New Specification

Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011–2012

Double Award Science: Chemistry

Unit C1

Higher Tier

[GSD22]

GSD22

WEDNESDAY 9 NOVEMBER 2011
9.15 am–10.15 am

TIME

1 hour.

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 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 **questions 5(b) and 9(a)**.
A Data Leaflet which includes a Periodic Table of the elements is provided.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

1 The table below shows part of **Mendeleev's** Periodic Table.

Examiner Only	
Marks	Remark

I	II	III	IV	V	VI	VII			
H									
Li	Be	B	C	N	O	F			
Na	Mg	Al	Si	P	S	Cl			
K	Ca		Ti	V	Cr	Mn	Fe	Co	Ni
Cu	Zn			As	Se	Br			

(a) In what order did Mendeleev set out the elements?

_____ [1]

(b) **(i)** Name the Group of elements known today which is not in Mendeleev's table.

_____ [1]

(ii) Suggest a reason why this Group was not in Mendeleev's table.

_____ [1]

(c) Using the Data Leaflet and your knowledge, name one element that Mendeleev placed in the wrong position.

_____ [1]

(d) In what order are the elements set out in the modern Periodic Table?

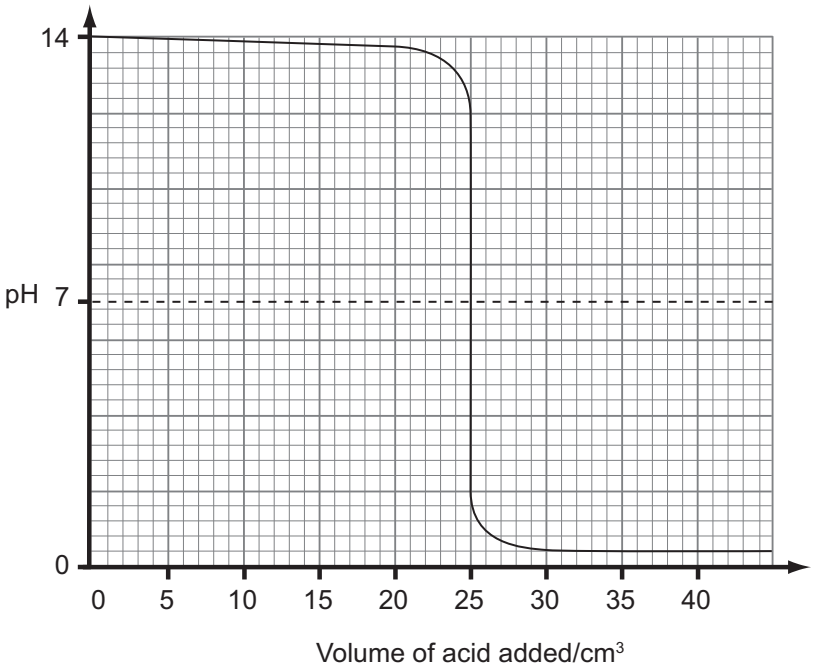
_____ [1]

(e) Name another scientist who made a contribution to the development of the Periodic Table.

_____ [1]

Examiner Only	
Marks	Remark

2 The pH changes during the reaction between sodium hydroxide and hydrochloric acid were measured using a pH meter. The following graph was produced.



(a) What was the pH value of the liquid in the flask at the start of the experiment?

_____ [1]

(b) What volume of acid was needed to cause a sudden drop in the pH value?

_____ [1]

(c) Explain why litmus paper could **not** be used instead of a pH meter for this experiment.

_____

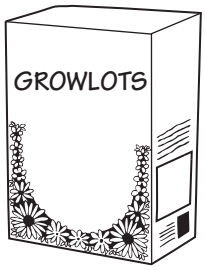
_____ [1]

(d) Complete the symbol equation for this reaction:

$HCl + NaOH \longrightarrow \quad + \quad$ [2]

Examiner Only	
Marks	Remark

3 GROWLOTS plant fertiliser is a blue powder. It is a mixture of two **hydrated** salts, copper(II) sulfate and iron(III) sulfate.



(a) (i) Suggest why Growlots fertiliser is blue in colour.

_____

_____ [1]

(ii) Explain the meaning of the term **hydrated**.

_____

_____ [1]

(b) The fertiliser is made up of two salts, copper(II) sulfate and iron(III) sulfate. Each salt can be made by reacting an acid with a base.

(i) Name the acid used to make the two salts in the fertiliser.

_____ [1]

(ii) What is the name given to this **type** of chemical reaction?

_____ [1]

(c) You may find your Data Leaflet helpful to answer this question.

(i) What is the formula of copper(II) sulfate?

_____ [1]

(ii) Circle the correct formula for iron(III) sulfate given in the list below.

$Fe_3(SO_4)_2$ $Fe_2(SO_4)_3$ $FeSO_4$ Fe_3SO_4 [1]

BLANK PAGE

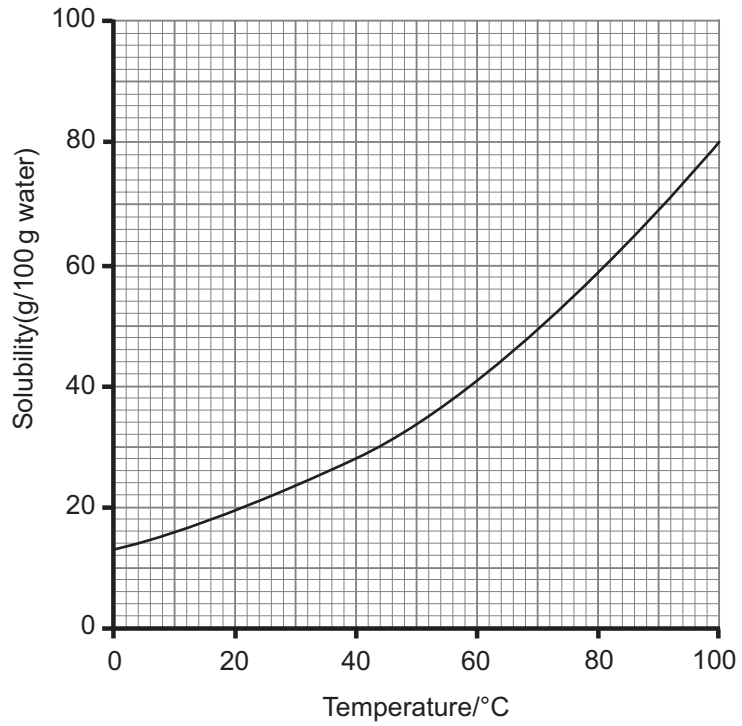
(Questions continue overleaf)

Examiner Only	
Marks	Remark

4 **(a)** Explain fully what is meant by the term **solubility**.

[4]

(b) The solubility curve for copper(II) sulfate is drawn below.



Use the solubility curve to answer the following questions.

(i) How does the solubility of copper(II) sulfate change as the temperature of the water increases?

[1]

(ii) What is the solubility of copper(II) sulfate at 76 °C?

[1]

(iii) State whether the following copper(II) sulfate solutions are saturated or unsaturated.

Solution			Saturated/unsaturated
Mass of $CuSO_4$ (g)	**Mass of water (g)**	**Temperature °C**	
45	100	60	
15	50	20	
125	500	40	

[3]

(iv) What mass of copper sulfate will crystallise from a saturated solution containing 100 g of water when the solution is cooled from 56 °C to 22 °C? You should show your working out clearly.

_____ g/100 g H_2O [4]

Examiner Only

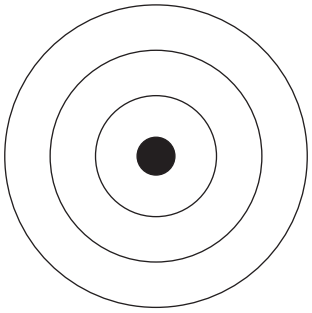
Marks	Remark

Examiner Only	
Marks	Remark

5 Sodium reacts with chlorine to form the compound sodium chloride.

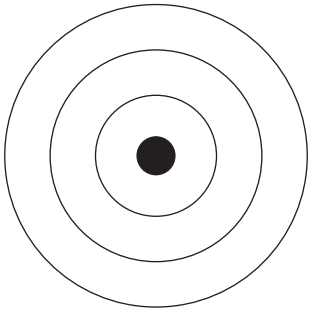
(a) Complete the diagrams below to show the arrangement of **all** of the electrons in a sodium atom and a chlorine atom.

(i) Sodium atom



[1]

(ii) Chlorine atom



[1]

In Part (b) you will be assessed on your written communication skills including the use of specialist science terms.

(b) Explain, using electronic structures, how sodium and chlorine bond to form the compound sodium chloride.

[6]

(c) Sodium chloride has a high melting point. Give **two** other physical properties you would expect sodium chloride to have.

1. _____

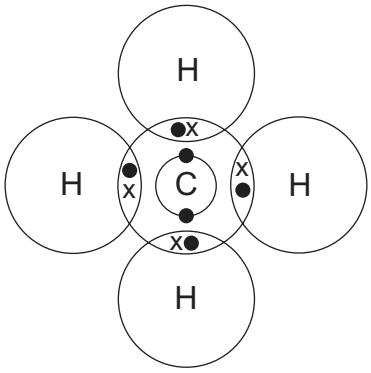
2. _____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

6 Methane, water and nitrogen occur as molecules.

The diagram below shows the electrons in the atoms of carbon and hydrogen in a molecule of methane.



