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

TUESDAY 28 FEBRUARY 2012
11.00 am–12.00 noon

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 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 **2(b)**.
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	
Total Marks	

Examiner Only	
Marks	Remark

1 The box below shows the chemical symbols for some different types of ions.

K^+	S^{2-}	Mg^{2+}
Al^{3+}	Cl^-	NO_3^-
SO_4^{2-}	Na	N^{3-}

(a) From the box above choose

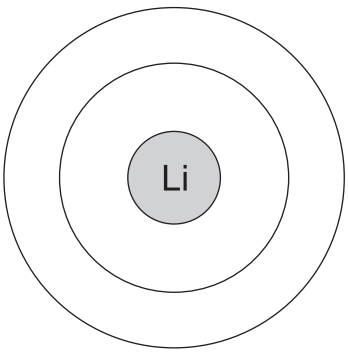
(i) a cation with a charge of 2 _____ [1]

(ii) a molecular ion _____ [1]

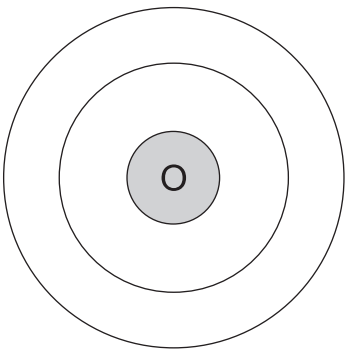
(iii) a symbol which is not an ion _____ [1]

(iv) the symbol for the nitrate ion _____ [1]

(b) Lithium reacts with oxygen to form lithium oxide, a solid white compound.
Draw diagrams to show all the electrons in an atom of lithium and an atom of oxygen.



lithium atom



oxygen atom

[2]

(c) Explain how lithium and oxygen react to form the compound lithium oxide.

_____

_____

_____

_____

_____ [3]

(d) Give **two** physical properties of the compound lithium oxide.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

2 A selection of colourless solvents used in the laboratory is shown in the photograph below. One of the liquids is water.

Image of a selection of colourless solvents removed due to copyright.

(a) What is meant by the term solvent?

_____

_____ [1]

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

Examiner Only	
Marks	Remark

(b) Explain how you would identify which liquid is water. Give the full chemical name for any substance used to test the liquids.

[6]

Examiner Only	
Marks	Remark

3 Chemists have collected a vast amount of information about the atoms of elements and have displayed it on a table called the Periodic Table.

The table below gives information about the atomic number, group number and electronic configuration of the atoms of elements A, B, C and D.

Elements	Atomic Number	Electronic configuration	Group Number
A	12	2,8,2	
B	6		4
C		2,7	7
D	15		5

(a) Complete the table above. [4]

(b) How many electrons would you expect an atom of strontium to have in its outer shell?

_____ [1]

(c) Name the element in Group 6 and Period 3 of the Periodic Table.

_____ [1]

Examiner Only

Marks	Remark

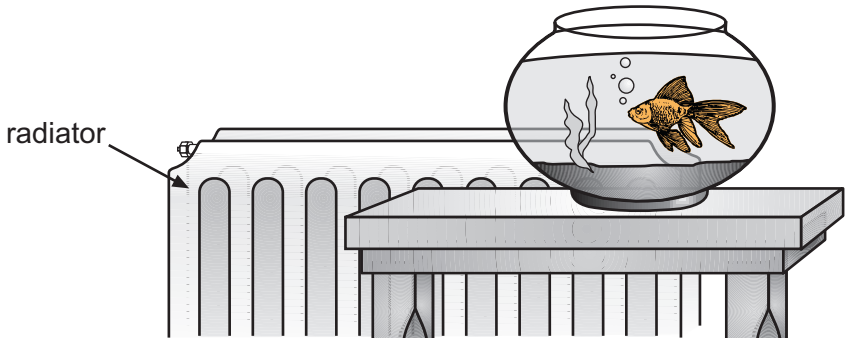
4 The table below shows the solubility of different substances in water at 15 °C and 20 °C.

