Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2013–2014

Double Award Science: Chemistry

Unit C1

Higher Tier

[GSD22]

GSD22

THURSDAY 15 MAY 2014, MORNING

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 **7**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

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

Examiner Only	
Marks	Remark

1 Potassium is a soft metal which can be cut with a knife. It reacts violently with chlorine to form potassium chloride.

(a) Complete and balance the symbol equation below for the reaction of potassium with chlorine.

$$K \quad + \quad Cl_2 \quad \rightarrow$$

[2]

(b) Describe the appearance of a piece of freshly cut potassium.

_____

_____ [1]

(c) What happens to the freshly cut potassium when it is left in the air for a few minutes?

_____

_____ [1]

(d) Why is potassium stored under oil in the laboratory?

_____

_____ [1]

(e) Before reacting Group 1 elements with water a risk assessment is carried out.
Give two safety precautions, apart from wearing safety glasses, which must be included in the risk assessment.

1. _____

_____

2. _____

_____ [2]

(f) Equal sized pieces of three Group 1 metals are added to separate troughs of water which contain universal indicator.
The observations made are recorded in the table below.

Name of Group 1 metal	Observation when the metal is added to water	Colour of universal indicator
potassium	• catches fire • burns with a lilac flame on the surface of the water • quickly disappears	• changes colour from green to blue
lithium	• floats • moves about the surface of the water • eventually disappears	• changes colour from green to blue
sodium	• melts into a silvery ball on the surface of the water • disappears	• changes colour from green to blue

Read the information in the table carefully.

(i) What happens to the reactivity of the Group 1 elements as the Group is descended? You may find your Data Leaflet helpful.

_____ [1]

(ii) Explain fully why the universal indicator changed colour from green to blue.

_____

_____

_____

_____ [3]

(iii) Give one more observation which could be added to the table for **all three** reactions.

_____ [1]

(iv) Write a **word** equation to describe the reaction between sodium and water.

_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

2 Mendeleev was one of the scientists involved in the development of the Periodic Table.

(a) He placed elements which reacted in a similar way into Groups. Explain what is meant by the term **element**.

_____

_____ [1]

Complete the sentence.

(b) In his Periodic Table, Mendeleev arranged the elements in order of

increasing _____ . [1]

(c) Complete the table below which gives information about two elements in Group 5 of the Periodic Table.

Name	Symbol	Metal/Non-metal
phosphorus		
	Bi	

[2]

(d) Nitrogen is also a Group 5 element. What Period is nitrogen in?

Period _____ [1]

(e) Element X has an electronic configuration 2, 8, 7. Explain why it is **not** an element in Group 5 of the Periodic Table.

_____

_____

_____ [2]

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(Questions continue overleaf)

Examiner Only	
Marks	Remark

3 Magnesium chloride is produced in one type of fire extinguisher by the reaction of acid A and the base, magnesium hydroxide.

(a) Name acid A which reacts with magnesium hydroxide to produce magnesium chloride.

_____ [1]

(b) Suggest a reason why magnesium hydroxide is described as a base and not as an alkali.

_____ [1]

(c) Explain why the reaction between acid A and magnesium hydroxide is a neutralisation reaction.

_____

_____ [1]

Magnesium chloride is also formed by the reaction of magnesium oxide and acid A.

(d) What would you expect to observe when acid A is added to magnesium oxide?

_____

_____ [2]

(e) A solution of 0.05 mol/dm^3 acid Y was tested using a pH meter and universal indicator paper. The results are recorded in the table below.

Test	Result
pH meter	pH = 3.03
Universal indicator	orange pH = 3

(i) Explain how the colour of universal indicator is used to give a pH value.

_____

_____ [1]

(ii) How do the results show that acid Y is a weak acid?

_____

_____ [1]

(iii) Give one example of a weak acid.

_____ [1]

(iv) Which property of the acid is measured in the units mol/dm^3? Circle the correct answer.

