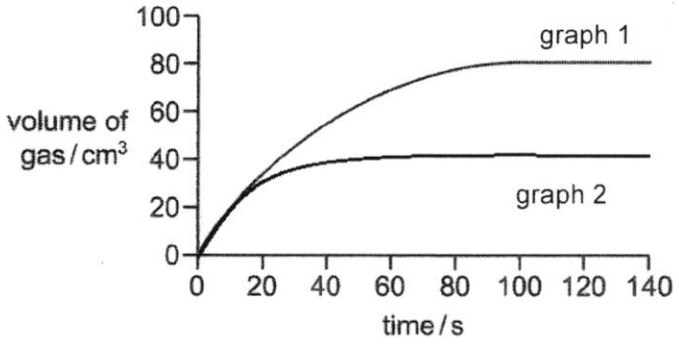
B Group II

C Group V

D Group VI

36 Some zinc carbonate was reacted with excess dilute nitric acid.

The graph shows the volume of carbon dioxide gas evolved at 20 second intervals until the reaction has finished. Graph 1 shows the results obtained from this reaction.



Which of the following could have been changed to produce graph 2?

A The concentration of acid was doubled.

B The concentration of acid was halved.

C The mass of zinc carbonate was halved.

D The particle size of the zinc carbonate was doubled.

37 The reaction between hydrochloric acid and calcium carbonate is shown.

$$2HCl + CaCO_3 \rightarrow CaCl_2 + H_2O + CO_2$$

What volume of 1.0 mol/dm^3 hydrochloric acid is needed to react completely with 1.0 g of calcium carbonate (M_r = 100)?

A 10 cm^3 **B** 20 cm^3

C 100 cm^3 **D** 200 cm^3

38 Which of the following substances is **not** present in the reaction during the extraction of iron?

A calcium oxide **B** calcium carbonate

C calcium hydroxide **D** calcium metasilicate

39 Which oxide will neither react with acids nor alkalis?

A carbon dioxide

B carbon monoxide

C magnesium oxide

D zinc oxide

40 The results of three metal displacement experiments are tabulated as shown.

experiment	metal	metal nitrate solution		
		JNO_3	KNO_3	LNO_3
1	**J**	-	no reaction	**L** displaced
2	**K**	**J** displaced	-	**L** displaced
3	**L**	no reaction	no reaction	-

What is the order of reactivity of these metals?

	most reactive ⟶		least reactive
A	**J**	**K**	**L**
B	**K**	**L**	**J**
C	**K**	**J**	**L**
D	**L**	**J**	**K**

End of Paper

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
						1 H hydrogen 1											2 He helium 4
3 Li lithium 7	4 Be beryllium 9		**Key** proton (atomic) number atomic symbol name relative atomic mass									5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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

Pasir Ris Secondary School

Name	Class	Register Number

SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC
MID YEAR EXAMINATION 2018

SCIENCE (PHYSICS, CHEMISTRY) **5076/03**

Paper 3 Chemistry **07 May 2018**

Monday 0800 – 0915 **1 hour 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

The use of an approved scientific calculator is expected, where appropriate.
You may use lose marks if you do not show your working or if you do not use appropriate units.

Section A
Answer **all** 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 15.
A copy of the Periodic Table is printed on page 16.

For Examiner's Use	
Section A	
Total	

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **16** printed pages, including the cover page.

Setter: Mr Mohd Riffaii

[Turn over

Section A

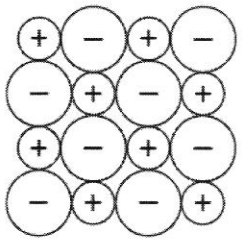
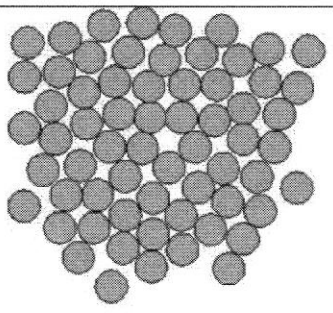
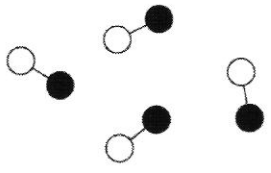
Answer **all** the questions in the spaces provided.

For Examiner's Use

1 **(a)** Use **three** words from the box below to describe each substance in Table 1.1. The words can be used once, more than once, or not at all.

solid	liquid	gas	atom	molecule
element	compound	mixture	ions	

Table 1.1

substance	diagram	description words
A		1 ..... 2 ..... 3 .....
B		1 ..... 2 ..... 3 .....
C		1 ..... 2 ..... 3 .....

