



PASIR RIS CREST SECONDARY SCHOOL
Mid Year Examination
Secondary Three Express

CANDIDATE NAME

CLASS

	/	
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INDEX NUMBER

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Chemistry

Paper 1

6092**9 May 2019**

Papers 1 and 2: 1 h 40 min

Additional Materials: OTAS

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided.

There are **twenty** questions in this paper. For each question there are four possible answers **A, B, C and D**.

Choose one you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Answer all questions.

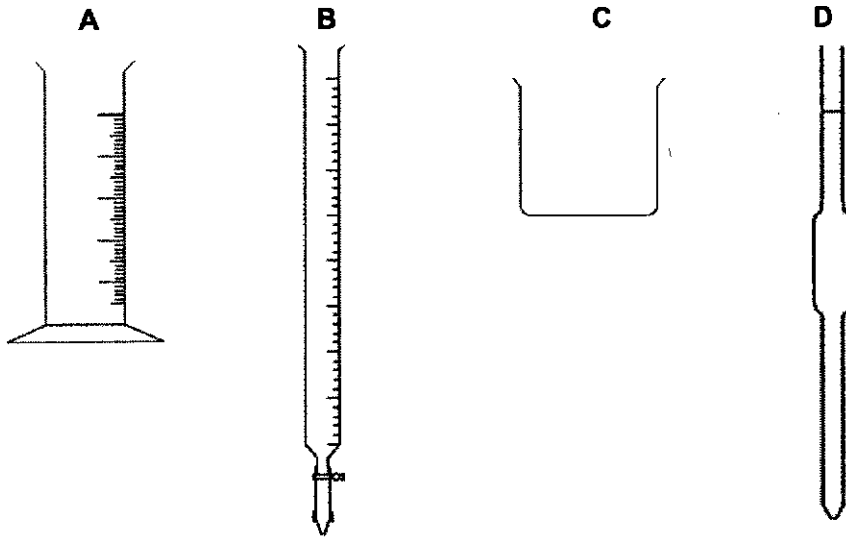
Each correct answer will score one mark.
A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 8.

For Examiner's Use	
TOTAL	/ 20

This document consists of 8 printed pages.

1 Which apparatus is most appropriate to accurately measure a fixed 25.0 cm³ of liquid?



2 What changes occur when a liquid at 20 °C becomes a gas at 100 °C?

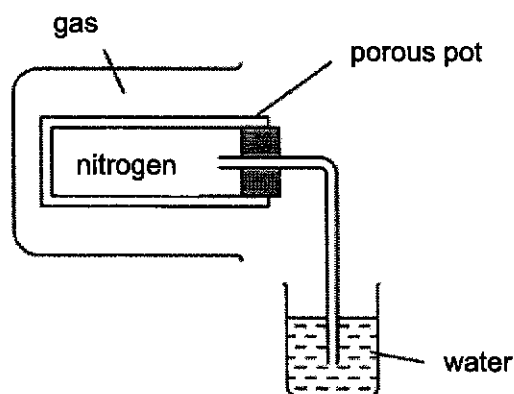
	distance between particles	energy of particles	attractive forces between particles
A	decreases	increases	decreases
B	decreases	decreases	increases
C	increases	increases	decreases
D	increases	decreases	increases

3 At room temperature and pressure, different gas molecules diffuse at different average speeds.

Which of the following shows a list of molecules diffusing in **increasing** average speed?

	slowest → fastest			
A	chlorine	sulfur dioxide	ammonia	methane
B	chlorine	sulfur dioxide	methane	ammonia
C	sulfur dioxide	chlorine	ammonia	methane
D	sulfur dioxide	chlorine	methane	ammonia

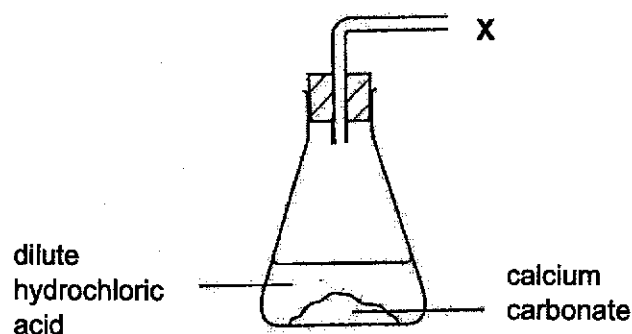
- 4 The apparatus shown below is used to compare the rate of diffusion between a gas and air.