(a) (i) Draw a dot and cross diagram to show the **outer electrons** of the atoms in a molecule of water.

[3]

(ii) Label the **lone pairs** of electrons in **your** diagram. [1]

(b) Nitrogen is made up of **diatomic** molecules.

(i) What is meant by the term **diatomic**?

_____

_____ [1]

(ii) Draw a dot and cross diagram to show how the outer electrons are arranged in a molecule of nitrogen.

[3]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

7 Substances may be classified in terms of their physical properties. Use the table below to answer the following questions.

Substance	Melting point °C	Boiling point °C	Electrical conductivity	
			As solid	As liquid
A	3550	4827	poor	poor
B	1540	2750	good	good
C	776	1500	poor	good
D	−95	69	poor	poor
E	327	1760	good	good

(a) Which substance, A, B, C, D or E, is an ionic compound? Explain your answer.

Substance _____

Explanation _____

_____ [2]

(b) Which substance, A, B, C, D or E, has a molecular covalent structure?

_____ [1]

(c) Which substance, A, B, C, D or E, is a metal with a low melting point?

Substance _____ [1]

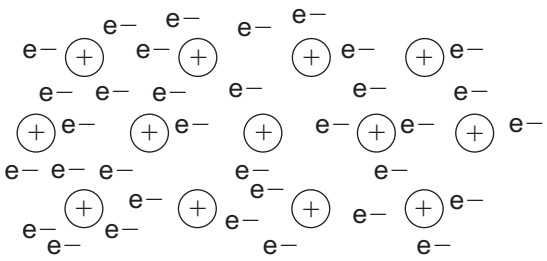
(d) Which substance, A, B, C, D or E, is an allotrope of carbon? Name the allotrope.

Substance _____

Name _____ [2]

Examiner Only	
Marks	Remark

8 Sodium is a soft metal that conducts electricity and has a low melting point. A simple model of its structure is shown below.



Use your understanding of metallic bonding to answer the following questions.

(a) Explain why sodium is able to conduct electricity.

_____

_____

_____ [2]

(b) The melting point of sodium is low compared to many other metals. What does this tell you about the metallic bonds in sodium?

_____

_____ [1]

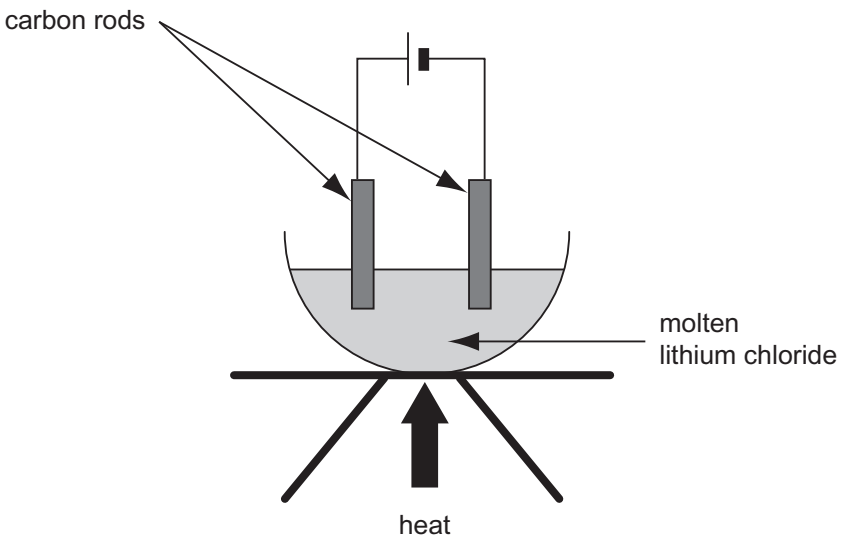
(c) Sodium, like all metals, is ductile. Explain why sodium is ductile.

_____

_____ [1]

Examiner Only	
Marks	Remark

9 The diagram shows the laboratory apparatus used in the electrolysis of lithium chloride.



In Part (a) you will be assessed on your written communication skills including the use of specialist science terms.

(a) Describe fully how to carry out this electrolysis and state what you would observe during the reaction. Your answer should include:

- Safety measures to be taken.
- Reason for the use of heat.
- The colours and states of the products formed at each named electrode.

[6]

(b) Write a balanced **ionic** equation for the reaction occurring at the anode.

_____ [2]

(c) Aluminium is extracted from its ore by electrolysis. This is a very costly process.

Give **two** ways of helping to keep the costs to a minimum in this industrial process.

_____

_____

_____ [2]

(d) Suggest what factors need to be considered when deciding on the site for an aluminium extraction plant.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

111998