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NAME	CLASS	INDEX NO.
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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.

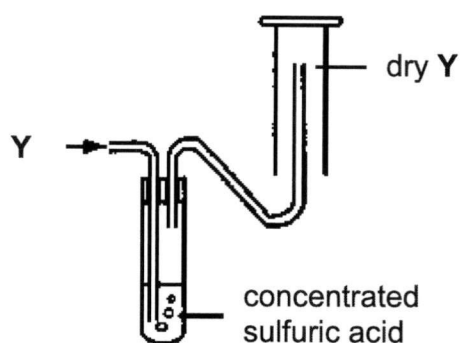
SECTION A [15 marks]

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.

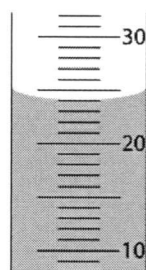
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

- 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 cm³ measuring cylinder filled with hydrochloric acid. What is the reading of the volume of hydrochloric acid in the measuring cylinder?



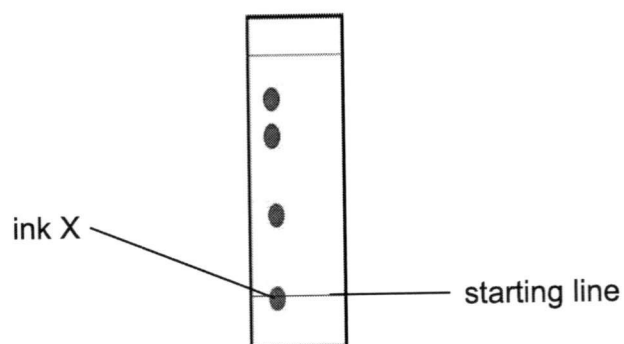
- A** 23.0 cm³
- B** 24.0 cm³
- C** 25.0 cm³
- D** 26.0 cm³

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

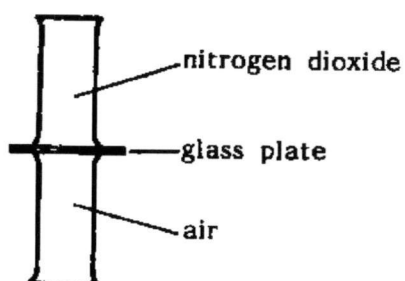
4 The chromatogram for ink X is shown below.



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

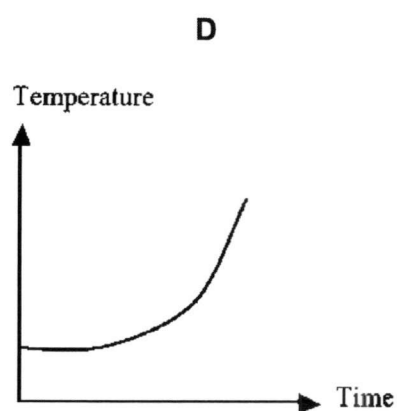
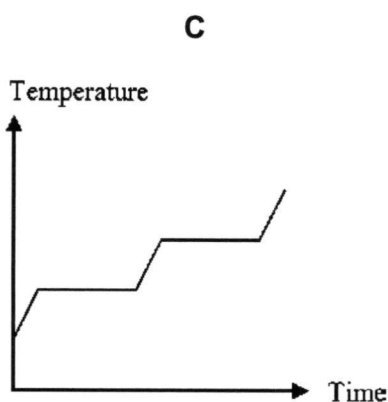
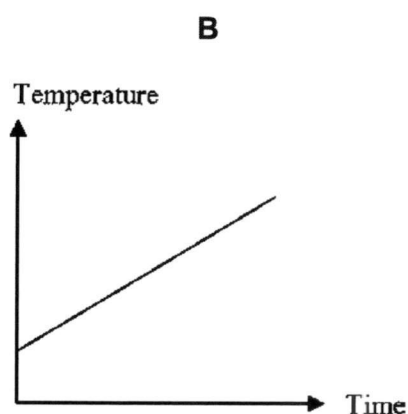
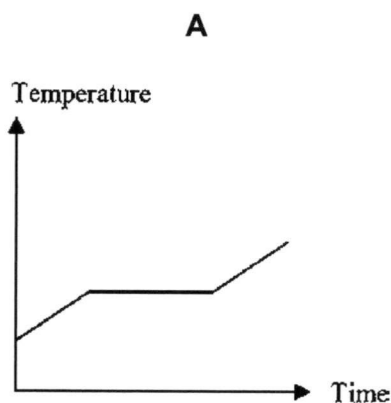
- A** The ink is insoluble in the solvent used.
- B** All the dyes in the ink have the same solubility in the solvent.
- C** The ink is made up of a mixture of three dyes.
- D** The ink is made up of a mixture of four dyes.