[3]

(b) **(i)** Explain why substance **A** will conduct electricity when dissolved in water.

..... [1]

(ii) Suggest another way of making substance **A** conduct electricity.

..... [1]

For Examiner's Use

2 Spots of different coloured dyes were placed along a pencil line on a sheet of chromatography paper. The paper was then placed in a solvent.

Fig. 2.1 shows the chromatogram obtained.

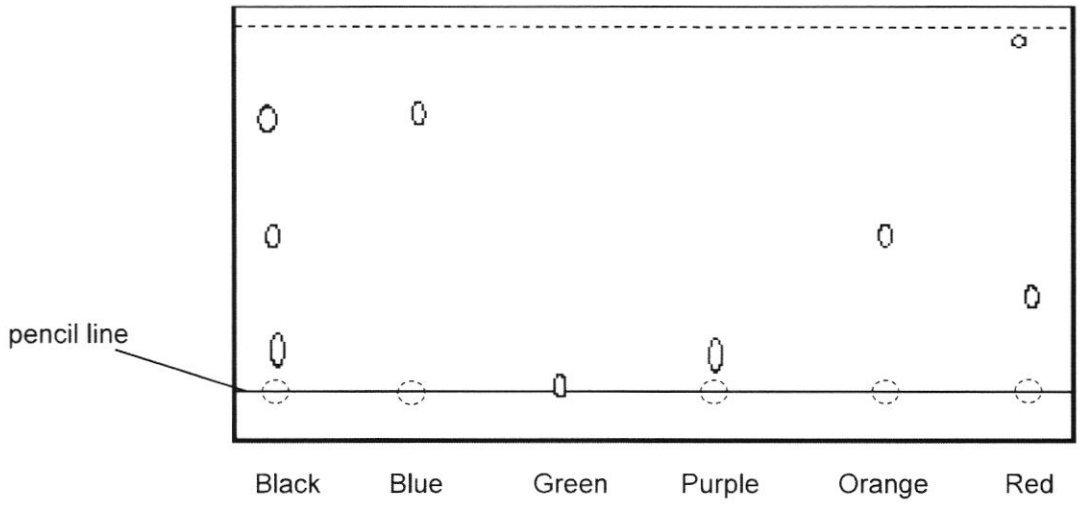


Fig. 2.1

(a) Which physical property allows chromatography to separate components of the dyes?

..... [1]

(b) Based on Fig. 2.1, what can be deduced about the components of the black dye?

..... [1]

(c) Suggest why the start line was drawn in pencil line and **not** in ink for this experiment?

.....

..... [1]

3 Hydrogen bromide has a melting point of –87 °C and a boiling point of –67 °C.

For Examiner's Use

(a) Draw a 'dot and cross' diagram to show the arrangement of electrons in a molecule of hydrogen bromide. Show only the outer shell electrons.

[2]

(b) Hydrogen bromide dissolves in water to form an acidic solution which is colourless.

(i) Give the formula of the ion which causes the acidity.

..... [1]

(ii) Describe what is seen when chlorine gas is bubbled through the solution.

.....

..... [1]

(iii) Construct an ionic equation, including state symbols, for the reaction you have described in **(ii)**.

..... [2]

For Examiner's Use

4 Zinc blende is an ore that contains mainly zinc sulfide (ZnS). The extraction of zinc from its ore happens in the blast furnace.

The ore of zinc blende is roasted in air (oxygen) to form zinc oxide which is then reduced with carbon monoxide in the blast furnace, similar to the extraction of iron from haematite.

The extraction of zinc can be represented by the equation as shown.

$$ZnO + CO \rightarrow Zn + CO_2$$

(a) State which substance is reduced and give a reason for your answer.

substance reduced .....

reason ..... [2]

(b) Zinc produced by the blast furnace is often alloyed to increase its hardness and strength. Brass is an alloy of zinc and copper.

(i) Draw the structure of brass in the box provided in Fig. 4.1.

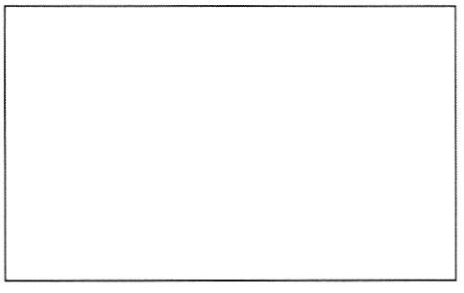


Fig. 4.1 [1]

(ii) With reference to your drawing in Fig. 4.1, explain why brass is harder and stronger compared to pure zinc.

