Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2014–2015

Double Award Science: Chemistry

Unit C1

Higher Tier

[GSD22]

GSD22

THURSDAY 14 MAY 2015, 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 blue or black ink only. **Do not write with a gel pen.**
Answer **all nine** 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 **5(a)**.
A Data Leaflet, which includes a Periodic Table of the elements is provided.

10081

1 Five particles are listed below:

Na^+ H_2 HCO_3^- Ne H_2O

Write down, from the list of particles above, an example of:

(a) an atom _____ [1]

(b) a cation _____ [1]

(c) a compound _____ [1]

(d) a molecular ion _____ [1]

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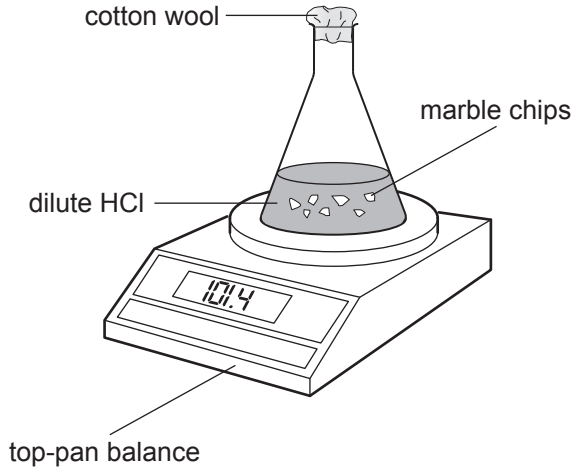
(Questions continue overleaf)

2 A pupil investigated the reaction between calcium carbonate (marble chips) and dilute hydrochloric acid. He used excess calcium carbonate.

The equation for this reaction is:

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$



The student measured the mass of the flask and its contents every minute for 8 minutes. The results are shown in the table below.

Mass/g	102.8	101.4	100.3	99.5	99.3	99.2	99.1	99.0	99.0
Time/min	0	1	2	3	4	5	6	7	8

(a) What is the name of the salt produced during the reaction?

_____ [1]

(b) What caused the mass of the flask and contents to decrease?

_____ [1]

(c) Suggest why the student used **excess** calcium carbonate.

_____

_____ [1]

(d) Give an **accurate** way of checking that the resulting solution was neutral.

_____ [1]

(e) Another student in the same class used calcium oxide instead of calcium carbonate. He observed no drop in mass. Explain why this would be the case.

_____

_____ [2]

[Turn over

3 The following table shows the solubilities of three gases in water, at different temperatures:

Gas	solubility (mg per 100 g water)* at:			
	0 °C	20 °C	40 °C	50 °C
carbon dioxide	348	169	97	76
nitrogen	2.9	1.9	1.5	1.2
oxygen	7.0	4.3	3.0	2.7

* mg = milligrams

(a) What is the solubility of carbon dioxide at 20 °C?

_____ mg/100 g water. [1]

(b) Which gas is **least** soluble at 50 °C?

_____ [1]

(c) How does the solubility of the three gases change as the temperature increases?

_____ [1]

(d) Use the table to help you explain why fish may die if the water in a river becomes too warm.

_____

_____

_____

_____ [2]

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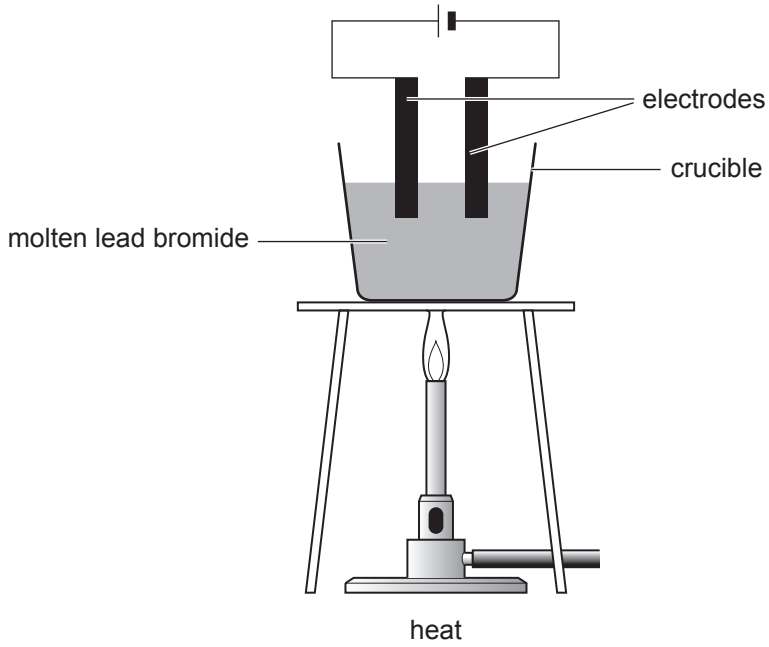
(Questions continue overleaf)

4 The diagram below shows the apparatus used to pass an electric current through molten lead bromide.



(a) What name is given to the process which happens in the crucible?

_____ [1]

(b) What is the **electrolyte** in this experiment?

_____ [1]

(c) Give **two** reasons why graphite is a suitable material for making the electrodes.

1. _____

2. _____ [2]

(d) Complete the table below by predicting the products and observations at the electrodes for the molten salts given.

name of substance	observations at anode	observations at cathode	product at anode	product at cathode
lead bromide		beads of metal	bromine	lead
lithium chloride	bubbles of greenish/ yellow gas	beads of metal		lithium
potassium iodide	bubbles/purple vapour			

[5]

(e) Write a half equation for the reaction which happens at the anode when an electric current is passed through molten lithium chloride.

_____ [2]

[Turn over

5 **(a)** Describe in words the structure of an atom of carbon with an atomic number of 6 and a mass number of 14.

Your answer should include the number and position of all the different particles in this carbon atom.

You will be assessed on your written communication skills including the use of specialist science terms.

[6]

(b) Carbon also has atoms with a mass number of 12.
What name is given to atoms with the same atomic number but different mass numbers?

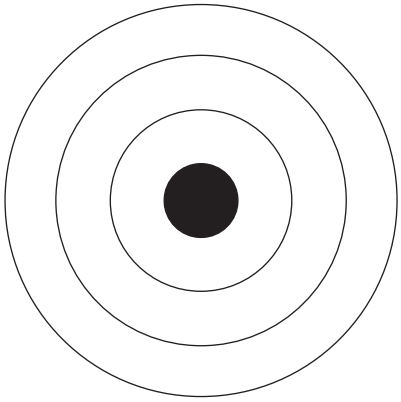
[1]

(c) When carbon atoms join together to form molecules they share electrons.
What name is given to this type of bonding?

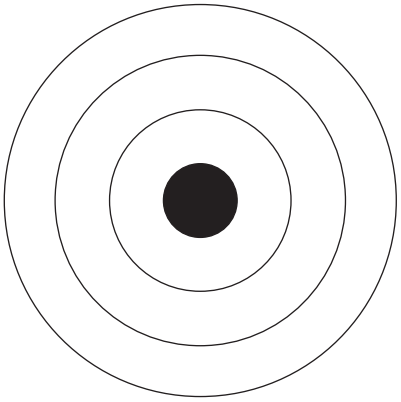
[1]

6 Magnesium reacts with sulfur to form the compound magnesium sulfide.

(a) Complete the diagrams below to show the arrangement of **all** the electrons in a magnesium atom and a sulfur atom.



magnesium atom



sulfur atom

[2]

(b) **(i)** In the space below draw the electronic arrangements for the ions formed when magnesium and sulfur bond together.
Your answer should include the charges on the ions.

magnesium ion **sulfide ion**

[4]

(ii) What is the chemical formula for magnesium sulfide?

_____ [1]

[Turn over

7 **(a)** What type of bonding is typical of non-metallic elements and compounds?

_____ [1]

(b) Draw dot and cross diagrams to show the outer electrons only in a molecule of water.

[3]

(c) Oxygen is a diatomic molecule which has a double bond.

Draw a diagram to show all the electrons in a molecule of oxygen.

Label:

(i) the double bond **(ii)** a lone pair

[4]

(d) What is meant by the term diatomic?

_____ [1]

8 When the elements sodium and potassium react with water very similar chemical reactions take place. However there are some noticeable differences.

(a) Give three ways in which the reactions of sodium and potassium with water are similar.

1. _____

2. _____

3. _____ [3]

(b) Explain fully, in terms of their electron arrangements, why sodium and potassium react in such similar ways.

_____

_____

_____ [2]

(c) Give two ways in which the reactions of sodium and potassium with water are different.

1. _____

2. _____ [2]

(d) Complete and balance the symbol equation for the reaction of potassium with water.

$$K + H_2O \longrightarrow \quad + \quad$$

[3]

(e) When sodium reacts with bromine it forms the compound sodium bromide. Write a balanced symbol equation for this reaction.

_____ [3]

[Turn over

9 The table below gives some information about five substances **A**, **B**, **C**, **D** and **E**.

Substance	Boiling point °C	Melting point °C	Electrical conductivity when solid	Electrical conductivity when liquid
A	1760	327	good	good
B	69	– 95	poor	good
C	1499	777	poor	good
D	4828	3551	poor	poor
E	2751	1539	good	good

(a) (i) Which **two** substances **A**, **B**, **C**, **D** or **E** have delocalised electrons?

_____ and _____ [1]

(ii) Explain your answer. _____

_____

_____ [2]

(b) Explain why substance **D** could be diamond.

_____

_____

_____ [2]

(c) Explain why substance **C** can be used as an electrolyte.

_____

_____

_____ [2]

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For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
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8	
9	
Total Marks	

Examiner Number