- 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?



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

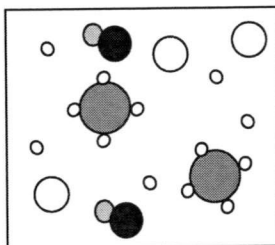
8 Which group of substances contains an element, a mixture and a compound respectively?

- 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.

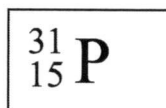
11 Which of the following statements is true for all atoms?

- 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?



- 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** $\text{CaO(s)} + \text{HCl(aq)} \rightarrow \text{CaCl}_2\text{(aq)} + \text{H}_2\text{O(l)}$
- B** $\text{CaO(s)} + 2\text{HCl(aq)} \rightarrow \text{CaCl}_2\text{(aq)} + \text{H}_2\text{O(l)}$
- C** $2\text{CaO(s)} + 2\text{HCl(aq)} \rightarrow \text{CaCl}_2\text{(aq)} + \text{H}_2\text{O(l)}$
- D** $2\text{CaO(s)} + 2\text{HCl(aq)} \rightarrow 2\text{CaCl}_2\text{(aq)} + \text{H}_2\text{O(l)}$

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

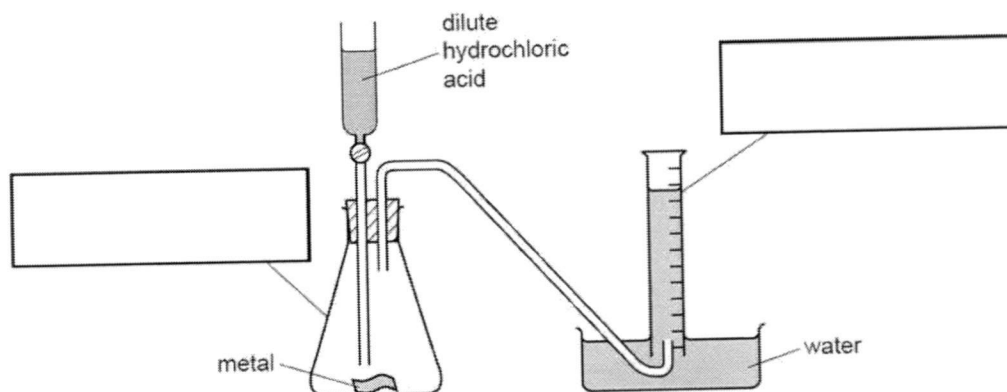
- A** $\text{SO}_4^{2-}(\text{aq}) + 2\text{Na}^+(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{aq})$
- B** $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O(l)}$
- C** $2\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_3\text{O(l)}$
- D** $\text{H}^+(\text{aq}) + \text{Na}^+(\text{aq}) \rightarrow \text{NaH(aq)}$

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 $\rightarrow$ magnesium chloride + hydrogen gas



