

Surname	Centre Number	Candidate Number
Other Names		0



GCSE

4472/02



S15-4472-02

ADDITIONAL SCIENCE/CHEMISTRY

CHEMISTRY 2

HIGHER TIER

A.M. THURSDAY, 14 May 2015

1 hour

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	7	
2.	6	
3.	5	
4.	6	
5.	6	
6.	7	
7.	12	
8.	5	
9.	6	
Total	60	

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ADDITIONAL MATERIALS

In addition to this paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

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

You are reminded of the necessity for good English and orderly presentation in your answers.

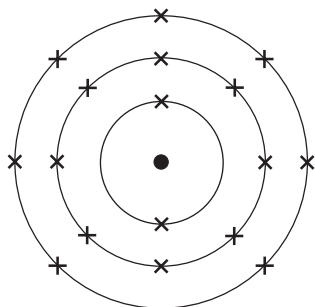
Assessment will take into account the quality of written communication (QWC) used in your answers to questions **4** and **9**.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

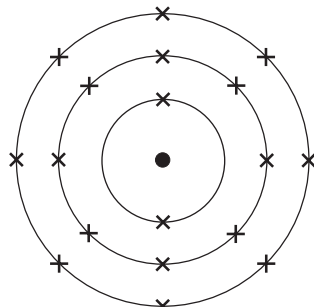
Answer all questions.

Examiner
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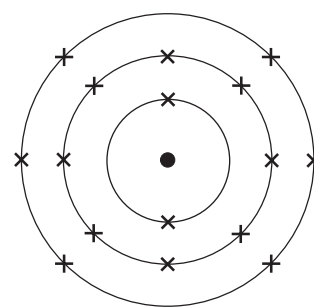
1. The following diagrams show the electronic structures of five elements, **A–E**.



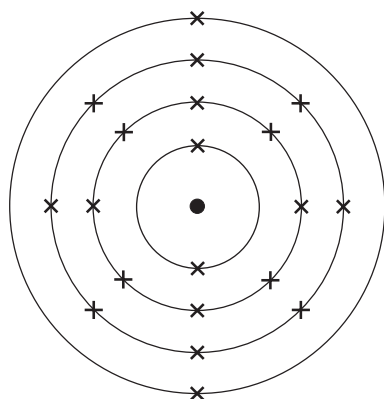
A



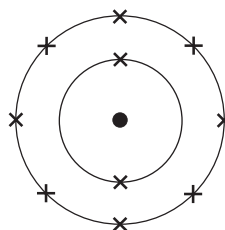
B



C



D



E

- (a) (i) Give the letter of the element, **A–E**, that is in Period 2 of the Periodic Table. Give the reason for your choice in terms of electronic structure. [2]

Element

Reason

.....

- (ii) Give the letters, **A–E**, of **two** elements that are in Group 0 of the Periodic Table. Give the reason for your choice in terms of electronic structure. [2]

Elements and

Reason

- (iii) Another element, **X**, is in the same group as element **E** but is one place above it. Draw a diagram of the electronic structure of element **X**. [1]

- (b) Explain how the electronic structure of element **A** can be used to determine the number of protons in its nucleus. [2]

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2. (a) Lithium, sodium and potassium are elements in Group 1 of the Periodic Table.

The following table shows what a student recorded when these elements reacted with water. Two of the observations are **incorrect**.

Element	Observations	pH of solution
lithium	bubbles slowly on the surface of the water	6
sodium	bubbles rapidly and melts into a ball	12
potassium	burns with an orange flame	13

Identify the errors and give the correct observations below.

[2]

Error 1

Correction

Error 2

Correction

- (b) A student carries out tests to prove that a powder contains sodium ions and chloride ions. The following box gives some tests for ions and some expected observations.

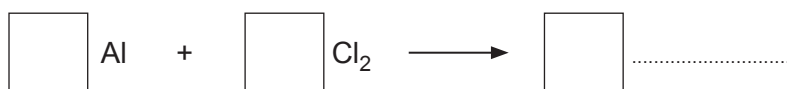
white precipitate	yellow precipitate	no reaction	cream precipitate
flame test	add sodium hydroxide solution	add silver nitrate solution	
add universal indicator	yellow flame	red flame	green flame

Select the appropriate tests and results to complete the following table.

[4]

Ion	Test used	Observation expected
sodium		
chloride		

3. (a) Aluminium reacts with chlorine to form aluminium chloride. Complete and balance the symbol equation for the reaction taking place. [2]



- (b) Aluminium oxide, Al_2O_3 , is found in bauxite.