.....

.....

..... [2]

5 The reaction between copper(II) oxide and hydrogen can be represented by the equation as shown.

For Examiner's Use

$$CuO(s) + H_2(g) \rightarrow H_2O(g) + Cu(s)$$

In this reaction, 0.40 g of solid copper(II) oxide was used.

(a) (i) Calculate the number of moles of copper(II) oxide used in the reaction.

[1]

(ii) Hence, determine the number of moles of hydrogen gas is required for all the copper(II) oxide to be used up in the reaction.

[1]

(b) It is also known that 165 cm^3 of hydrogen gas was used in the reaction.

(i) Using your answer from **(a)**, determine the limiting reagent.
Explain your answer clearly by showing all relevant calculations.

[3]

(ii) Hence or otherwise, calculate the mass of water vapour produced at the end of the reaction.

[2]

For Examiner's Use

6 Part of the Periodic Table is shown in Fig. 6.1.
The letters are **not** the actual chemical symbol of the elements.

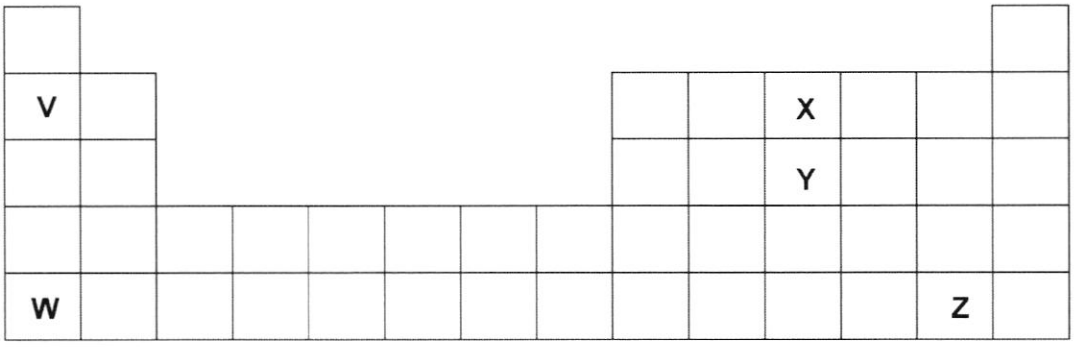


Fig. 6.1

For each of the following statements, decide whether the statement is true or false and state a reason for your decision.

(a) **W** is more metallic than **Z**.

.....

..... [1]

(b) **V** is less reactive than **W**.

.....

..... [1]

(c) **V** has a lower melting point than **W**.

.....

..... [1]

(d) **X** has more electron shells than **Y**.

.....

..... [1]

7 Study the flowchart in Fig. 7.1 and answer the following questions.

For Examiner's Use

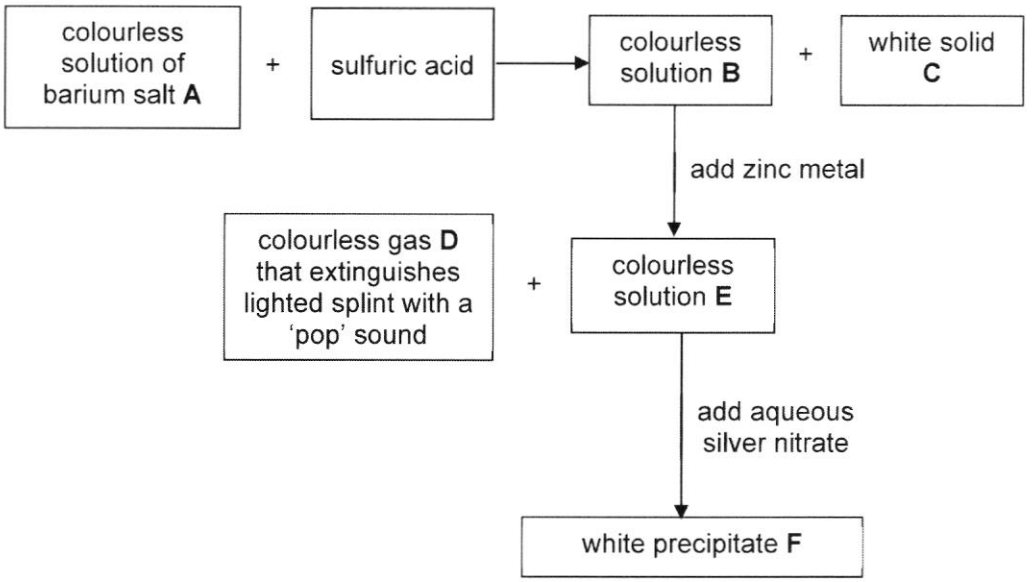


Fig. 7.1

(a) Identify substances **A** to **F**.

