



General Certificate of Secondary Education
2014–2015

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C1
Higher Tier

MV18

[GSD22]

WEDNESDAY 25 FEBRUARY 2015, MORNING

TIME

1 hour, plus your additional time allowance.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

Answer **all eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question **3**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

1 This question is about atomic structure.

(a) Use your knowledge of atomic structure to complete the table below. [5 marks]

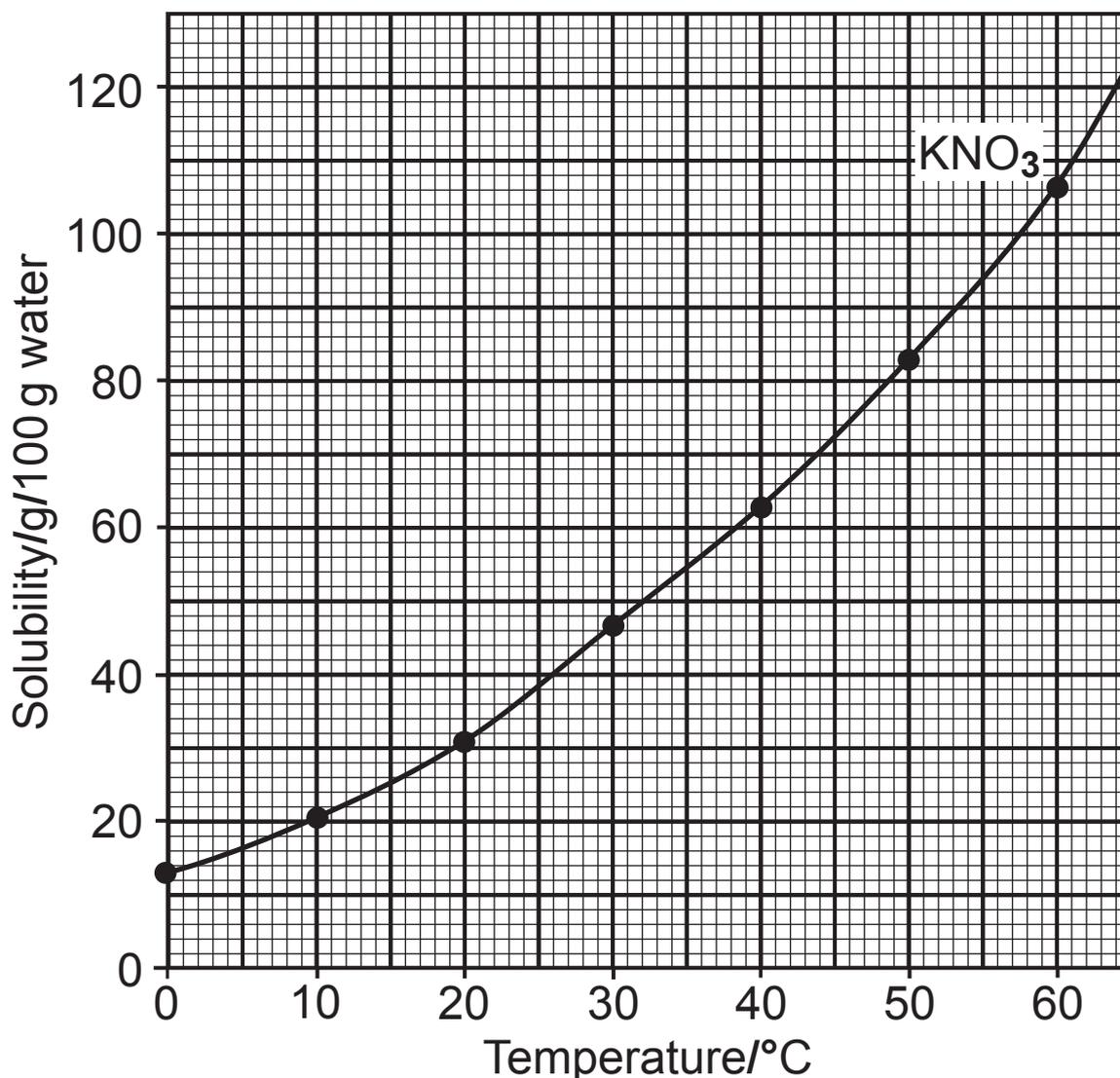
Atom/ion	Mass number	Number of protons	Number of electrons	Number of neutrons
A		3	3	3
B	27	13	13	
C	11		5	6
D		11	10	12
E		17	18	18

(b) Give the chemical symbol for each of the particles A, D and E.