- (i) Calculate the relative formula mass (M_r) of aluminium oxide, Al_2O_3 . [2]

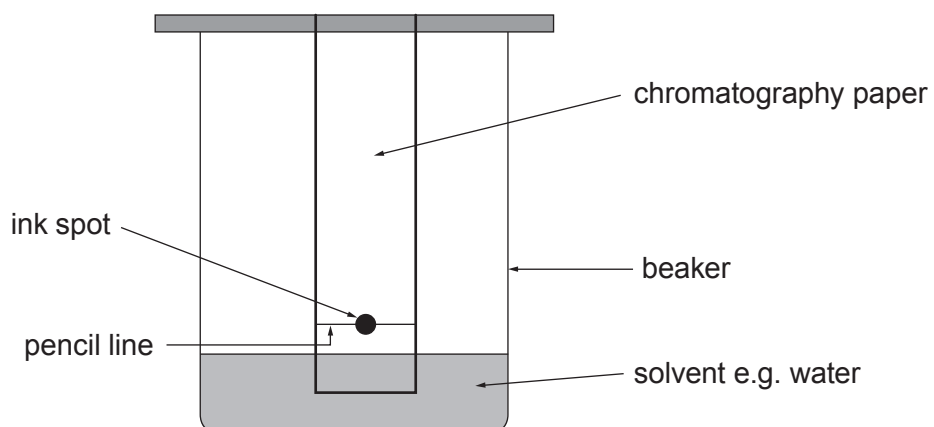
$$A_r(\text{Al}) = 27 \quad A_r(\text{O}) = 16$$

$$M_r(\text{Al}_2\text{O}_3) = \dots\dots\dots$$

- (ii) Using your answer from part (i) calculate the percentage of oxygen present in aluminium oxide, Al_2O_3 . [1]

$$\text{Percentage oxygen present} = \dots\dots\dots \%$$

4. Chromatography can be used to separate the pigments in ink.



Describe how chromatography can be used to determine whether two inks contain the same pigments. [6 QWC]

Your answer should include

- a description of how chromatography is carried out
- a description of what happens during the process
- how the results would show whether the two inks contain identical or different pigments.

You may include a diagram in your answer.



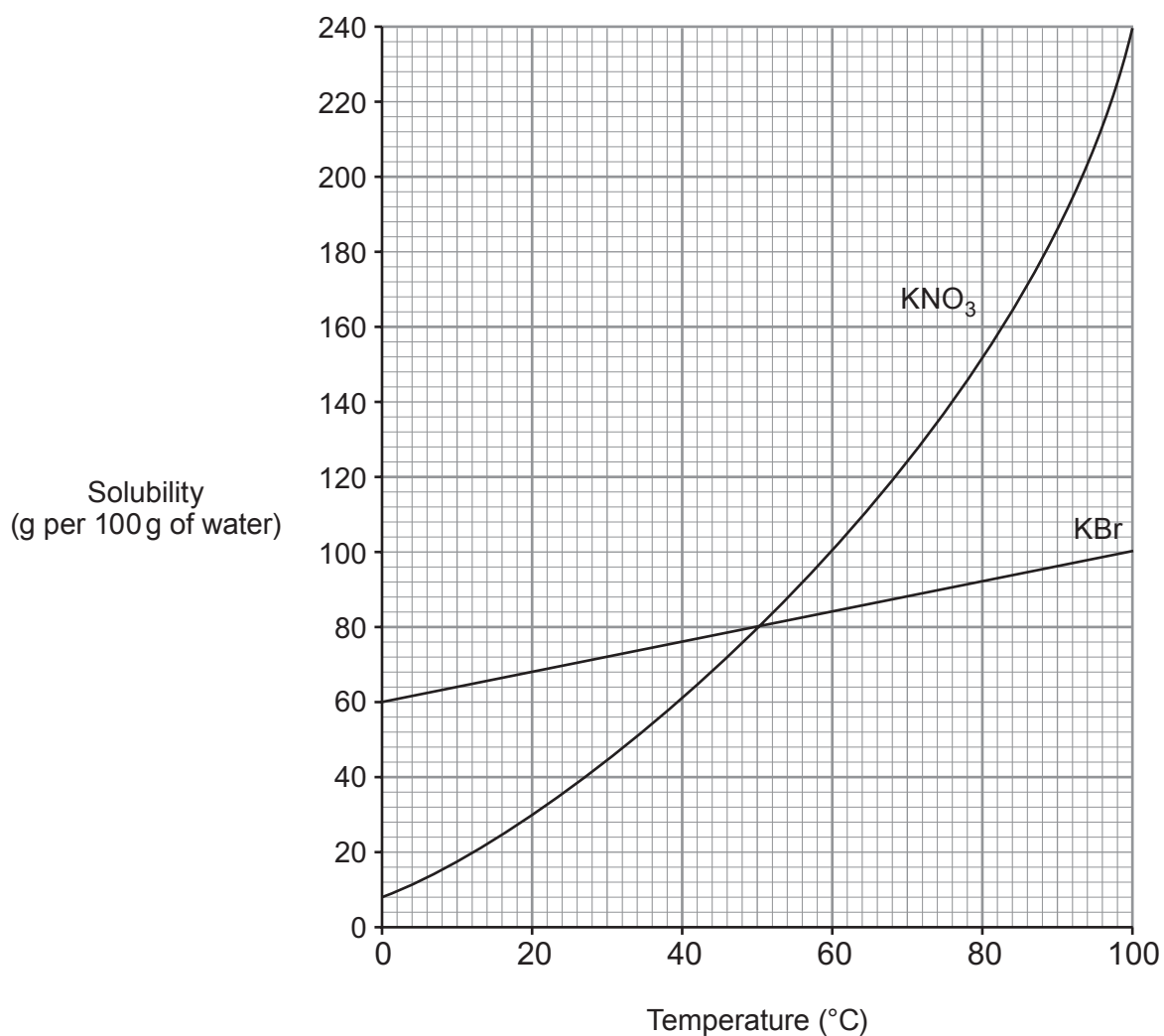
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5. The following graph shows the solubility curves of two substances.