A .....

B .....

C .....

D .....

E .....

F ..... [6]

(b) Write a balanced chemical equation for any **one** of the reactions described in Fig. 7.1.

..... [2]

For Examiner's Use

8 **(a)** A chemical company makes salts for use in industries. Table 8.1 shows some names and formulae of salts with the names of the acids and other compounds used to make them.

Complete the table by writing the missing information.

Table 8.1

name of salt	formula of salt	name of acid used to make salt	name of the other compound used to make salt
sodium sulfate	Na_2SO_4		
potassium phosphate	K_3PO_4	phosphoric acid	
silver chloride	AgC*l*		
calcium phosphate		phosphoric acid	calcium hydroxide

[3]

(b) Fig. 8.2 shows a rusted car. However, not all the parts have rusted. The areas that have not rusted are either painted or have plastic coatings.

Fig. 8.2

Explain how the paint and plastic coating can slow down rusting.

.....

..... [2]

(c) Harmful gases released into the atmosphere can form acid rain which speeds up rusting.

Name **one** such gas which causes acid rain and state its source.

..... [2]

For Examiner's Use

Section B

Answer any **two** questions in this section.

Write your answers in the spaces provided.

9 Read the information about chlorine.

> Chlorine ranks among the top ten chemicals produced today. Chlorine is produced by passing an electric current through a concentrated solution of sodium chloride or through molten sodium chloride. This process is one of the most important commercial processes in industry. Chlorine, in one form or another, is added to most swimming pools, spas, and public water supplies because it kills bacteria that cause disease. Many people also use chlorine to bleach their clothes. Large paper and pulp mills use chlorine to bleach their products.
>
> Two naturally occurring isotopes of chlorine exist, chlorine-35 and chlorine-37.
> Chlorine exists commonly both in the Earth's crust and in seawater as sodium chloride.
> Smaller amounts of potassium chloride and magnesium chloride also occur in seawater.
>
> Chlorine is very reactive. The reaction between chlorine and other elements can often be vigorous. For example, chlorine reacts explosively with hydrogen to form hydrogen chloride.

(a) The information contains examples of a mixture.
Identify **two** mixtures in the information.

.....

.....

[1]

(b) The chemical symbols of the two chlorine isotopes are shown below.

$^{37}_{17}Cl$ $^{35}_{17}Cl$

Compare and contrast the structures of the nuclei in chlorine isotopes.

.....

.....

.....

[2]

For Examiner's Use

(c) Magnesium burns in chlorine gas to produce magnesium chloride.

(i) Complete Table 9.1 which gives information about the two ions in magnesium chloride.

Table 9.1

name of ion	number of protons	number of neutrons	number of electrons	electronic structure
magnesium ion	12			2,8
chloride ion	17	18		

[2]

(ii) Draw a 'dot' and cross diagram to show the arrangement of electrons in magnesium chloride. Show only outer shell electrons.

[2]

(d) Chlorine can react with hydrogen to form hydrogen chloride. Hydrogen chloride is a gas at room temperature.

(i) In terms of electrons, describe the bonding in hydrogen chloride.

.....

..... [1]

(ii) At room temperature, magnesium chloride is a solid while hydrogen chloride is a gas.
Use your knowledge of the bonding in magnesium chloride and hydrogen chloride to explain the difference in physical state.

.....

.....

.....

.....

..... [2]

For Examiner's Use

10 **(a)** Hydrochloric acid is used for rust removal while sodium hydroxide is used in detergents.

(i) State the colour of Universal Indicator in dilute hydrochloric acid and in aqueous sodium hydroxide.

.....

..... [2]

(ii) Explain briefly, in terms of ions in solution, the reason for the difference in acidity and alkalinity of hydrochloric acid and sodium hydroxide solutions.

.....

..... [2]

(iii) The reaction between hydrochloric acid and magnesium metal produces a soluble salt, magnesium chloride.
Describe the steps to obtain a pure sample of magnesium chloride from the reaction.

.....

.....

.....

.....

.....

..... [4]

(b) In an experiment, 20.0 cm^3 of 1.50 mol/dm^3 sodium hydroxide exactly neutralised 25.0 cm^3 of hydrochloric acid. Using the chemical equation provided for the reaction, calculate the concentration of the hydrochloric acid used.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

[2]

For Examiner's Us

11 **(a)** Fig. 11.1 shows the speed of reaction between calcium carbonate and hydrochloric acid in two different experiments.