They may be atoms or ions. [3 marks]

	Symbol
A	
D	
E	

- 2 The graph below shows the solubility curve for potassium nitrate, KNO_3 .



- (a) Use the data given in the table below to plot a solubility curve for potassium chloride, KCl , on the same grid as the solubility curve for potassium nitrate. [3 marks]

Temperature/°C	0	10	20	30	40	50	60
Solubility of potassium chloride/g/100 g water	28	31	33	36	39	42	45

(b) Describe and compare the trends in solubility for potassium nitrate and potassium chloride. [2 marks]

(c) At what temperature do both salts have the same solubility? [1 mark]

(d) (i) What is the solubility of potassium nitrate in 100 g of water at 43 °C? [1 mark]

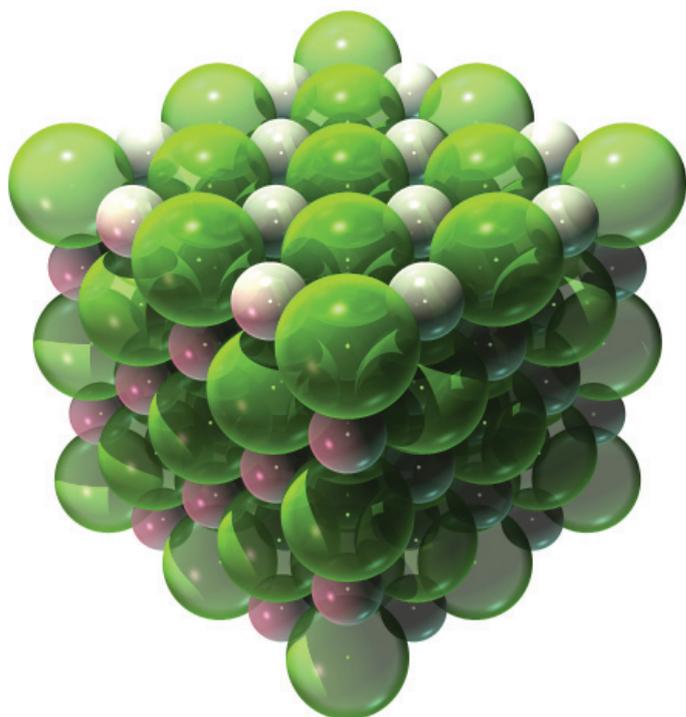
(ii) Calculate the difference in solubility between potassium nitrate and potassium chloride in 100 g of water at 43 °C. [2 marks]

(e) Calculate the amount that would crystallise out if a saturated solution of potassium nitrate in 100 g of water was cooled from 56 °C to 25 °C. [3 marks]

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(Questions continue overleaf)

- 3 Sodium chloride has an ionic crystal lattice structure like that shown in the diagram below.



In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

- 4 The table below gives information about the salts formed when metal carbonates react with acids.

Metal carbonate	Acid used	Cation in salt	Anion in salt	Formula of salt produced
calcium	hydrochloric	Ca^{2+}		CaCl_2
sodium		Na^+	SO_4^{2-}	
	sulfuric	Cu^{2+}		CuSO_4
magnesium	nitric			$\text{Mg}(\text{NO}_3)_2$

(a) Complete the table. [4 marks]

(b) One of the reactions shown in the table involves a colour change.

Give the **colours** of the starting metal carbonate and the salt solution produced: [2 marks]

metal carbonate colour: _____

colour of salt solution produced: _____

(c) All of the reactions shown in the table produce the same gas.

Name this gas and describe a test that is used to identify it. [3 marks]

Name: _____

Test: _____

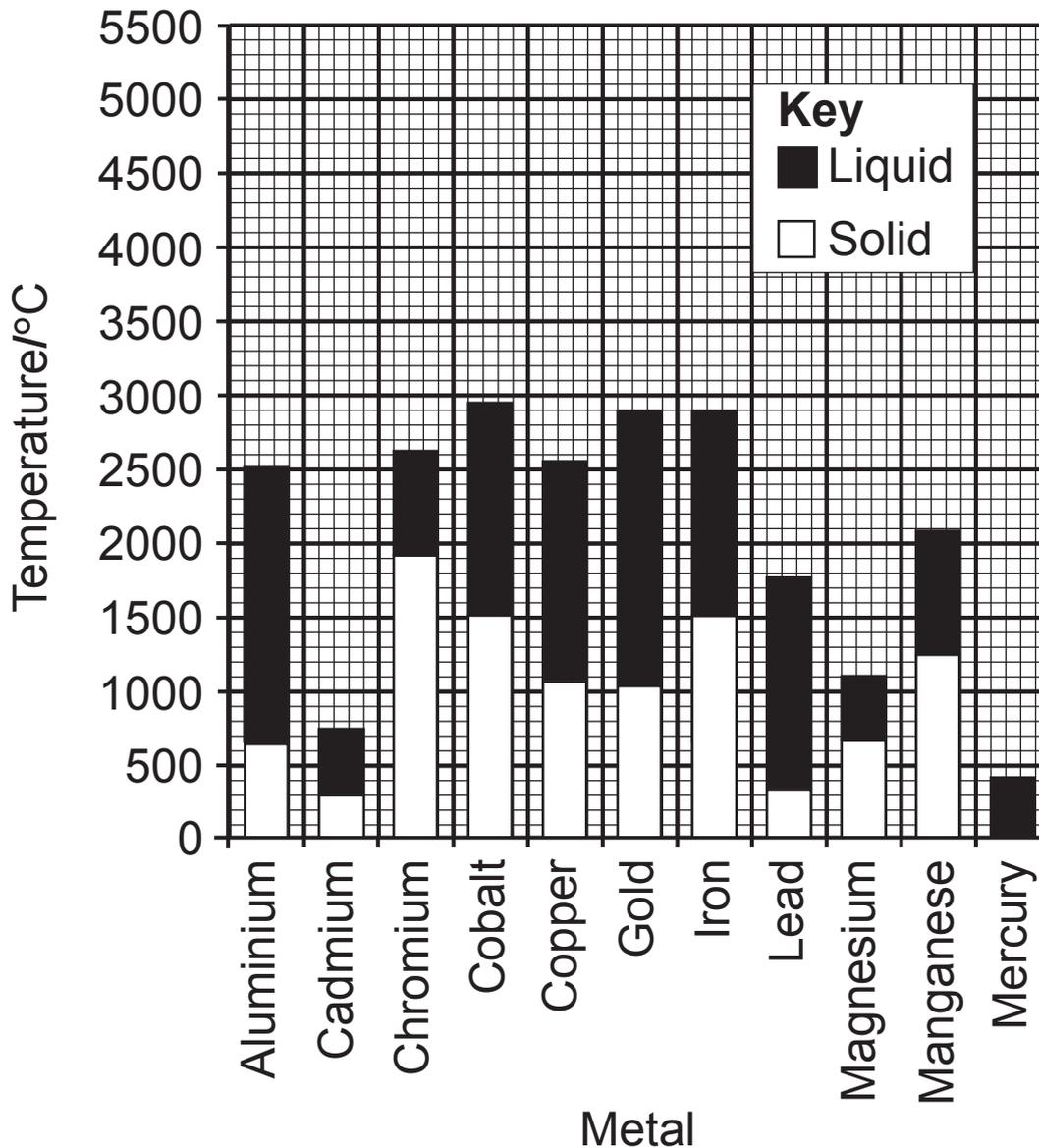
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(Questions continue overleaf)

5 (a) What is meant by the term **melting point**? [1 mark]

Melting point is: _____

(b) The data shown below gives information about the melting and boiling points of some metals.



(i) Which metal, in the table, has the lowest boiling point? [1 mark]

(ii) Which metal, in the table, has the highest melting point? [1 mark]

(iii) From the data in the table, in what way are gold and aluminium very similar? [1 mark]

(c) The following table gives information about the relative ductility and malleability of some metals.

	Ductility	Malleability	
Most ductile	gold	gold	Most malleable
↓	iron	aluminium	↓
	copper	copper	
	aluminium	tin	
	zinc	lead	
	tin	zinc	
Least ductile	lead	iron	Least malleable

Describe similarities and differences you can notice in the relative ductility and malleability of these seven metals. [3 marks]

(d) Explain, in terms of their electrons and positive ions, how the structure of all metals allows them to be both malleable and ductile. [4 marks]

- 6 (a) What do you understand by the term **covalent bond**?
[1 mark]

- (b) (i) Draw a dot and cross diagram to show the bonding in a molecule of carbon dioxide, CO_2 . Show outer electrons only. [3 marks]

(ii) Draw a dot and cross diagram to show the bonding in a molecule of ammonia, NH_3 . Show outer electrons only. [2 marks]

(iii) On your diagram of the molecule of ammonia above label a lone pair of electrons. [1 mark]

7 The table below gives information about four members of the halogens.

element	ion	physical state at room temperature	colour	formula of molecule	toxicity
fluorine	F ⁻	gas	yellow	F ₂	high
chlorine	Cl ⁻	gas	green	Cl ₂	high
bromine	Br ⁻	liquid	reddish-brown	Br ₂	high
iodine	I ⁻	solid	grey-black	I ₂	high

(a) Describe the trends in physical state at room temperature and colour as you move down the group of halogens. [2 marks]

(b) Explain why all the halogens form ions with a charge of minus one. [2 marks]

(c) Astatine, At, is the fifth member of the halogens.