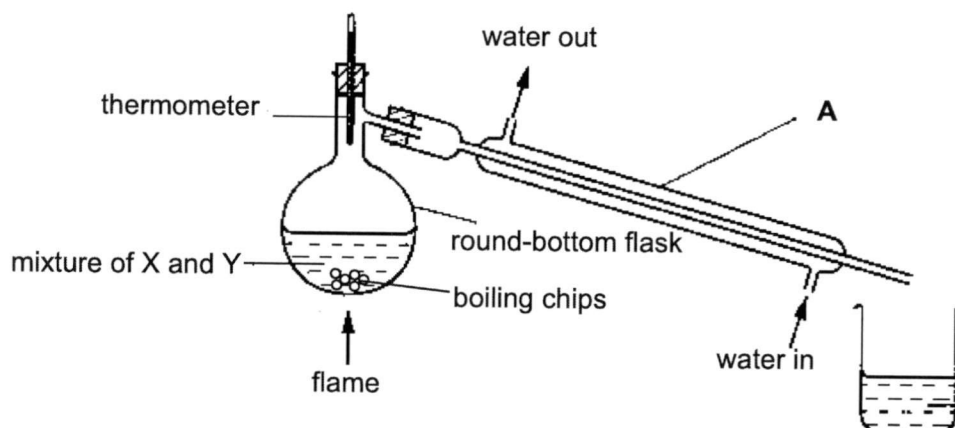
- (a) Complete the boxes to identify the apparatus used. [2]

- (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 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
Li													C	N	O	F	He
Na															S	Cl	Ne
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]

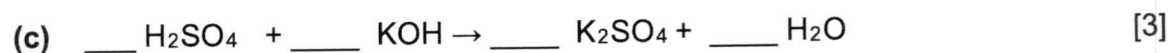
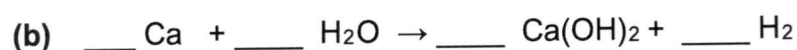
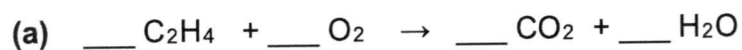
(f) forms an ion with charge +1,

_____ [1]

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

_____ [1]

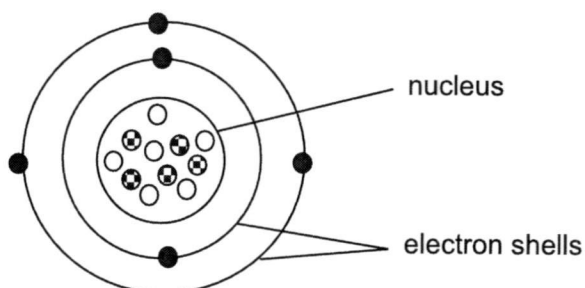
5 Balance the chemical equations.



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]

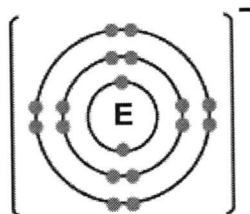
- (ii) Element **D** has another *isotope*. Both of them have the same chemical properties. Define the term *isotope* and explain why both of them have the same chemical properties.

[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

The Periodic Table of Elements																		
Group												III	IV	V	VI	VII	0	
I	II																	2
																		He helium 4

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
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 —

actinoids



^{25 °C} **ST. PATRICK'S SCHOOL** **MID-YEAR EXAM 2017**

SUBJECT : SCIENCE CHEMISTRY
LEVEL : 3 EXPRESS

DATE : XX MAY 2017
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 <u>gas/vapour to liquid</u> (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 <u>increase the surface area for repeated evaporation and condensation</u>	1 1
	c		Temperature Time	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	

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

C2	(a)	(i)	Na ₂ O	1
		(ii)	CO	1
	(b)	(i)	[1] for Na and [1] for O²⁻ 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)		<u>Strong electrostatic force of attraction/ Strong ionic bond between ions</u> <u>Large amount of energy is required</u> to overcome the force of attraction.	1 1
	(d)		No. Carbon dioxide <u>does not contain any mobile electrons/ ions</u> to conduct electricity.	1 1