Experiment 1 was performed using 10 g of powdered calcium carbonate.
Experiment 2 was performed using 10 g calcium carbonate in lumps.

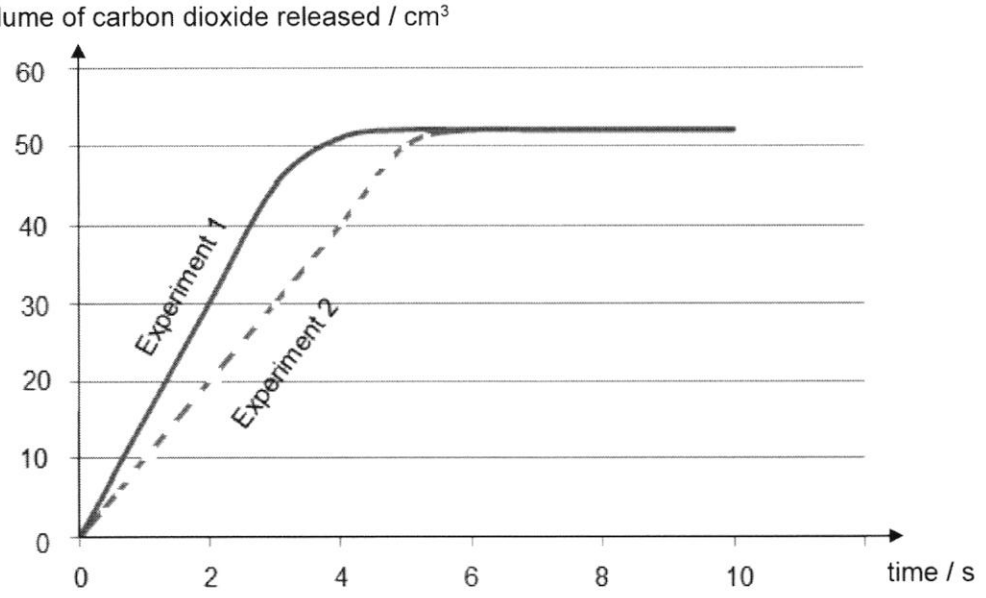


Fig. 11.1

(i) Based on the graphs, compare the speed of reaction for the two experiments.

.....

..... [1]

(ii) Use your knowledge of reacting particles to explain why the particle size of calcium carbonate affects the speed of reaction.

.....

.....

.....

..... [2]

(iii) Write a balanced chemical equation, including state symbols, for the reaction between calcium carbonate and hydrochloric acid.

..... [2]

(b) Sketch on Fig. 11.1 the speed of reaction for **5 g of powdered calcium carbonate**. Label this 'Experiment 3'. [1]

(c) The temperature of the mixtures increased during the reaction in both experiments 1 and 2.

(i) Suggest whether the reactions are exothermic or endothermic.

..... [1]

(ii) Explain in terms of bond breaking and bond forming for your answer in **c (i)**.

.....

.....

.....

.....

.....

..... [2]

(iii) Suggest a method that can be used to accurately determine that all the acid has been used up during the reaction.

..... [1]

End of Paper

DATA SHEET

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 Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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

Answers for Paper 1							
21	A	26	C	31	D	36	C
22	A	27	B	32	A	37	B
23	D	28	C	33	B	38	C
24	A	29	A	34	A	39	B
25	C	30	B	35	B	40	C

Pasir Ris Secondary School

SECONDARY 4 EXPRESS
MID-YEAR EXAMINATION 2018

SCIENCE (CHEMISTRY)	5076
Paper 1: Friday 0800 – 0900	04 May 2018
Paper 3: Monday 0800 - 0915	07 May 2018
	20 + 65 marks

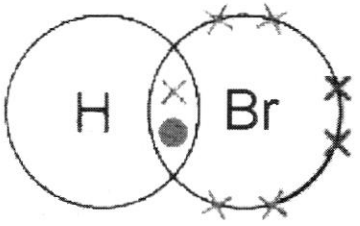
MARKING SCHEME

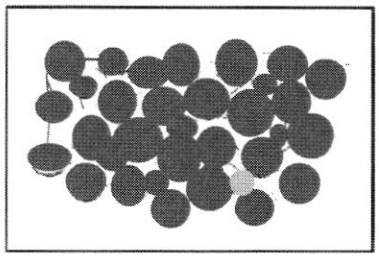
This document consists of **14** printed pages (inclusive of this page).

Setter: Mr Mohd Riffaii

[Turn over

Section A: Structured Questions [45 marks]

<table>
<tr><td>1</td><td>(a)</td><td colspan="2"><table><tr><td>description words</td><td></td></tr><tr><td>1 solid
2 ions
3 compound</td><td>Students incorrectly state mixture due to the different charges.</td></tr><tr><td>1 liquid
2 element
3 atom</td><td>Students incorrectly state solid due to the connecting atoms or molecule</td></tr><tr><td>1 gas
2 compound
3 molecule</td><td>Students incorrectly state mixture due to the different coloured shapes failing to appreciate the line or as atoms.</td></tr><tr><td>Any order</td><td></td></tr></table>1 mark for every 3 correct answers</td><td></td><td>[3]</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Presence of mobile ions to act as charge carriers to enable conduction of electricity</td><td>Missing key terms of mobile ions act as charge carriers. Students state free electrons which is reserved for metals.</td><td>[1]</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Heating A till it melts / A is in molten state.</td><td>Students state electrolysis and electroplating it as a method.</td><td>[1]</td></tr>
<tr><td></td><td></td><td></td><td>[Total: 5 marks]</td><td></td><td></td></tr>
<tr><td>2</td><td>(a)</td><td colspan="2">Different solubilities of components in solvent</td><td>Many students wrote solubility as a one-word response. Failing to state solubility of the dyes.</td><td>[1]</td></tr>
<tr><td></td><td>(b)</td><td colspan="2">Contains blue, purple and orange</td><td>Most who got wrong failed to indicate blue as well as they felt it wasn't perfectly in line.</td><td>[1]</td></tr>
<tr><td></td><td>(c)</td><td colspan="2">Graphite/Carbon in the pencil is insoluble in the solvent and would not affect the results.</td><td>Students failed to answer question of why pencil was used by only stating why ink is not used. Some used 'lead' as a term to explain about the carbon from pencil.</td><td>[1]</td></tr>
<tr><td></td><td></td><td colspan="2">[Total: 3 Marks]</td><td></td><td></td></tr>
<tr><td>3</td><td>(a)</td><td colspan="2"> 
</td><td>Most could not recall how to draw the bromine electrons properly. Left blank.
Legend stated only as hydrogen/bromine</td><td>[2]</td></tr>
</table>

	(b)				
		(i)	H^+	Students wrote equations of HBr or H^- .	[1]
		(ii)	Colourless solutions starts to turn reddish - brown	Students described the displacement reaction itself rather than colour observations. Some stated yellow instead of reddish brown.	[1]
		(iii)	$Cl_2(g) + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$ [1] – correct chemical formula/ions [1] – correct state symbols (2nd mark is only awarded if the 1st mark is given)	Very poorly done. 98% could not do this question and could not balance equation. Need to revisit this topic.	[2]
				[Total: 6 marks]	
4	(a)	Substance reduced: ZnO has been reduced [1] Reason: ZnO has lost an oxygen atom to form Zn / oxidation number of Zn has decreased from +2 in ZnO to 0 in Zn. [1]		**substance reduced**: most incorrectly state as just Zn. **Reason: student are** able to explain the **loss of oxygen** to identify the substance **reduced. However**, their phrasing is wrong using *oxygen has been reduced from zinc oxide.*	[2]
	(b)	(i)		most students who made mistakes drew orderly arranged atoms or did not differentiate the size of the atoms enough. the size of the atoms enough. Labelling might help.	[1]
		(ii)	The <u>different sized atoms disrupts the orderly arrangement</u> [1] of pure metal. This makes it <u>harder for the layers to slide over one another</u> [1] thereby making it harder.	Most fail to get the full marks by either omitting *different size disrupts orderly arrangement.*	[2]
				[Total: 5 marks]	
5	(a)	(i)	Mr of CuO = 64 + 16 = 80 No. of moles of CuO $= \frac{0.40}{80}$ $= 0.0050$ moles		[1]