- (a) (i) Use the graph to find the solubility of potassium bromide, KBr, at 60 °C. [1]

Solubility = g per 100g of water

- (ii) A student places 200g of potassium bromide in 200g of water at 60 °C and stirs until no more dissolves. Calculate the mass of solid that remains undissolved. [2]

Mass of undissolved solid = g

- (b) Compare the solubilities of potassium bromide and potassium nitrate between 0 °C and 100 °C. [3]

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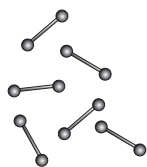
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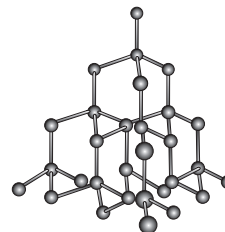
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6. Covalent bonds are formed by the sharing of pairs of electrons.

The following diagrams show the structures of hydrogen and diamond, a form of carbon.



hydrogen



diamond

- (a) Explain why diamond has a higher melting point than hydrogen. [3]

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- (b) Graphite is another form of carbon that has a high melting point. Give **one other** property of graphite and explain this property in terms of structure and bonding. [2]

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- (c) The bonding in oxygen, O_2 , is also covalent. Draw a dot and cross diagram to show the bonding present in a molecule of oxygen. [2]

O = 2,6

7. (a) (i) Give the balanced **symbol** equation for the reaction between ethene and bromine. [2]

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- (ii) Describe the observation made during this reaction. [1]

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- (b) Ethene can also undergo a reaction known as polymerisation to produce polyethene.

- (i) By means of an equation, or otherwise, describe what happens during the polymerisation of ethene. [3]

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- (ii) Polymerisation requires the use of a catalyst. Explain the effect of catalysts on chemical reactions. [2]

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- (c) The following table shows the observations made when two different plastics, **A** and **B**, are heated to a temperature of 150 °C.

Examiner
only

Plastic	Effect of heat on plastic
A	softens and can be reshaped
B	does not soften but turns black (chars) if over-heated

Name the two **types** of plastic and explain the different observations in terms of the bonding present. [4]

Type of plastic

A

B

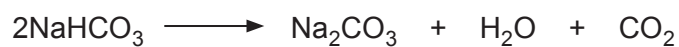
Explanation of observations

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8. When sodium hydrogencarbonate is heated, it decomposes to form sodium carbonate, water and carbon dioxide gas.



- (a) Calculate the mass of sodium carbonate that can be produced from 126 g of sodium hydrogencarbonate. [3]

$$A_r(\text{Na}) = 23; A_r(\text{C}) = 12; A_r(\text{O}) = 16; A_r(\text{H}) = 1$$

Mass of sodium carbonate = g

- (b) It was found that the actual mass obtained was only 70 g. Calculate the percentage yield for this reaction and give your answer to two decimal places. [2]

Percentage yield = %

5

9. Lithium chloride is a solid with a high melting point. It conducts electricity only when molten or in solution.

Describe the bonding present in lithium chloride and explain the properties given above.

[6 QWC]

Li = 2,1

Cl = 2,8,7

You may include a diagram in your answer.