A beaker containing the gas was placed over the porous pot.
Which gas would cause bubbles to be observed in the beaker of water?

- A carbon dioxide
 - B hydrogen
 - C oxygen
 - D sulfur dioxide
- 5 Calcium carbonate reacts with dilute hydrochloric acid to form calcium chloride, water and carbon dioxide.

The following diagram shows part of the apparatus used to measure the volume of carbon dioxide gas produced.



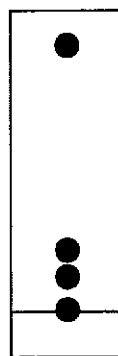
Which apparatus should be connected at position X?

- A gas jar
- B gas syringe
- C measuring cylinder
- D test tube

- 6 A class was investigating the colourings found in a flower. The chromatograms from two groups of students are shown below.



chromatogram 1



chromatogram 2

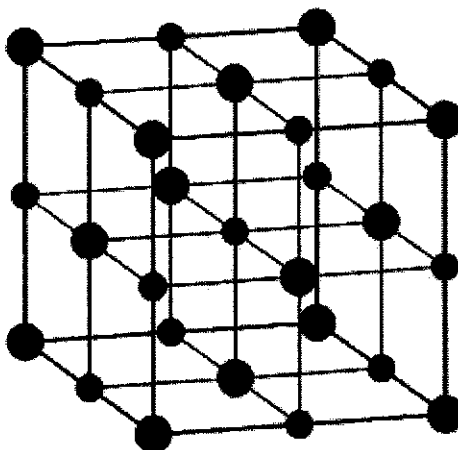
If both groups analysed the same flower, why were the chromatograms different?

- A One group did not use enough solvent.
 B One group did not use enough of the flower sample.
 C The solvent in chromatogram 1 did not reach the top of the paper.
 D The two groups used different solvents.
- 7 Which statement about elements, compounds and mixtures is correct?
- A A compound contains only two types of elements.
 B A molecule is formed by two different elements only.
 C A mixture is a substance that cannot split into two or more simpler substances by chemical means.
 D Every atom in an element contains the same number of protons and electrons.
- 8 Which substance cannot be decomposed into simpler substances?
- A ammonia
 B carbon monoxide
 C lead
 D silicon carbide
- 9 Which substance describes a compound?
- A clear liquid that distills at two distinct temperatures
 B colourless liquid that decomposes to form two substances
 C grey solid that is magnetic
 D white solid where some parts can dissolve in water

- 10 Elements **P** and **Q** are in the same Group. Which statement must be correct?
- A Atoms of **P** and **Q** have the same electronic structure.
 B If **P** is a metal, **Q** must be a non-metal.
 C The number of shells containing electrons is the same in atoms **P** and **Q**.
 D The number of valence electrons is the same in atoms **P** and **Q**.
- 11 An atom of element **Z** has 35 neutrons and 30 protons. It forms a positive ion. How many electrons does the ion of **Z** have?
- A 28
 B 30
 C 33
 D 35
- 12 Which particle has the least number of valence electrons?
- A argon atom
 B magnesium atom
 C oxide ion
 D sodium ion
- 13 A metal **G** and a non-metal **H** react together to form an ionic compound GH_2 . Which row is correct?

	electrons given away by each atom of G	electrons received by each atom of H
A	1	2
B	2	2
C	2	1
D	3	1

- 14 The diagram shows the structure of an ionic compound.

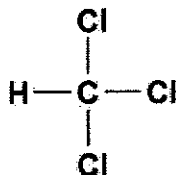


Which is a possible formula for this compound?

- A AgNO_3
 B K_2CO_3
 C MgF_2
 D NH_3
- 15 Which molecule has only four electrons involved in covalent bonds?

- A F_2
 B H_2S
 C Br_2
 D N_2

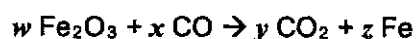
- 16 How many pairs of non-bonding electrons are there in chloroform CHCl_3 ?



- A 9
 B 13
 C 24
 D 25

- 17 Which statement explains why graphite is used as a dry lubricant?
- A Graphite is made of continuous layers of hexagons.
 B Each carbon atom is covalently bonded to three other carbon atoms.
 C Each carbon atom has one outer electron that is not used to form covalent bonds.
 D The layers of carbon atoms are held loosely by weak intermolecular forces of attraction.
- 18 Sodium cyanide has the formula NaCN. What is the chemical formula of magnesium cyanide?
- A $\text{Mg}(\text{CN})_2$
 B MgCN_2
 C MgC_2N
 D Mg_2CN
- 19 Which substance has the largest percentage by mass of copper?
- A CuO
 B CuI_2
 C $\text{Cu}(\text{NO}_3)_2$
 D CuSO_4

- 20 An equation is shown.



Which set of numbers will correctly balance this equation?

	w	x	y	z
A	2	1	1	2
B	2	2	2	1
C	1	2	2	2
D	1	3	3	2



PASIR RIS CREST SECONDARY SCHOOL
Mid Year Examination
Secondary Three Express

CANDIDATE
NAME

CLASS

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INDEX
NUMBER

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Chemistry

Paper 2

6092

9 May 2019

Papers 1 and 2: 1 h 40 min

Additional Materials: No additional materials required

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

You may use a 2B pencil for any diagrams or graphs.

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

Answer all questions.

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.

The total number of marks for this paper is 60.

A copy of the Periodic Table is printed on page 13.

For Examiner's Use
60
Parent's Signature

This document consists of 13 printed pages.

[Turn over

Section A [40 marks]

Answer all questions in this section in the spaces provided.

- A1** Lithium is a Group I metal. The following table provides information about the lithium isotopes that exist on earth.

isotope	natural abundance
${}^6\text{Li}$	7.59 %
${}^7\text{Li}$	92.41 %

- (a) State a physical property of metals.
 [1]
- (b) Explain why the various isotopes of lithium show similar chemical properties.
 [1]
- (c) Define *relative atomic mass*.

 [2]
- (d) Calculate the relative atomic mass of lithium. Round off your answer to 3 significant figures.

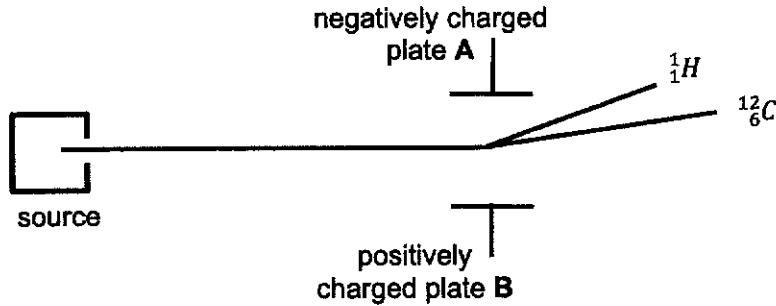
[2]

[Total: 6]

2

A2 Particle therapy is a type of radiotherapy for cancer treatment where beams of neutrons or positively charged particles are aimed at the targeted tumour. These positively charged particles are usually charged hydrogen nuclei or carbon nuclei.

When a beam containing 1_1H and ${}^{12}_6C$ nuclei is passed between two electrically charged plates **A** and **B**, both nuclei are deflected as shown in the diagram below.



(a) Complete the table about the sub-atomic particles in the beam.

	1_1H nucleus	${}^{12}_6C$ nucleus
number of protons		
number of electrons		
number of neutrons		

[3]

(b) Predict and draw on the diagram the path that will be taken by a beam of neutrons. Give a reason for your answer.

.....
 [2]

(c) Suggest a factor about the particles that will affect how much the beam of particles gets deflected when passed between charged plates.

.....
 [1]