		(ii)	Mole ratio, CuO:H_2 is 1:1, hence 0.0050 moles of H_2 is required	Students fail to state why the value is same as a(i).	[1]
	(b)	(i)	No. of moles of hydrogen gas used $= \frac{165}{24000}$ = 0.006875moles [1] Mole ratio, CuO:H_2 is 1:1 0.005mole of CuO requires only 0.005 moles of H_2. However, 0.006875moles of H_2 is used. Hence H_2 is in excess. [1] CuO is the limiting reagent. [1]	Quite a large number of students had not done this part as they forgot to change cm3 to dm3. They also had forgotten the formula. Lastly, they incorrectly associate CuO and H2 mole directly by looking which is more rather than by looking at amount of H2 available vs needed.	[3]
		(ii)	Mr of water vapour = 2 + 16 = 18 Mole ratio of CuO:H_2O is 1:1. Hence 0.005mols of water vapour is formed. [1] Mass of water vapour = 0.005 x 18 = 0.09g [1]	Quite a fair number of students erroneously used the amount of hydrogen used in a(i). to calculate the number of moles. 1m was given for method mark.	[2]
				[Total: 7 marks]	
6	(a)		True; In the same Period, metallic character of elements decreases from left to right of PT so W is more metallic than Z.	Most students were able to do this question. However the explanation needs improvement as they only say the Z is a halogen rather than showing less character of a metal.	[1]
	(b)		True; On moving down Group I elements, the reactivity increases so V is less reactive than W.	Most students could do this well.	[1]
	(c)		False; On moving down Group I elements, the melting point of the element decreases so V should have a higher melting point than W.	Quite a fair number of students had forgotten trends of Grp 1	[1]
	(d)		False, On moving down any group, the number of electron shells in the atoms of the element increases so X should have less electron shells than Y.	Almost all students were able to answer this question well.	[1]

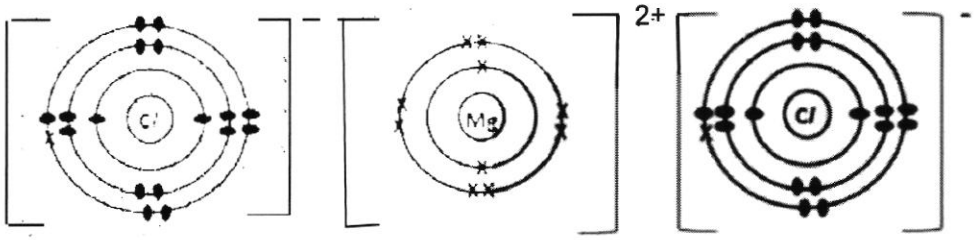
		(No mark for reason if 'true/false' is incorrect.)		
			[Total: 4 marks]	
7	(a)	A: barium chloride B: hydrochloric acid C: barium sulfate D: hydrogen gas E: zinc chloride F: silver chloride	**A** students could not identify the acid. **B** students could not identify the acid as HCl. Most placed Barium sulfate in this option. **C** most left this blank **D** all students could identify this **E** some students were able to identify this but was not able to work backwards. **F** **as above**	[6]
	(b)	$2AgNO_3\,(aq) + ZnCl_2\,(aq) \rightarrow 2AgCl\,(s) + Zn(NO_3)_2\,(aq)$ $BaCl_2\,(aq) + H_2SO_4\,(aq) \rightarrow BaSO_4\,(s) + 2HCl\,(aq)$ $2HCl\,(aq) + Zn\,(s) \rightarrow ZnCl_2\,(aq) + H_2\,(g)$	Most students who could not do the above could not write a balanced equation. Some also wrote nonsensical response as the reaction cannot go through.	[2]
			[Total: 8 marks]	
8	(a)			[3]

name of salt	formula of salt	name of acid used to make salt	name of the other compound used to make salt
sodium sulfate	Na_2SO_4	**sulfuric acid**	**sodium oxide/hydroxide/carbonate**
potassium phosphate	K_3PO_4	phosphoric acid	**potassium oxide/ hydroxide/carbonate**
silver chloride	$AgCl$	**hydrochloric acid**	**silver nitrate**
calcium phosphate	**$Ca_3(PO_4)_2$** Few recalled the charge for phosphoric acid	phosphoric acid	calcium hydroxide

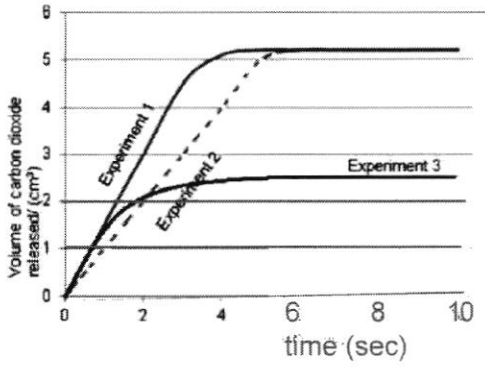
	(b)	The paint and plastic coating acts as a barrier [1] to	Most students could identify why the paint can be used to prevent rusting but quite a large number did not state how it acts as a protective layer/ barrier from the reactants.	[2]

		Prevent / minimize oxygen and water from coming into contact with iron directly [1]		
	(c)	Nitrogen dioxide – motor vehicles Sulfur dioxide – factories / coal/ volcanic eruptions	Most correctly stated the gases SO2 but CO was another incorrect response.	[2]
			[Total: 7 marks]	
	Section B – Free Response Questions [20 marks]			For Examiner's Use
9	(a)	Solution of sodium chloride and seawater	Many stated swimming pool, tap but the water was only inferred not mentioned.	[1]
	(b)	Both have same number of protons, 17. They have different number of neutrons, Cl-35 has 18 neutrons while Cl-17 has 20 neutrons.	Many students correctly stated the the same number in proton but did not elaborate on the difference in the number of neutron through calculation to show how they knew the neutron was different.	[1] [1]
	(c)	(i) Table 8.1		[2]

name of ion	number of protons	number of neutrons	number of electrons	electronic structure
magnesium ion		**12**	**10** Ions mean that there is a difference between proton and electron. Mg loses 2 electrons	
chloride ion			**18** Chlorine gains one electron	**2,8,8**

		(ii) 	charges [1], electrons [1] Most failed to draw the proper charges and wrongly indicated the outermost shell for magnesium with 2 electrons.	[2]

	(d)	(i)	Hydrogen and chlorine share a pair of electrons between them.	Most wrongly stated by just stating it has covalent bonds without describing further.	[1]
		(ii)	Magnesium chloride is a solid at room temperature as a large amount of energy is required to overcome the strong electrostatic forces of attraction between oppositely charged ions. Hydrogen chloride is a gas at room temperature as only a small amount of energy is required to overcome the weak intermolecular forces of attraction between molecules.	Most students failed to state everything to get full marks. Many confused between structure and bonding. Structure describes how the particles are packed and its movement and arrangement.	[1] [1]
				[Total : 10 marks]	
10	(a)	(i)	Universal indicator in hydrochloric acid is red while it is purple in sodium hydroxide. Reject orange/yellow for hydrochloric acid and blue for sodium hydroxide	Orange and blue are synonymous for weak acid **and alkalis**	[2]
		(ii)	There are more H^+ ions than OH^- ions in acid. [1] There are more OH^- than H^+ ions in alkaline solutions. [1]	Acids have both types of ions only that there are more of one type than the other. The converse is true.	[2]
		(iii)	Add magnesium/carbonate/oxide in excess to acid [1] Filter the mixture to obtain magnesium as residue and keep the filtrate [1] Heat the filtrate to saturate the solution and allow it to cool to allow crystals to form [1] Dry the crystals between sheets of filter paper [1]	By drawing out the reaction, students can visualise better and not omit the steps.	[4]
	(b)		No. of moles of NaOH = 0.02x1.5 = 0.03 [1] Concentration of HCl = 0.03 / 0.0250 [1] = 1.20 mol/dm^3		[2]
				[Total: 10 marks]	
11	(a)	(i)	Experiment 1 has a faster rate of reaction than experiment 2. / Experiment 1 took a faster time to complete than experiment 2.	Steeper gradient indicates a faster rate of reaction.	[1]
		(ii)	Powdered calcium carbonate has a larger surface area to volume	Most omitted to state which particle was the smaller one and assumed the reader to	[2]

			ratio / larger total surface area exposed to collisions. [1] Results in higher frequency of effective collisions [1], thus greater speed of reaction.	know. Many used higher **probability** instead of frequency.	
		(iii)	$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$	Most could not recall reactions between acid and carbonates and the product obtained.	[2]
	(b)			Sizeable number of students failed to label the correct term. Students **failed to** appreciate the half volume **compared to first fgraph.** Students **did not follow** the reaction speed of the first graph.	[1]
	(c)	(i)	Exothermic reactions.	Heat increase is exothermic reaction	[1]
		(ii)	Greater energy is given off when bonds of products are formed [1] then energy taken in from surrounding in breaking bonds [1] of reactants. Hence there is a net increase in temperature.	Students failed to appreciate how bonds of existing compunds need to be broken in order to form new bonds. Breaking of bonds require energy which is **taken in** (endo) from surroundings. Forming of bonds require the energy to be **given out** to surroundings (exo). Since final is exo it means that more energy is given off than taken in.	[2]
		(iii)	Using a pH meter.	***accurately*** = use instrument to measure	[1]
				[Total: 10 marks]	

End of Paper