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END OF PAPER

FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	Formula	Name	Formula
Aluminium	Al^{3+}	Bromide	Br^-
Ammonium	NH_4^+	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^-
Calcium	Ca^{2+}	Fluoride	F^-
Copper(II)	Cu^{2+}	Hydroxide	OH^-
Hydrogen	H^+	Iodide	I^-
Iron(II)	Fe^{2+}	Nitrate	NO_3^-
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^+	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^+		
Silver	Ag^+		
Sodium	Na^+		
Zinc	Zn^{2+}		

PERIODIC TABLE OF ELEMENTS

1 2 3 4 5 6 7 0

Group

		${}^1_1\text{H}$ Hydrogen										${}^4_2\text{He}$ Helium					
${}^7_3\text{Li}$ Lithium	${}^9_4\text{Be}$ Beryllium											${}^{19}_9\text{F}$ Fluorine	${}^{20}_{10}\text{Ne}$ Neon				
${}^{23}_{11}\text{Na}$ Sodium	${}^{24}_{12}\text{Mg}$ Magnesium											${}^{35}_{17}\text{Cl}$ Chlorine	${}^{40}_{18}\text{Ar}$ Argon				
${}^{39}_{19}\text{K}$ Potassium	${}^{40}_{20}\text{Ca}$ Calcium	${}^{45}_{21}\text{Sc}$ Scandium	${}^{48}_{22}\text{Ti}$ Titanium	${}^{51}_{23}\text{V}$ Vanadium	${}^{52}_{24}\text{Cr}$ Chromium	${}^{55}_{25}\text{Mn}$ Manganese	${}^{56}_{26}\text{Fe}$ Iron	${}^{59}_{27}\text{Co}$ Cobalt	${}^{59}_{28}\text{Ni}$ Nickel	${}^{64}_{29}\text{Cu}$ Copper	${}^{65}_{30}\text{Zn}$ Zinc	${}^{70}_{31}\text{Ga}$ Gallium	${}^{73}_{32}\text{Ge}$ Germanium	${}^{75}_{33}\text{As}$ Arsenic	${}^{79}_{34}\text{Se}$ Selenium	${}^{80}_{35}\text{Br}$ Bromine	${}^{84}_{36}\text{Kr}$ Krypton
${}^{86}_{37}\text{Rb}$ Rubidium	${}^{88}_{38}\text{Sr}$ Strontium	${}^{89}_{39}\text{Y}$ Yttrium	${}^{91}_{40}\text{Zr}$ Zirconium	${}^{93}_{41}\text{Nb}$ Niobium	${}^{96}_{42}\text{Mo}$ Molybdenum	${}^{99}_{43}\text{Tc}$ Technetium	${}^{101}_{44}\text{Ru}$ Ruthenium	${}^{103}_{45}\text{Rh}$ Rhodium	${}^{106}_{46}\text{Pd}$ Palladium	${}^{108}_{47}\text{Ag}$ Silver	${}^{112}_{48}\text{Cd}$ Cadmium	${}^{115}_{49}\text{In}$ Indium	${}^{119}_{50}\text{Sn}$ Tin	${}^{122}_{51}\text{Sb}$ Antimony	${}^{128}_{52}\text{Te}$ Tellurium	${}^{127}_{53}\text{I}$ Iodine	${}^{131}_{54}\text{Xe}$ Xenon
${}^{133}_{55}\text{Cs}$ Caesium	${}^{137}_{56}\text{Ba}$ Barium	${}^{139}_{57}\text{La}$ Lanthanum	${}^{179}_{72}\text{Hf}$ Hafnium	${}^{181}_{73}\text{Ta}$ Tantalum	${}^{184}_{74}\text{W}$ Tungsten	${}^{186}_{75}\text{Re}$ Rhenium	${}^{190}_{76}\text{Os}$ Osmium	${}^{192}_{77}\text{Ir}$ Iridium	${}^{195}_{78}\text{Pt}$ Platinum	${}^{197}_{79}\text{Au}$ Gold	${}^{201}_{80}\text{Hg}$ Mercury	${}^{204}_{81}\text{Tl}$ Thallium	${}^{207}_{82}\text{Pb}$ Lead	${}^{209}_{83}\text{Bi}$ Bismuth	${}^{210}_{84}\text{Po}$ Polonium	${}^{210}_{85}\text{At}$ Astatine	${}^{222}_{86}\text{Rn}$ Radon
${}^{223}_{87}\text{Fr}$ Francium	${}^{226}_{88}\text{Ra}$ Radium	${}^{227}_{89}\text{Ac}$ Actinium															

Key:

