NAME	CLASS	INDEX NO.

ST. PATRICK'S SCHOOL
MID-YEAR EXAMINATION 2017

SUBJECT	:	SCIENCE CHEMISTRY	DATE	:	3 May 2017
LEVEL	:	SECONDARY 3 EXPRESS	DURATION	:	1 hr 20 mins

INSTRUCTIONS TO CANDIDATES

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. Write your name, class and index number on the **cover page of this Booklet**.
2. Answer **ALL** questions in **Section A** on the **table** provided in page 2.
3. Answer **ALL** questions in **Section B** and **Section C** in the spaces provided in this booklet.
4. Calculators may be used where necessary. **Where numerical answers are not exact, give answers to three (3) significant figures.**

Parent's Signature: _____

For Examiner's Use Only						
Section	A [15 m]	B [30 m]	C [20m]	Total [65m]	Grade	Target Grade
Score						

This paper consists of 15 printed pages, including the Periodic Table.

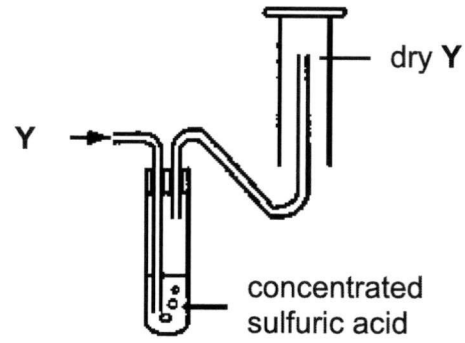
SECTION A [15 marks]

Each question is provided with **four** possible answers (**A**, **B**, **C** and **D**).

Select the most appropriate answer and write down the corresponding letter in the table provided below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

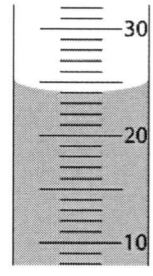
1 A dry sample of gas, Y, is collected using the experimental set up shown below.



Which of the following statements can be concluded based on the diagram shown?

A Gas Y is an alkaline gas.
B Gas Y is denser than air.
C Gas Y is an acidic gas.
D Gas Y is ammonia.

2 The diagram below shows a portion of a 50.0 cm^3 measuring cylinder filled with hydrochloric acid. What is the reading of the volume of hydrochloric acid in the measuring cylinder?



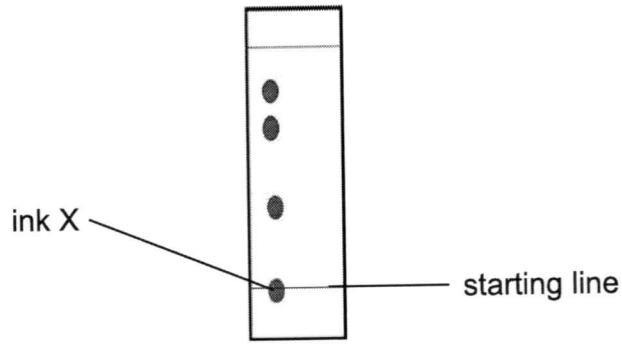
A 23.0 cm^3 **B** 24.0 cm^3 **C** 25.0 cm^3 **D** 26.0 cm^3

3 Which of the following can be used to test the purity of a substance?

I. Colour
II. Boiling point
III. Chromatography
IV. Solubility

A I and II
B II and III
C II and IV
D III and IV

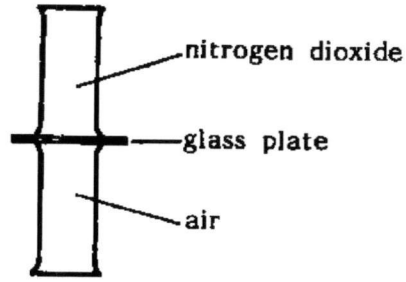
4 The chromatogram for ink X is shown below.



Which of the following statements can be concluded based on the chromatogram shown?

A The ink is insoluble in the solvent used.
B All the dyes in the ink have the same solubility in the solvent.
C The ink is made up of a mixture of three dyes.
D The ink is made up of a mixture of four dyes.