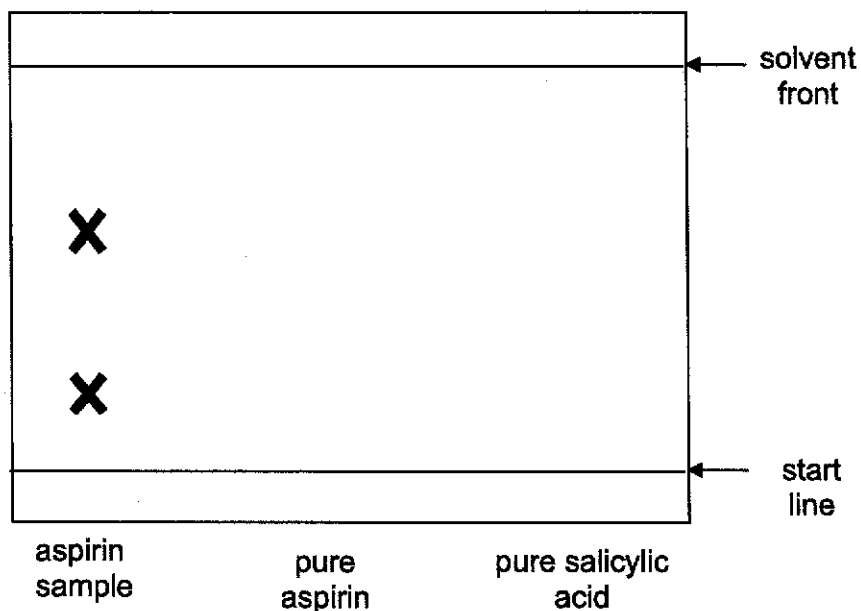
[Total: 6]

A3 Aspirin, $C_9H_8O_4$, is a medication used to treat pain. It is made from salicylic acid. A student makes a sample of aspirin and uses chromatography to produce a chromatogram.

(a) The spots made by aspirin were not visible. What should the student do next?

..... [1]

(b) The R_f value of pure aspirin is 0.6 and that of pure salicylic acid is 0.7. Draw the spots made by pure aspirin and pure salicylic acid in the chromatogram below. [2]



(c) From the chromatogram above, what can you conclude about the student's aspirin sample?

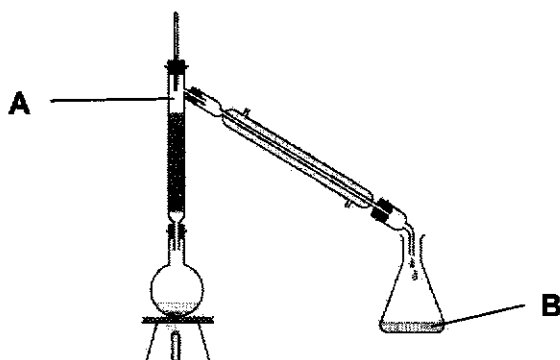
.....

..... [2]

[Total: 5]

A4 A mixture containing 50 cm³ of ethanoic acid and 50 cm³ of ethanol was separated using the apparatus shown below.

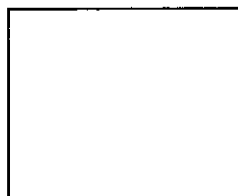
- ethanol, boiling point 78 °C
- ethanoic acid, boiling point 118 °C



(a) Draw, in the boxes below, diagrams showing the arrangement of particles at **A** and **B**.



A



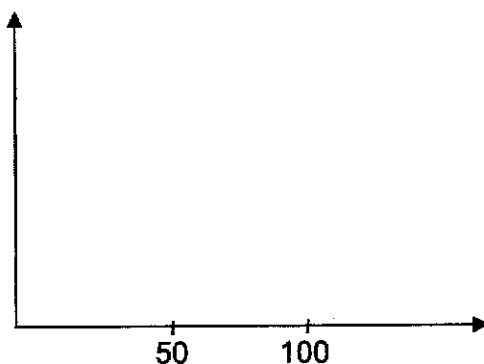
B

[2]

(b) Which liquid would be collected first? Explain your answer.

..... [1]

(c) Complete the graph of temperature against total volume of distillate collected.



[3]

[Total: 6]

A5 Use the information in the table to answer the following questions.

substance	melting point/ $^{\circ}\text{C}$	boiling point/ $^{\circ}\text{C}$	solubility in water	electrical conductivity	
				when molten	when solid
A	-97	65	very soluble	no	no
B	1600	2230	insoluble	no	no
C	800	1465	soluble	yes	no
D	-57	126	insoluble	no	no
E	1080 - 1110	2550 - 2600	insoluble	yes	yes

(a) Which substance is most likely to be a

(i) gas at 100°C ;

[1]

(ii) mixture?

[1]

(b) Identify the type of bonding present in substance **C**. Explain your answer.

.....
 [2]

(c) (i) State the physical state of substance **D** at 25°C

[1]

(ii) Name a method you could use to separate a mixture of substance **D** and water.

..... [1]

(d) Describe how you could obtain a pure and dry sample of substance **B** from a mixture of substance **B** and substance **C**.

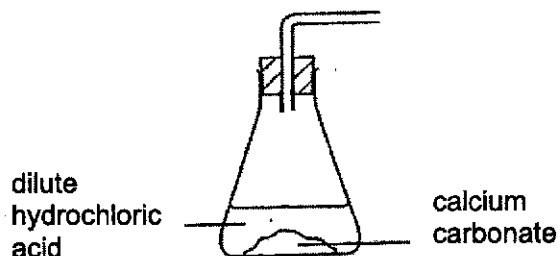
.....

 [4]

[Total: 10]

A6 Calcium carbonate reacts with dilute hydrochloric acid to form calcium chloride, water and carbon dioxide.

The following diagram shows the apparatus used to produce carbon dioxide gas.



(a) Draw a 'dot-and-cross' diagram to show the bonding in carbon dioxide.

[2]

(b) Using your understanding of bonding and structure, explain why carbon dioxide is a gas at room temperature and pressure.

.....
.....
.....
.....
..... [3]

(c) Describe and explain how carbon dioxide gas can be dried.

.....
.....
..... [2]
[Total: 7]

Section B [20 marks]

Answer all questions.

- B7** The first ionisation energy of elements is the energy required to remove one mole of electrons from one mole of gaseous atoms to form one mole of gaseous ions with a charge of +1. By convention, the positive sign shows an intake of energy. The less energy taken in, the more easily an electron is removed from the atom.

This can be represented by the equation:



The second ionisation energy of elements is the energy required to remove one mole of electrons from one mole of gaseous ions with a charge of +1 to form one mole of gaseous ions with a charge of +2.

This can be represented by the equation:



The table below shows the first and second ionisation energy for Group I and Group II elements.

group	element	first ionisation energy/ kJ/ mol	second ionisation energy/ kJ/ mol
I	lithium	520	7298
	sodium	496	4562
	potassium	419	3052
	rubidium	403	2633
	caesium	376	2234
II	beryllium	900	1757
	magnesium	737	1451
	calcium	590	1145
	strontium	550	1064
	barium	503	965

(a) Write an equation for the first ionisation of beryllium.

..... [1]

(b) Describe and explain the trend in the first ionisation energies down Group I.

.....
.....
.....
.....
..... [2]

(c) (i) Write the electronic configurations for potassium and calcium atoms.

K:

Ca: [2]

(ii) Using your answer in (c)(i), suggest why the difference between the first and second ionisation energies is significantly higher for potassium than calcium.

.....
.....
.....
.....
..... [2]

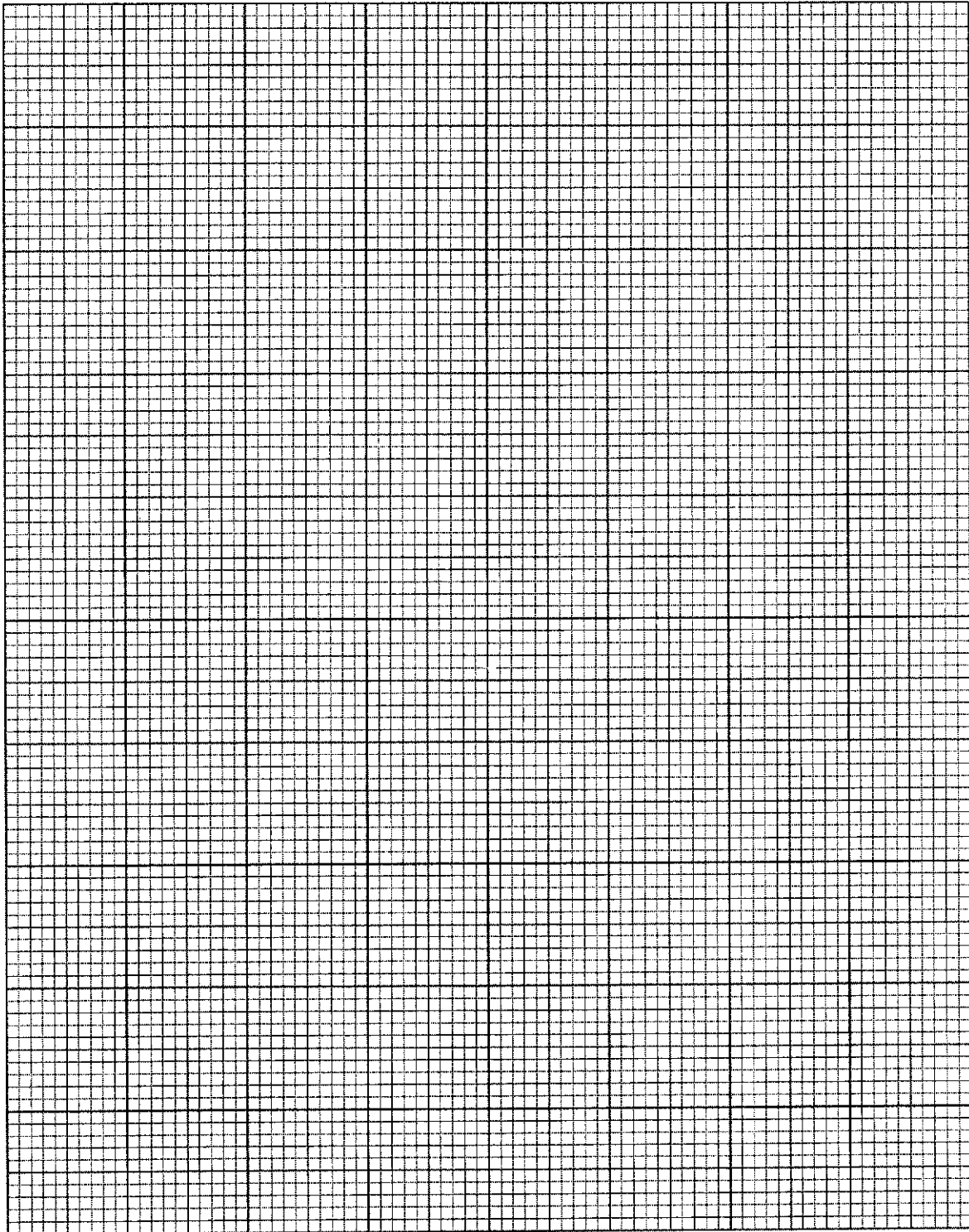
[Total: 7]

- B8** 100 cm³ of dilute hydrochloric acid, HCl, was added to an excess of zinc powder to form a solution of zinc chloride and hydrogen gas. The gas evolved was collected at room temperature and pressure, and the total volume was recorded at 20-second intervals. The results are shown in the table below.

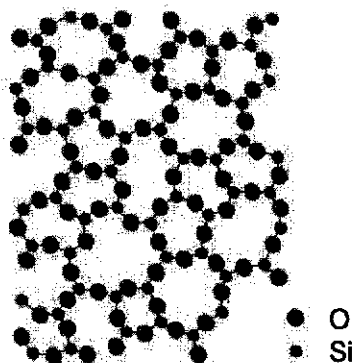
time/ s	total volume/ cm ³
0	0
20	225
40	340
60	
80	395
100	400
120	400
140	400

- (a) Write a balanced chemical equation, with state symbols, for the reaction.
 [2]
- (b) Plot the results on the grid provided on page 11. Draw a smooth curve of best fit, taking into account all the plotted points. [4]
- (c) **From your graph**, determine the total volume of gas collected at 60 seconds. Show clearly on the graph how you obtained your answer.
 [1]
- (d) Explain why the total volume of gas collected stopped increasing after 100 seconds.
 [1]

[Total: 8]



- B9 (a)** Tempered glass is made by heating glass to around 620 °C and then rapidly cooling it with forced air drafts. Its structure is shown below.



- (i)** Suggest why tempered glass does not conduct electricity.

.....
 [1]

- (ii)** In terms of bonding and structure, suggest why tempered glass is commonly used to make mobile phone screen protectors.

.....

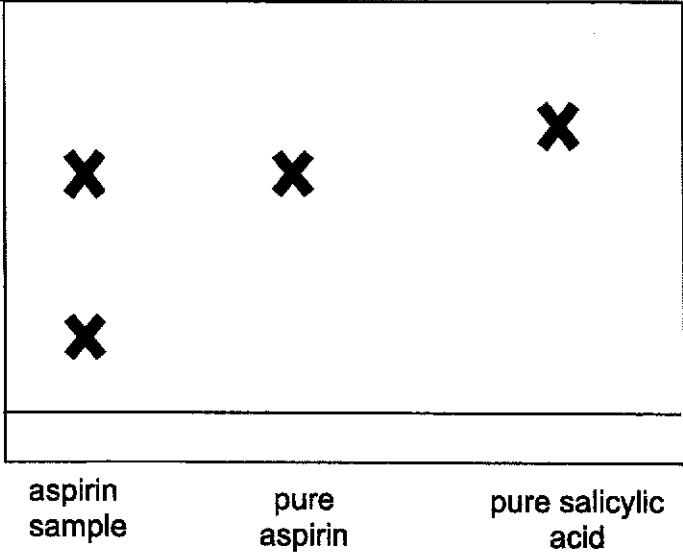
 [2]

- (b)** Glass is made up of 47% silicon and the rest being oxygen. Calculate the empirical formula of glass.

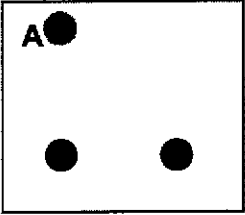
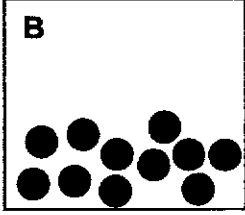
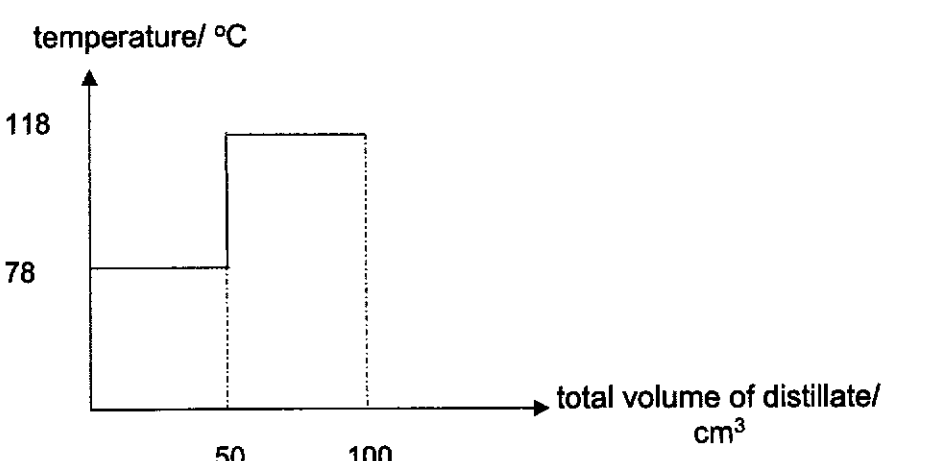
[2]

[Total: 5]

Mark Scheme 2019 3E Chemistry MYE

A1 (a)	Shiny/ sonorous/ high melting point/ high boiling point/ good conductor of heat/ good conductor of electricity/ malleable/ ductile	1												
(b)	They have <u>1 valence electron</u> .	1												
(c)	it is the <u>average mass of an atom</u> of the element <u>compared to the mass of 1/12 of a carbon-12 atom.</u>	1 1												
(d)	Ar = 6(7.59%) + 7(92.41%) = 6.92 (3sf) Reject answers with units or in fractions	1 1												
A2 (a)	<table border="1"> <thead> <tr> <th></th> <th>${}^1_1\text{H}$ nucleus</th> <th>${}^{12}_6\text{C}$ nucleus</th> </tr> </thead> <tbody> <tr> <td>number of protons</td> <td>1</td> <td>6</td> </tr> <tr> <td>number of electrons</td> <td>0</td> <td>0</td> </tr> <tr> <td>number of neutrons</td> <td>0</td> <td>6</td> </tr> </tbody> </table>		${}^1_1\text{H}$ nucleus	${}^{12}_6\text{C}$ nucleus	number of protons	1	6	number of electrons	0	0	number of neutrons	0	6	1 1 1
	${}^1_1\text{H}$ nucleus	${}^{12}_6\text{C}$ nucleus												
number of protons	1	6												
number of electrons	0	0												
number of neutrons	0	6												
(b)	Draw straight horizontal line Neutrons have <u>no charge/ are neutral</u> (and will not be deflected by the charged plates).	1 1												
(c)	Charge of particle / mass of particle	1												
A3 (a)	Apply/spray a <u>locating agent</u>	1												
(b)	 <p>aspirin sample pure aspirin pure salicylic acid</p> <p>Spot for pure aspirin at about 3.3cm [1] Spot for pure salicylic acid at about 3.9cm [1]</p>													
(c)	The student's aspirin sample <u>contains aspirin</u> , and <u>no salicylic acid</u> . It <u>contains 1 unknown substance</u> .	Any 2 correct 1m All correct 2m												

