



Rewarding Learning

General Certificate of Secondary Education
2021–2022

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--

Double Award Science: Chemistry

Unit C1

Higher Tier



[GDW22]

GDW22

TUESDAY 23 NOVEMBER, MORNING

TIME

1 hour.

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 outside the boxed area on each page or on blank pages.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question 8.

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

13309



16GDW2201

1 (a) What is meant by the term atomic number?

Atomic number is _____
_____ [2]

(b) Write the electronic configuration for a sulfur **atom** and a potassium **ion**.

sulfur **atom**: _____

potassium **ion**: _____ [2]

(c) Naturally occurring lithium consists of two stable isotopes, ${}^6\text{Li}$ and ${}^7\text{Li}$.

(i) Use the information in the table below to calculate the relative atomic mass of lithium to **two decimal places**.

Show your working out.

Mass number	Relative abundance
6	7.59%
7	92.41%

_____ [2]

(ii) How many electrons does an atom of ${}^7\text{Li}$ have?

_____ [1]





BLANK PAGE
DO NOT WRITE ON THIS PAGE
(Questions continue overleaf)

13309

[Turn over



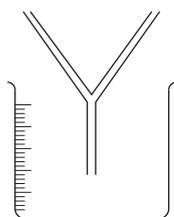
16GDW2203

2 Sodium sulfate is a soluble salt.

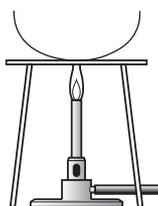
(a) What colour would you expect solid sodium sulfate to be?

_____ [1]

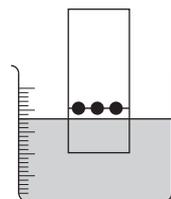
The diagrams A, B, C, D and E below show apparatus used to separate mixtures.



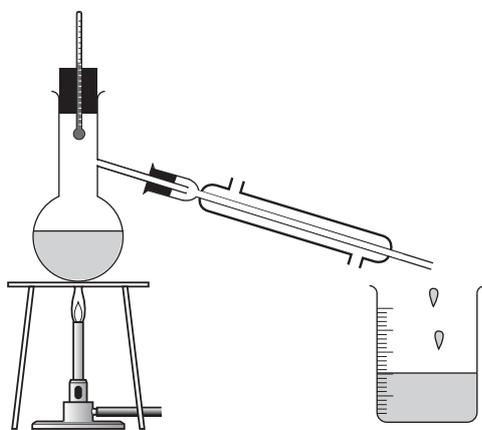
A



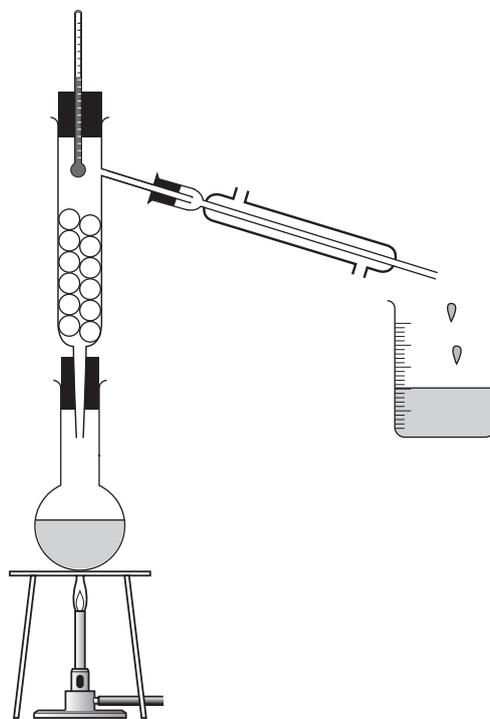
B



C



D



E



(b) Which diagram **A, B, C, D** or **E** shows the apparatus **most** suitable for:

Obtaining pure water from an aqueous solution of sodium sulfate?

Obtaining solid sodium sulfate from an aqueous solution of sodium sulfate?

_____ [2]

(c) A student separated a colourless liquid from a salt solution and thought it could be water.

(i) Describe the chemical test for water.

_____ [2]

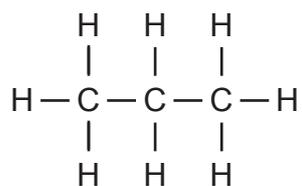
(ii) Explain how the student could find out if the liquid was **pure** water.

_____ [2]

[Turn over



3 (a) The structure of a molecule of propane is shown below.



How many covalent bonds are there in a molecule of propane?

_____ [1]

(b) (i) Draw a dot and cross diagram of a molecule of carbon dioxide, CO_2 , showing outer shell electrons only.

[3]

(ii) What is meant by the term **single covalent bond**?

_____ [1]



(c) Magnesium reacts with iodine to form the ionic compound magnesium iodide. Electrons are transferred from magnesium to iodine.

(i) Write a balanced symbol equation for the formation of magnesium iodide from magnesium and iodine.

_____ [2]

(ii) How many electrons are transferred from each magnesium atom?

_____ [1]

(iii) Write the formula of the **anion** formed.

_____ [1]

(iv) Complete the sentence below about ionic bonding.

Ionic bonding involves the attraction between _____

_____ [1]

[Turn over



5 Ethanoic acid is a weak acid found in vinegar. It can react with both alkalis and carbonates.

(a) What is the formula of the ion which is present in all **alkalis**?

_____ [1]

(b) Explain fully, in terms of particles, why ethanoic acid is described both as **weak** and as an **acid**.

_____ [2]

(c) A solution of ethanoic acid can be neutralised by adding potassium hydroxide solution.

Write an ionic equation, with state symbols, for the neutralisation reaction.

_____ [3]

(d) A colourless solution of ethanoic acid reacts with copper(II) carbonate powder.

State three observations which you would expect to **see** during this reaction.

1. _____

2. _____

3. _____ [3]

[Turn over



6 (a) The element potassium reacts with water. During the reaction heat is given out.

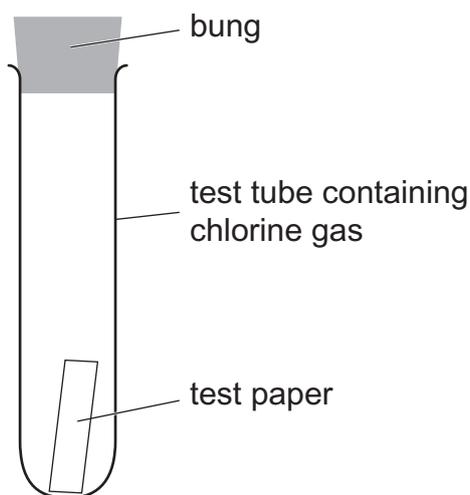
(i) State three **other** observations which would be made during this reaction.

1. _____
2. _____
3. _____ [3]

(ii) Write a balanced symbol equation for the reaction between potassium and water.

_____ [3]

(b) The diagram below shows how a test for chlorine gas may be carried out in the laboratory.



Describe the test paper used in the test for chlorine and what would be observed.

Description of test paper used:

Observations made during the test for chlorine:

_____ [3]



(c) Chlorine reacts with potassium iodide solution.

(i) State the colour change observed in the solution when chlorine gas is bubbled through potassium iodide solution.

from _____ to _____ [2]

(ii) Explain why the Group 7 elements have similar chemical properties.

_____ [2]

[Turn over



- 7 (a) The relative formula mass of calcium oxide, CaO, is 56.
Calculate, to two decimal places, the percentage by mass of oxygen in calcium oxide.

_____ % [2]

- (b) Aluminium burns in oxygen to produce aluminium oxide as shown below:



- (i) Calculate the theoretical yield of aluminium oxide that can be produced from 10.8 g of aluminium.

(Relative atomic masses: O = 16, Al = 27; relative formula mass: $\text{Al}_2\text{O}_3 = 102$)

Show your working out.

_____ g [3]

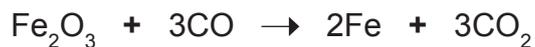
- (ii) In an experiment 17.2 g of aluminium oxide were produced from 10.8 g of aluminium.
Calculate, to one decimal place, the percentage yield.

Show your working out.

_____ % [2]



- (c) The main chemical reaction in the extraction of iron from iron ore is shown in the balanced symbol equation below:



- (i) How many moles of iron can be produced from one mole of iron(III) oxide and one mole of carbon monoxide?

_____ [1]

- (ii) Calculate the minimum mass of iron(III) oxide, in grams, needed to make 840 g of iron.

(Relative atomic mass: Fe = 56; relative formula mass: $\text{Fe}_2\text{O}_3 = 160$)

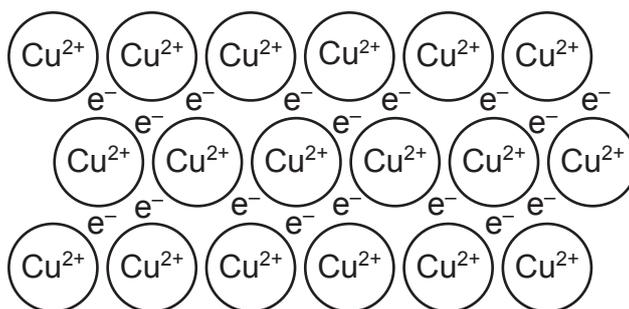
Show your working out.

_____ g [3]

[Turn over



8 The diagram below shows the structure and bonding in a metal.



Use your knowledge and understanding of metallic bonding and structure along with the information provided in the diagram to:

- describe what **this** diagram shows
- explain why metals are good conductors of electricity
- explain why metals generally have high melting points
- explain why metals are malleable and ductile.

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

Description of what **this** diagram shows:

Explanation of why metals are good conductors of electricity:



Explanation of why metals generally have high melting points:

Explanation of why metals are malleable and ductile:

[6]

THIS IS THE END OF THE QUESTION PAPER



DO NOT WRITE ON THIS PAGE

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

Total Marks	
--------------------	--

Examiner Number

Permission to reproduce all copyright material has been applied for.
In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA will be happy to rectify any omissions of acknowledgement in future if notified.

13309/5



16GDW2216