



General Certificate of Secondary Education
2018–2019

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C1
Higher Tier

MV18

[GDW22]

THURSDAY 28 FEBRUARY 2019, 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.

You must answer the questions in the spaces provided.

Do not write on blank pages.

Complete in black ink only.

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 **2(b)**.

A Data Leaflet, which includes a Periodic Table of the elements is provided.

1 (a) The metal ions in some compounds can be identified using a flame test.

(i) Complete the table about some metal ions.
[3 marks]

Ion	Atomic number	Number of electrons
	19	18
Ca^{2+}		
	29	27

(ii) What term is used to describe a positive ion?
[1 mark]

(iii) Describe how you would carry out a flame test.
[3 marks]

(iv) What colour would be observed if a flame test was carried out on a solid compound containing calcium ions? [1 mark]

(b) Calcium nitrate is a compound.

(i) Write the formula for calcium nitrate. [1 mark]

(ii) What is meant by the term compound? [2 marks]

(iii) Name two compounds which could react together to form a solution of calcium nitrate. [2 marks]

2 Magnesium carbonate reacts with hydrochloric acid. A salt is produced.

(a) What do you understand by the term **salt**? [3 marks]

(b) Describe the reaction of solid magnesium carbonate with hydrochloric acid. [6 marks]

Your answer should include:

- the name of the salt produced and the names of any other products
- the appearance of the reactants
- observations during the reaction

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

The name of the salt produced and the names of any other products:

The appearance of the reactants:

Observations during the reaction:

3 The elements aluminium and oxygen react to form the ionic compound aluminium oxide.

(a) Draw diagrams to show the arrangement of all the electrons in an aluminium ion and in an oxide ion and give the charge on both ions. [4 marks]

aluminium ion

oxide ion

charge _____

charge _____

(b) Below are three predictions made by students during a class discussion about aluminium oxide.

Prediction 1: solid aluminium oxide will conduct electricity

Prediction 2: aluminium oxide will have a high melting point

Prediction 3: the formula of aluminium oxide is Al_2O_3

(i) Decide if each prediction is true or false and complete the table below by putting a tick (✓) in the correct boxes. One has been done for you.

[2 marks]

Prediction	Prediction is true	Prediction is false
1		✓
2		
3		

(ii) Explain fully why prediction 1 is false. [1 mark]

4 Methane and oxygen are covalently bonded molecules.

(a) (i) In the spaces below draw dot and cross diagrams to show the bonding in methane (CH_4) and in oxygen (O_2). Only outer electrons are needed. [4 marks]