(i) Using the data given predict the following properties of astatine. [2 marks]

Physical state at room temperature: _____

Colour: _____

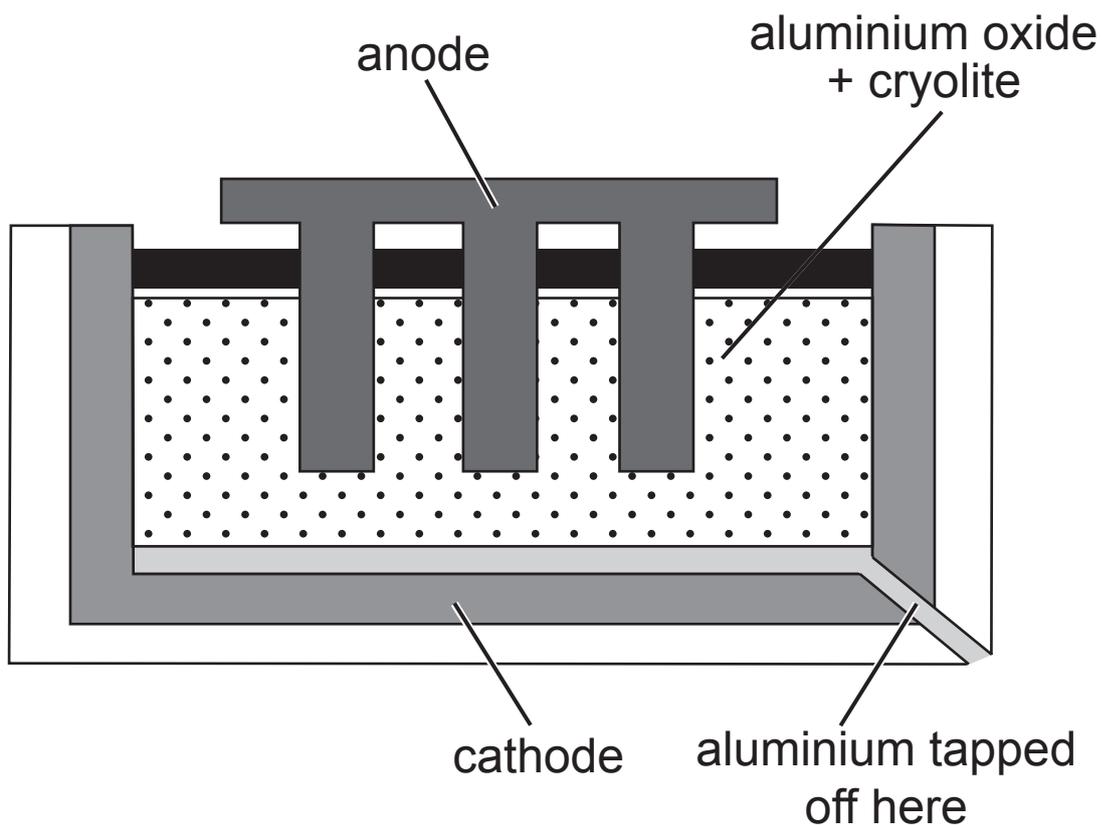
Toxicity: _____

Formula of ion: _____

Formula of molecule: _____

(ii) What would you predict to be the name of the compound formed when sodium reacts with astatine? [1 mark]

- 8 The diagram below shows how aluminium is extracted from its ore.



- (a) What is the name of the aluminium ore used in this extraction process? [1 mark]

- (b) Write a half equation to show what happens at the cathode. [2 marks]

- (c) Explain why the anodes need to be replaced periodically during this process. [3 marks]

(d) The extraction process of aluminium is very expensive. Give **two** ways in which cryolite helps reduce costs. [2 marks]

1. _____

2. _____

(e) State **two** factors which should be taken into account when siting an aluminium extraction plant. [2 marks]

1. _____

2. _____

THIS IS THE END OF THE QUESTION PAPER

SOURCES:

Pg 8, Q3, Diagram showing sodium chloride with its ionic crystal lattice structure, © Russell Kightley / Science Photo Library

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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
Total Marks	

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