Substance	Solubility (g/100 g water)	
	at 15 °C	at 20 °C
salt	28.0	36.0
oxygen	0.005	0.004
carbon dioxide	0.18	0.14
sugar	176.0	204.0

(a) Which substances shown in the table decrease in solubility as the temperature increases?

_____ [1]

During spells of cold weather some goldfish owners place their goldfish near a warm radiator.



(b) Suggest, using the information in the table, why this may not be such a good idea.

_____

_____

_____ [3]

(c) An experiment was carried out to investigate the solubility of potassium chloride. Two grams of potassium chloride were added to different masses of hot water and the temperature at which crystals began to form on cooling was recorded.
The results are shown in the table below.

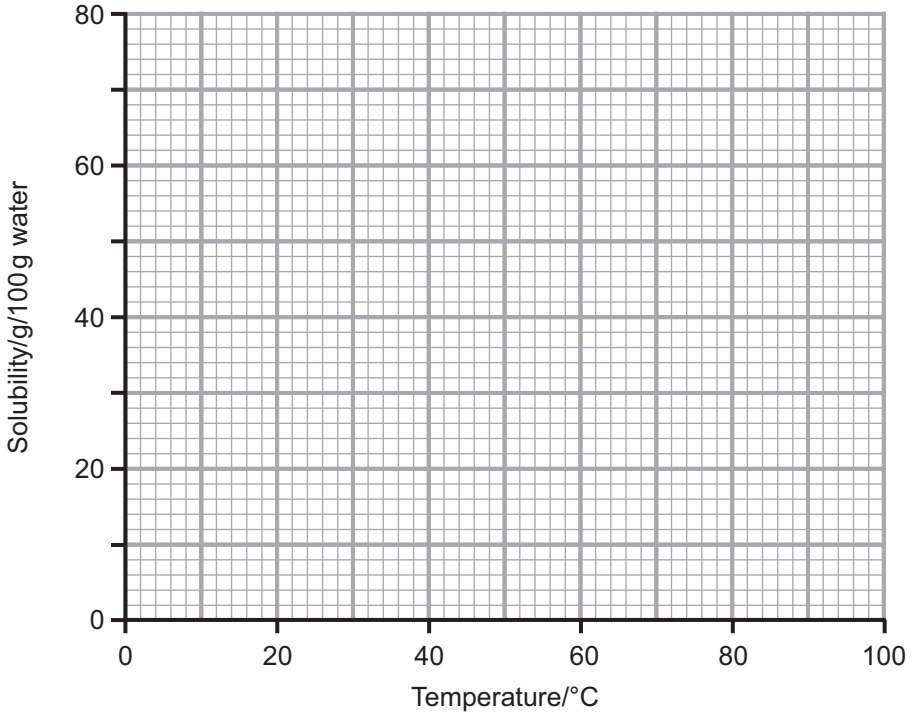
Mass of potassium chloride (g)	Mass of water (g)	Temperature at which crystals appear (°C)	Solubility (g/100 g water)
2.0	4.0	80	50.0
2.0	4.5	58	44.4
2.0	5.0	41	
2.0	5.5	28	36.4
2.0	6.0	16	33.3

(i) Complete the table by calculating the solubility of potassium chloride (g/100 g water) at 41 °C. **(Show your working).**

[2]

Examiner Only	
Marks	Remark

(ii) Plot a graph of solubility (g/100 g water) against temperature (°C) for potassium chloride below.



[3]

(d) Use your graph to answer the following questions.

(i) What is the solubility of potassium chloride at 50 °C?

_____ [1]

(ii) A solution of potassium chloride at 20 °C contains 30 g of potassium chloride dissolved in 100 g of water. State whether the solution is saturated or unsaturated.

_____ [1]

Examiner Only

Marks	Remark

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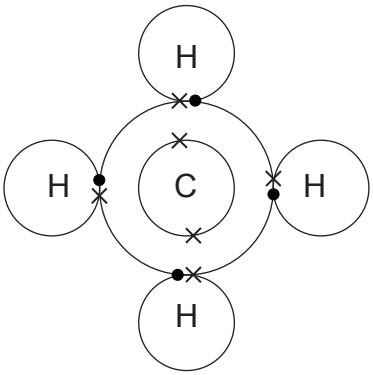
Examiner Only	
Marks	Remark

5 Methane and ammonia are both covalent compounds with very similar bonding.

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

Methane



In the space below draw a dot and cross diagram to show how **all** the electrons are arranged in a molecule of ammonia.