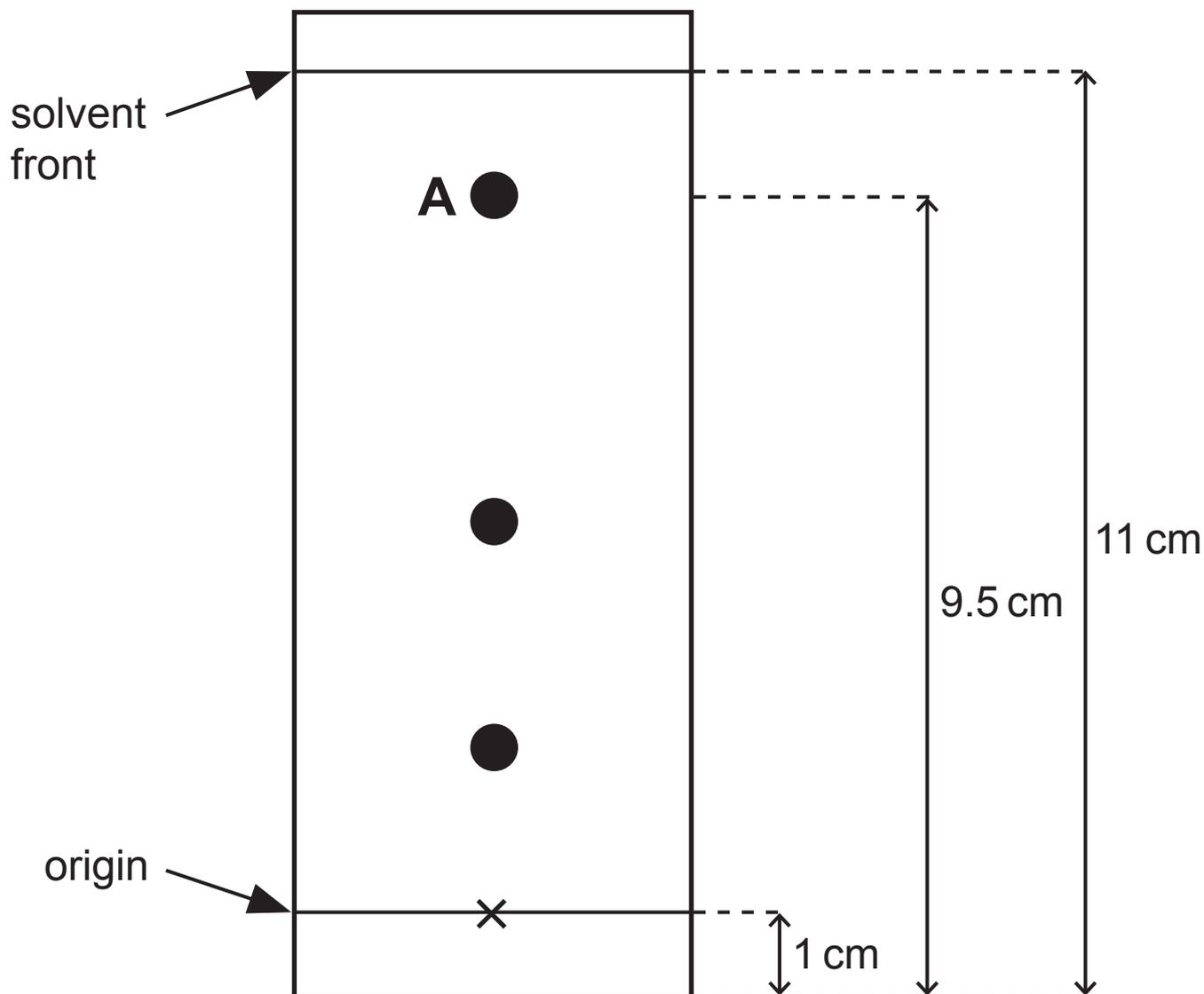
methane

oxygen

(ii) Label a lone pair of electrons on one of the diagrams. [1 mark]

(b) What name is given to the weak intermolecular forces between oxygen molecules? [1 mark]

- 5 The diagram below shows the results of a chromatography experiment to separate a mixture of dyes.



- (a) In paper chromatography what is meant by the term “mobile phase”? [1 mark]

(b) Describe how the experiment could have been carried out to achieve the results shown opposite. [4 marks]

(c) Calculate the R_f value for the spot labelled **A**. Use the measurements provided. [2 marks]

Show your working out.

$R_f =$ _____

6 The table below gives information about four halogens.

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

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

Trend in physical state:

Trend in colour:

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

(c) Fluorine is the most reactive halogen. Write a balanced symbol equation for the reaction of fluorine with potassium iodide. [3 marks]

(d) Astatine is the fifth member of the halogens.

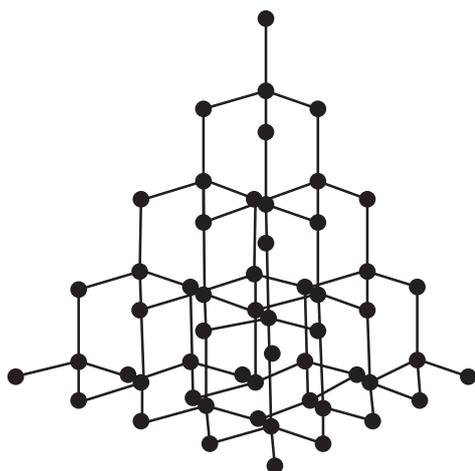
(i) Use the information given in the table and your understanding of halogen chemistry to predict the following properties of astatine. [2 marks]

Physical state at room temperature:

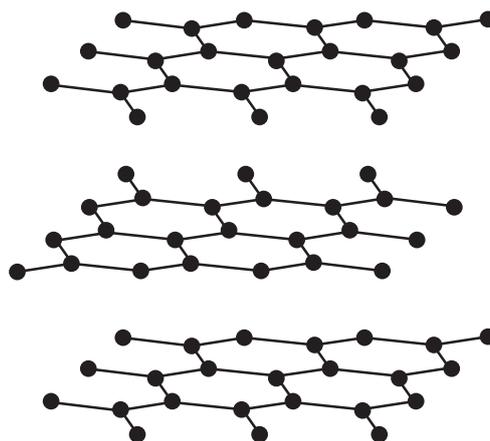
Formula of molecule: _____

(ii) Predict the name of the compound formed when potassium reacts with astatine. [1 mark]

7 (a) The diagrams below show two allotropes of carbon.



X



Y

(i) Name both allotropes. [1 mark]

X _____

Y _____

(ii) What do the black dots in the diagrams represent?
[1 mark]

(iii) Both these allotropes of carbon are solids which are insoluble in water. Name another physical property they share and explain why they have this property.
[2 marks]

Physical property: _____

Explanation: _____

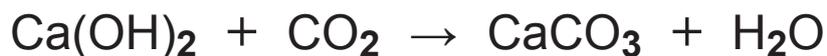
(b) Stainless steel is widely used because it is shiny and resists corrosion. A popular type of stainless steel is known as 18-8. It is an alloy of iron containing 18% chromium and 8% nickel.

What word, apart from alloy, is used to describe a mixture such as this? [1 mark]

(c) Draw a labelled diagram of the structure of a metal such as iron. [3 marks]

(d) Explain why iron is a good conductor of electricity. [2 marks]

- 8 Calcium hydroxide reacts with carbon dioxide according to the equation:



- (a) 370 g of calcium hydroxide were mixed with 308 g of carbon dioxide.

(relative formula masses (M_r): $\text{Ca(OH)}_2 = 74$; $\text{CO}_2 = 44$; $\text{CaCO}_3 = 100$)

- (i) Calculate the number of moles of calcium hydroxide in 370 g. [1 mark]

moles = _____

- (ii) Calculate the number of moles of carbon dioxide in 308 g. [1 mark]

moles = _____

(iii) Using the ratio in the equation on page 16 opposite and your answers to (i) and (ii) state which reactant is the limiting reactant. [1 mark]

(iv) Calculate the number of moles of calcium carbonate formed. [1 mark]

moles = _____

(v) Calculate the mass of calcium carbonate formed. [1 mark]

mass = _____ g

- (b) (i) Complete the expression below used to calculate percentage yield. [1 mark]

$$\text{percentage yield} = \frac{\quad\quad\quad}{\text{theoretical yield}} \times 100$$

- (ii) Suggest two reasons why the percentage yield of a reaction may be less than 100%. [2 marks]

1. _____
2. _____

THIS IS THE END OF THE QUESTION PAPER

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

Total Marks	
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Examiner Number

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