Mark Scheme 2019 3E Chemistry MYE

A4 (a)	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>A</p> <p>Gas diagram</p> <ul style="list-style-type: none"> - Far apart - Random </div> <div style="text-align: center;">  <p>B</p> <p>liquid diagram</p> <ul style="list-style-type: none"> - closely packed - random </div> </div>	1 each
(b)	Ethanol because it has a lower boiling point.	1
(c)	<p style="text-align: center;">temperature/ °C</p>  <p style="text-align: center;">total volume of distillate/ cm³</p>	1 – axes labels with units 1 – shape 1 – data labels
A5 (a)	(i) A (ii) E	1 1
(b)	Ionic bonding. The substance can conduct electricity when in molten state, but not when in solid state. (ignore other properties stated)	1 1
(c)	(i) Liquid (ii) Use of separating funnel	1 1
(d)	Add <u>sufficient distilled water</u> to the mixture and <u>stir</u> . <u>Filter</u> to collect <u>substance B as residue</u> . <u>Rinse</u> the residue/ substance B with <u>distilled water</u> . <u>Dry</u> between pieces of filter paper.	1 1 1 1
A6 (a)	Award covalent bonding only Draw O=C=O [1] Correct electronic configuration (C: 2, 4; O: 2, 6) [1]	

Mark Scheme 2019 3E Chemistry MYE

(b)	Carbon dioxide is a <u>simple molecule</u> (has <u>simple molecular structure</u>). It exists as a gas at rtp because it has a <u>low boiling point</u> . A <u>small amount of energy</u> is enough to <u>overcome the weak intermolecular forces of attraction/ Van der Waals forces</u> . Reject break bonds/ break forces	1 1 1
(c)	Pass carbon dioxide through fused calcium chloride / conc sulfuric acid Because it is an acidic gas	1 1
B7(a)	$\text{Be} \rightarrow \text{Be}^+ + \text{e}^-$ Ignore state symbols	1
(b)	Trend: Ionisation energy decreases down Group I. Explanation: any one <ul style="list-style-type: none"> Down the group, electron to be removed/valence electron is found further away from the nucleus <u>Less energy</u> is needed to <u>overcome the forces of attraction</u> between nucleus and valence electron/ <u>forces of attraction</u> between nucleus and valence electron is <u>weaker</u> 	1 1
(c)(i)	Potassium: 2,8,8,1 Calcium: 2,8,8,2	1 1
(c)(ii)	The two electrons to be removed for potassium are third and fourth electron shells. Both electrons removed from calcium are from the fourth electron shell. OR Removing the second electron will disrupt the stable electronic configuration of a noble gas/ octet configuration in the potassium ion Removing the second electron will give calcium ion the stable electronic configuration	1 1 1 1
B8(a)	$2\text{HCl}(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{ZnCl}_2(\text{aq}) + \text{H}_2(\text{g})$	1 – balanced eqn 1 – state symbols
(b)	Axes labels with units Appropriate scale All points correctly plotted Best fit curve	1 1 1 1
(c)	375 cm^3 with indication on graph (accept $\pm 10 \text{ cm}^3$) Reject if no units and if no indication	1
(d)	All the <u>acid</u> was used up.	1

Mark Scheme 2019 3E Chemistry MYE

B9(a)	(i) There are <u>no free moving electrons or ions</u> in tempered glass.	1		
	(ii) Tempered glass has a <u>giant molecular structure</u> . It is <u>difficult to break</u> the extensive network of <u>strong covalent bonds</u> .	1 1		
(b)		Silicon	Oxygen	1
	%	47	100-47 = 53	
	Ar	28	16	
	Mole	$47/28 = 1.678$	$53/16 = 3.3125$	
	Ratio	1	2	
	The empirical formula is SiO ₂			1

MCQ

1. D
2. C
3. A
4. B
5. B
6. D
7. D
8. C
9. B
10. D
11. A
12. B
13. C
14. A
15. B
16. D
17. D
18. A
19. A
20. D

Name _____

Index No _____

Subject _____

Class _____

Date _____

total volume / cm³