5 A gas jar full of brown nitrogen dioxide was placed over a gas jar full of colourless air. After a few hours, the colour of the gas in both jars became the same.

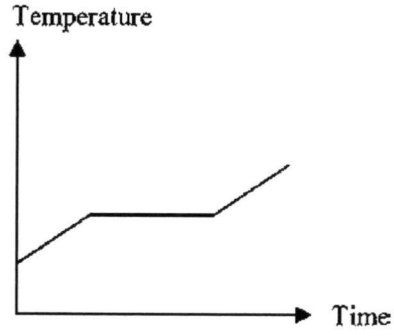


Which statement correctly explains this change?

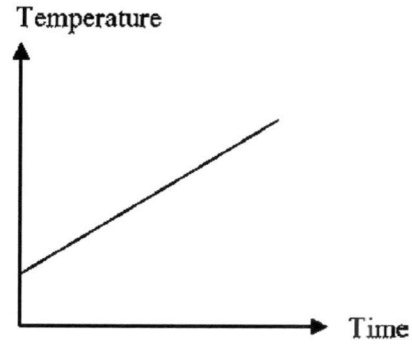
A Nitrogen dioxide and air molecules diffuse at the same rate.
B Nitrogen dioxide molecules move more quickly than air molecules.
C Nitrogen dioxide and air molecules move randomly in all direction.
D Nitrogen dioxide and air molecules have the same density.

6 Substance **X** has a melting point of -20 °C and a boiling point of 59 °C. It was heated from room temperature to 80 °C. Which of the following graphs represents the temperature profile obtained from the experiment?

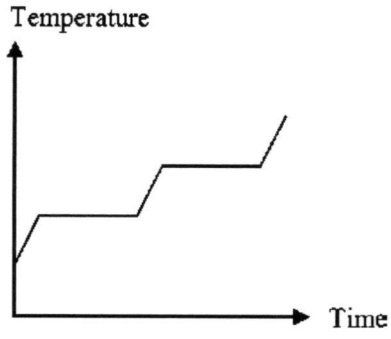
A



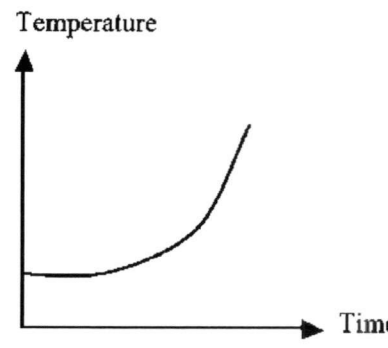
B



C



D



7 Initially, particles in substance W vibrate about a fixed position. Due to a change in temperature, the particles started to move slide pass each other. What is the name of the process that happened?

A Boiling
B Melting
C Sublimation
D Freezing

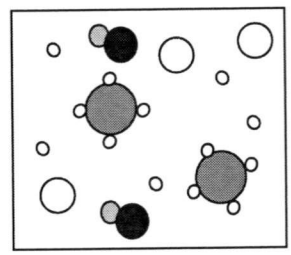
8 Which group of substances contains an element, a mixture and a compound respectively?

A air, pure water, sodium chloride
B copper, air, copper(II) sulfate
C pure water, sulfur, magnesium
D sulfur, copper(II) sulfate, sodium chloride

9 How many atoms are there in one molecule of chlorosulfonic acid, HSO_3Cl?

A 4 **B** 5 **C** 6 **D** 7

10 Which of the following is true about the diagram shown below?



A It contains only compounds.
B It contains only elements.
C It contains a mixture of elements and compounds.
D It does not contain diatomic molecules.

11 Which of the following statements is true for all atoms?

A The number of neutrons is equal to the number of electrons.
B The number of protons is more than the number of electrons.
C The number of protons is equal to the number of electrons.
D The number of protons is more than the number of neutrons.

12 Hydrogen can form both H^+ ions and H^- ions. Which statement about these two ions is correct?

A H^+ ion has more protons than an H^- ion.
B H^+ ion has no electrons in its first shell.
C H^- ion has one more electron than an H^+ ion.
D H^- ion is formed when a hydrogen atom loses an electron.

13 The diagram below shows the chemical notation for phosphorus. Which of the following represents the correct electronic configuration?

$$^{31}_{15}P$$

A 2. 8. 5
B 2. 8. 8
C 2. 8. 8. 5
D 2. 8. 8. 8. 5

14 Which of the following shows a balanced chemical equation for the reaction between calcium oxide and hydrochloric acid?

A $CaO(s) + HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l)$
B $CaO(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l)$
C $2CaO(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l)$
D $2CaO(s) + 2HCl(aq) \rightarrow 2CaCl_2(aq) + H_2O(l)$

15 Which of the following shows the correct ionic equation for the neutralisation reaction between sulfuric acid and sodium hydroxide?

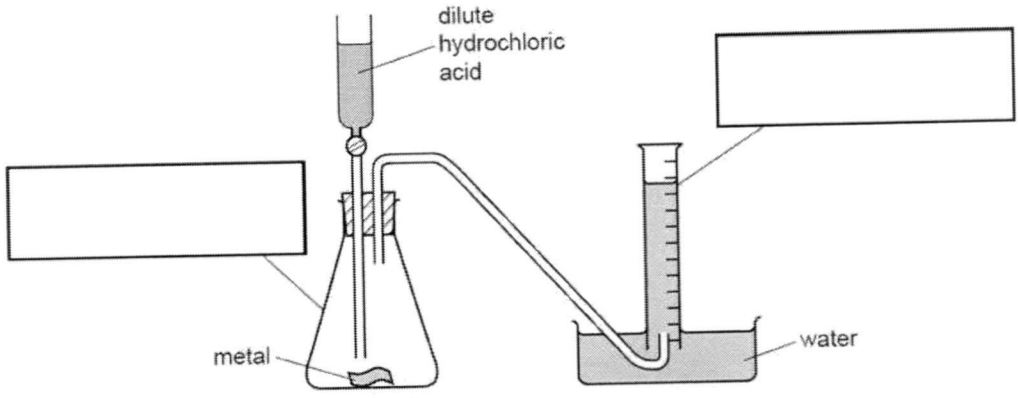
A $SO_4^{2-}(aq) + 2Na+(aq) \rightarrow Na_2SO_4(aq)$
B $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
C $2H^+(aq) + OH^-(aq) \rightarrow H_3O(l)$
D $H^+(aq) + Na^+(aq) \rightarrow NaH(aq)$

SECTION B [30 marks]

Answer ALL questions in this section. Show your working and write your answers in the space provided.

1 The apparatus below was used to prepare hydrogen and measure the volume of gas produced.

magnesium + hydrochloric acid → magnesium chloride + hydrogen gas



(a) Complete the boxes to identify the apparatus used. [2]

(b) **(i)** Name the method of gas collection shown.

_____ [1]

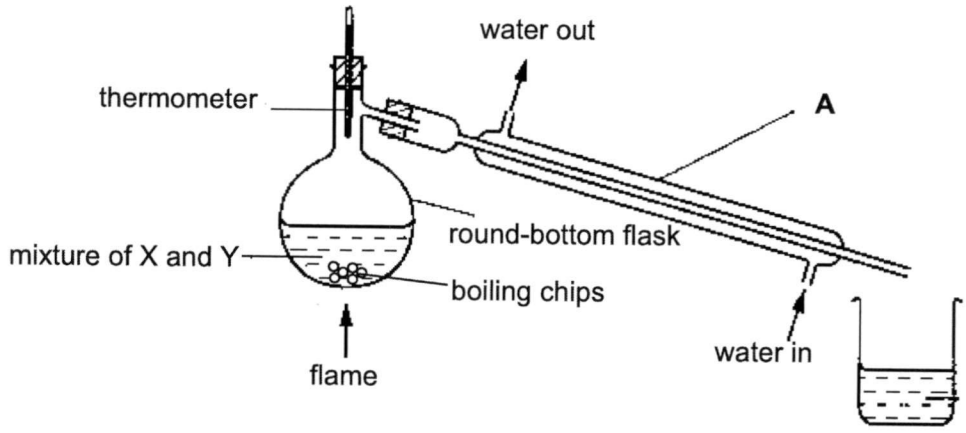
(ii) Give a property of the gas which enables collection of the gas using this method.