(i) Ammonia

[3]

(ii) Label the lone pair of electrons in ammonia. [1]

(b) Some covalent compounds have multiple bonds.
In the space below draw a **dot and cross diagram** to show the multiple bonds in a molecule of carbon dioxide.
Draw the **outer electrons only**.

[3]

Examiner Only	
Marks	Remark

6 Substances may be classified according to their physical properties. Use the table below to answer the following questions.

Substance	Melting point	Boiling point	Electrical conductivity	
			as solid	as liquid
A	650	1100	good	good
B	114	184	poor	poor
C	3550	4827	poor	poor
D	776	1500	poor	good
E	–79	–56	poor	poor
F	327	1760	good	good

(a) (i) Which substance A, B, C, D, E or F has a molecular covalent structure and is a solid at room temperature?

_____ [1]

(ii) Suggest a name for this substance.

_____ [1]

(b) Which substance A, B, C, D, E or F could be an electrolyte?

_____ [1]

(c) Which substance A, B, C, D, E or F is a metal with the lowest boiling point?

_____ [1]

(d) **(i)** Describe the state and structure of substance E at room temperature.

_____

_____ [2]

(ii) Would you expect substance E to dissolve in water?

_____ [1]

(iii) Explain your answer to **(d)(ii)**.

_____

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

7 Sulfuric acid is a strong acid. It will react with metal carbonates and will neutralise alkalis.

(a) State the pH range for a strong acid.

_____ [1]

(b) **(i)** Write a balanced chemical equation for the reaction between copper carbonate and sulfuric acid.

_____ [3]

(ii) Describe what you would observe during the reaction between copper carbonate and sulfuric acid. Include colour changes in your answer.

_____

_____

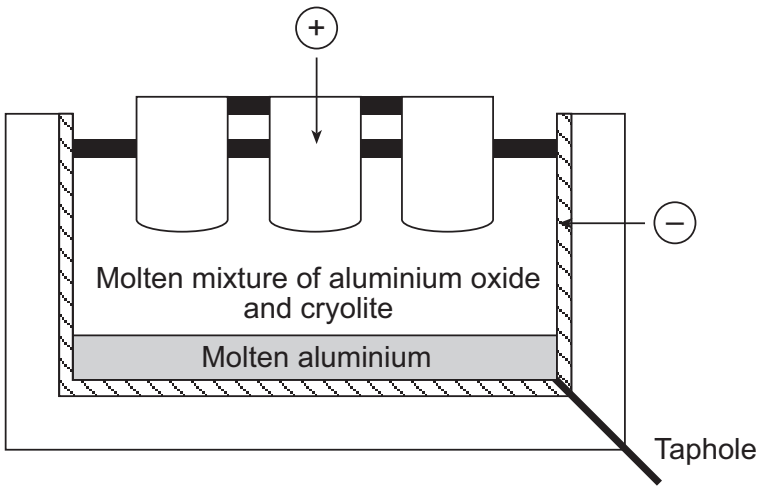
_____ [3]

(c) Write a balanced ionic equation for the neutralisation reaction. Include state symbols in your answer.

_____ [3]

Examiner Only	
Marks	Remark

8 Aluminium metal is extracted from its ore by the electrolysis of a molten mixture containing aluminium oxide and cryolite.



(a) What is the name of the ore of aluminium?

_____ [1]

(b) Give **two** reasons why cryolite is added to the aluminium oxide.

_____

_____

_____ [2]

(c) Write an ionic equation for the reaction which takes place at the cathode.

_____ [2]

(d) Explain why the anodes have to be replaced periodically.

_____

_____

_____ [3]

An increasing amount of aluminium products are produced from recycled aluminium.

(e) Give **two** reasons why aluminium is recycled.

_____

_____ [2]