_____ [1]

(iii) Suggest another gas which can be collected using this method.

_____ [1]

2 A student carried out a separation technique to separate a mixture of 2 miscible liquid X (boiling point of 38 °C) and Y (boiling point of 70 °C). Both X and Y are volatile liquids.



(a) Briefly explain what is meant by *volatile liquids*.

_____

_____ [1]

(b) **(i)** Name apparatus **A** and state its function

Name of apparatus **A**: _____

Function: _____

_____ [2]

(ii) The student has observed that he was unable to separate the mixture completely. Suggest a modification to the set-up above and explain why it is needed.

_____

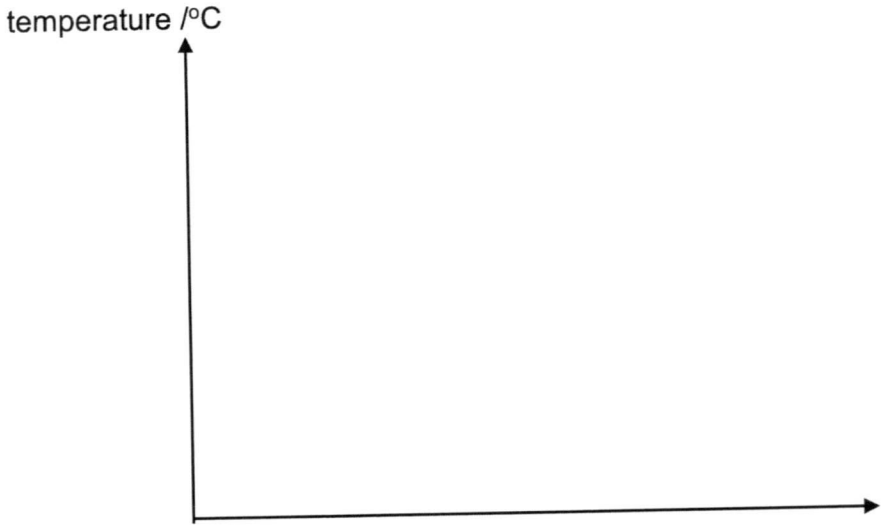
_____

_____

_____ [2]

(c) Given that the mixture of X and Y was heated from room temperature 25°C to 100°C, draw the heating curve obtained using the axes provided below. Label clearly on the graph the following:

- starting temperature and ending temperature;
- boiling point of X and Y.



[3]

3 The following describes an experiment in which iron powder was reacted with sulfuric acid.

I.	Iron powder is a grey solid. Excess iron powder was placed in a beaker containing 20cm^3 of colourless sulfuric acid. The initial thermometer reading was 25°C.
II.	A green solution of iron (II) sulfate was seen with some insoluble grey powder. Hydrogen gas is produced. The final thermometer reading was 28°C.
III.	The green solution was filtered to obtain the filtrate.
IV.	The filtrate was heated to form a saturated solution and the solution is left to cool. The crystals obtained were dried in between filter papers.

(a) In this experiment, identify

(i) an element,

_____ [1]

(ii) a compound,

_____ [1]

(iii) filtrate from the filtration,

_____ [1]

(iv) a residue from filtration.

_____ [1]

(b) State one evidence that a chemical change has taken place.

_____

_____ [1]

(c) State one difference between mixtures and compounds.

_____

_____

_____ [1]

(d) For step IV, explain the importance of evaporating the filtrate to form a saturated solution instead of evaporation to dryness.

_____

_____ [1]

4 The diagram below shows part of the Periodic Table.

I	II										III	IV	V	VI	VII	0
																He
Li												C	N	O	F	Ne
Na														S	Cl	Ar
K							Fe			Cu	Zn				Br	Kr

Answer these questions using only the elements shown in the diagram.

Write down the symbol for an element which

(a) is a metal,

_____ [1]

(b) has six valence electrons,

_____ [1]

(c) is found in period 3,

_____ [1]

(d) does not form an ion,

_____ [1]

(e) exists as diatomic molecules,

_____ [1]

(f) forms an ion with charge +1,

_____ [1]

(g) forms a covalent compound with hydrogen, XH_3.

_____ [1]

5 Balance the chemical equations.

(a) ___ C_2H_4 + ___ O_2 → ___ CO_2 + ___ H_2O

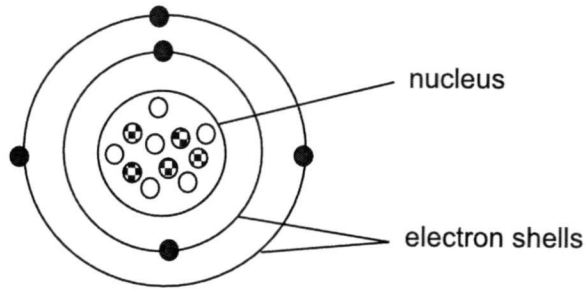
(b) ___ Ca + ____ H_2O → ____ $Ca(OH)_2$ + ____ H_2

(c) ___ H_2SO_4 + ____ KOH → ____ K_2SO_4 + ____ H_2O [3]

Section C [20 marks]

Answer all question in this section on the spaces provided.

1 (a) The diagram below shows the atomic structure of an atom of an unknown element D.



(i) Complete the table below.

particle	relative charge	relative mass
●	-1	
○		1
✪		

[4]

(ii) Element **D** has another *isotope*. Both of them have the same chemical properties. Define the term *isotope* and explain why both of them have the same chemical properties.

_____

_____

_____

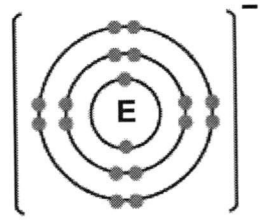
_____ [2]

(iii) Isotopes have different physical properties. Name one different physical property isotopes have other than atomic mass.

_____

_____ [1]

(b) The diagram below shows the electronic arrangement of an ion E.



(i) Name the element in ion E.

_____ [1]

(ii) Hence, explain why the element in (b)(i) forms ion E.

_____

_____ [2]

[Total: 10]

2 (a) State the chemical formula of each of the following substances.

(i) sodium oxide, _____

(ii) carbon monoxide. _____ [2]

(b) Showing only the valence electrons, draw dot-and-cross diagrams to represent the bonding in

(i) sodium oxide

[2]

(ii) carbon dioxide

[2]

(c) Explain why sodium oxide has a high melting and pointing point.

_____

_____

_____ [2]

(d) Does carbon dioxide conduct electricity in gaseous state? Explain your answer.

_____

_____

_____ [2]

[Total: 10]

---END OF PAPER---

The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 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 –

25 °C

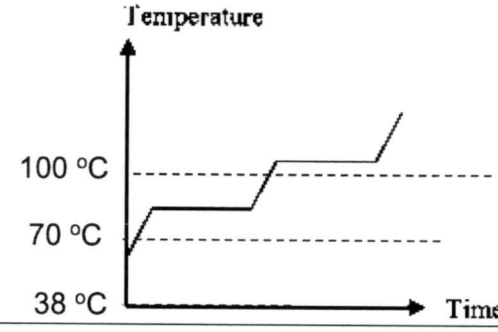
ST. PATRICK'S SCHOOL
MID-YEAR EXAM 2017

SUBJECT : SCIENCE CHEMISTRY **DATE : XX MAY 2017**
LEVEL : 3 EXPRESS **DURATION : 1 hr 20 min**

SECTION A

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C	**B**	**B**	**C**	**C**	**A**	**B**	**B**	**C**	**C**	**C**	**B**	**A**	**B**	**B**

SECTION B

			Answer	Marks
B1	a		Conical flask, measuring cylinder/gas jar **(no marks for spelling errors)**	2
	b	(i)	Displacement of water	1
		(ii)	Insoluble in water/ slightly soluble in water	1
		(iii)	carbon dioxide/ oxygen/ nitrogen/hydrogen/ noble gas	1
B2	a		Liquid that evaporates easily at room temperature. Liquid that is flammable [1/2]	1
	b	(i)	A: condenser/ Liebig condenser **(no marks for spelling errors)** Function: To change/condense gas/vapour to liquid **(no marks if students mention water/water vapour/steam)**	1 1
		(ii)	Add fractionating column./ Change to fractional distillation **(no marks for spelling errors)** To increase the surface area for repeated evaporation and condensation	1 1
	c			3

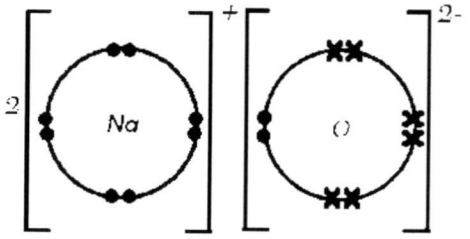
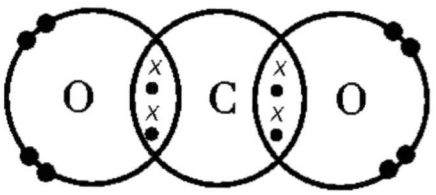
			---- [1/2] for starting and [1/2] for ending temperature [1] for correct shape of the graph [1/2] for b.p of X and [1/2] for b.p of Y	
B3	(a)	(i)	Iron/ hydrogen gas	1
		(ii)	Iron(II) sulfate/ sulfuric acid	1
		(iii)	Iron (II) sulfate solution	1
		(iv)	Iron	1
	(b)		Temperature increases/ hydrogen gas is produced/ green solution of iron (II) sulfate formed.	1
	(c)		Compound has fixed composition by mass while mixture does not./ Compound has fixed melting and boiling point while mixture does not. Accept any other suitable answers.	1
	(d)		Overheating will decompose the crystal/ It will remove all the water of crystallisation.	1
B4	(a)		Li/ Na/ K/ Fe/ Cu/ Zn **(For students that gave more than 1 answer, no marks awarded if there are wrong answers provided)**	1
	(b)		O/ S **(For students that gave more than 1 answer, no marks awarded if there are wrong answers provided)**	1
	(c)		Na/ S/ Cl/ Ar **(For students that gave more than 1 answer, no marks awarded if there are wrong answers provided)**	1
			He/ Ne/ Ar/ Kr **(For students that gave more than 1 answer, no marks awarded if there are wrong answers provided)**	1
	(e)		F/ Cl/ Br/ N/ O **(For students that gave more than 1 answer, no marks awarded if there are wrong answers provided)**	1
	(f)		Li/ Na/ K **(For students that gave more than 1 answer, no marks awarded if there are wrong answers provided)**	1
	(g)		N	1
B5	(a)		1, 3, 2, 2	1
	(b)		1, 2, 1, 1	1
	(c)		1, 2, 1, 2	1

Section C

C1	(a)	(i)	particle	relative charge	relative mass	4
			●	-1	**1/1840 or negligible**	
			○	**0**	1	

2

			⊗ +1 1	
		(ii)	Isotopes are atoms of the same element with the same number of protons but different number of neutrons. They contain same number of electrons/ electronic configuration.	1 1
		(iii)	Melting point/ boiling point/ density	1
	(b)	(i)	Chlorine	1
		(ii)	Chlorine atom gains 1 valence electrons to achieve a stable noble gas structure/ octet structure/ completely filled valence shell.	1 1

C2	(a)	(i)	Na_2O	1
		(ii)	CO	1
	(b)	(i)	 [1] for Na and [1] for O^{2-} Deduct [1] for students did not put include 2 Na^+	
		(ii)	 [1] for correct electrons in oxygen [1] for correct electrons in carbon	2
	(c)		**Strong electrostatic force of attraction/ Strong ionic bond** between **ions** **Large amount of energy is required** to overcome the force of attraction.	1 1
	(d)		No. Carbon dioxide **does not contain any mobile electrons/ ions** to conduct electricity.	1 1