mass **volume** **concentration** **strength**

[1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

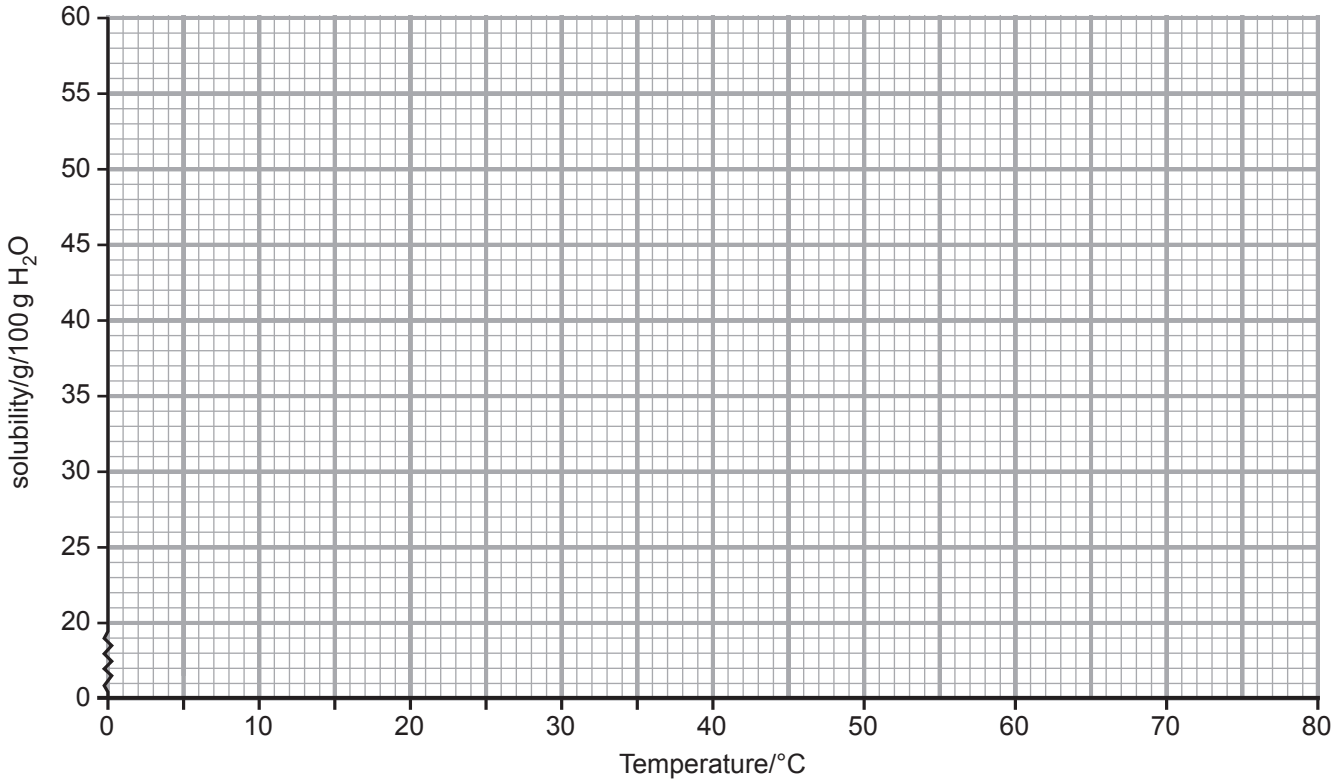
4 **(a)** An investigation was carried out to find the solubility (g/100 g H_2O) of potassium chloride at different temperatures. The results are given in the table below.

Temperature (°C)	0	10	20	30	40	50	60	80
Solubility (g/100 g H_2O)	27.8	30.9	34.0	37.1	40.0	42.9	45.8	51.2

(i) At 70 °C, 12.1 g of potassium chloride will saturate 25 g of water. Calculate the solubility of potassium chloride at 70 °C.
(You must show your working out.)

_____ g/100 g H_2O [1]

(ii) On the grid below draw the solubility curve for potassium chloride. [3]



(b) The table below gives the solubility (g/100 g H_2O) at different temperatures for four **solid** compounds, A, B, C and D.

Solid	Solubility (g/100 g H_2O)						
	0 °C	10 °C	20 °C	30 °C	40 °C	60 °C	80 °C
A	60.0	66.7	73.9	81.8	88.7	106.0	132.0
B	12.3	16.4	18.6	25.0	31.6	40.4	49.0
C	0.22	0.24	0.25	0.26	0.26	0.24	0.23
D	79.2	85.4	94.2	105.0	119.0	158.0	187.0

(i) Use the data in the table to complete the following general rule.

For most solids the solubility _____ as the

temperature _____. [1]

(ii) One of the compounds in the table does not follow this solubility rule.
Describe fully what happens to the solubility of this solid as the temperature is increased from 0 °C to 80 °C.

_____

_____

_____

_____ [2]

(iii) Calculate the mass of solid B which will crystallise when a saturated solution of B, in 50 g of water, is cooled from 60 °C to 10 °C.
(You must show your working out.)

Answer _____ g [2]

Examiner Only	
Marks	Remark

5 The formula for sodium oxide is Na_2O.

(a) Draw diagrams to show how two sodium ions and an oxide ion are formed when two sodium atoms react with an oxygen atom.

[4]

(b) Explain how the **ions** are held together in the compound, sodium oxide.

_____

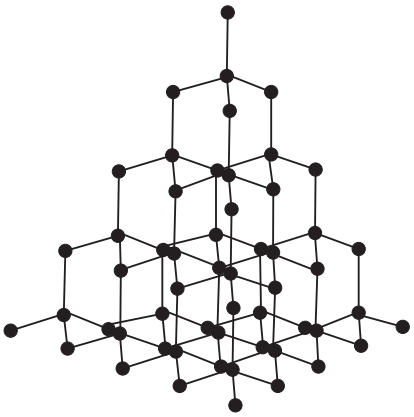
_____

_____

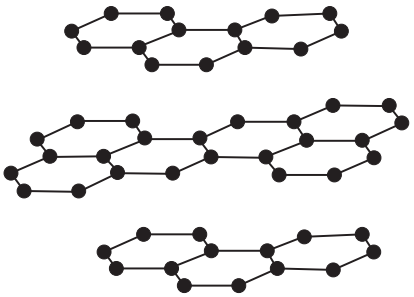
_____ [2]

Examiner Only	
Marks	Remark

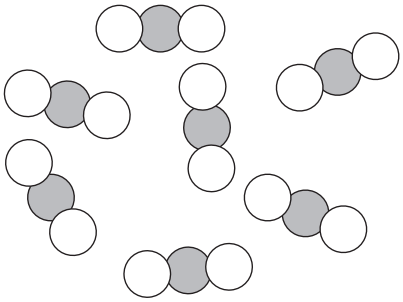
6 The diagrams below represent the structures of two allotropes of carbon, diamond and graphite, and of carbon dioxide. The atoms of each substance are held together by covalent bonds.



diamond



graphite



carbon dioxide

(a) What are **allotropes**?

Allotropes are _____

_____

_____ [2]

(b) Explain how a **covalent bond** is formed.

_____

_____

_____ [1]

Examiner Only

Marks	Remark

(c) Draw a dot and cross diagram to show the bonding in a molecule of carbon dioxide. **(Show all the electrons)**

[3]

(d) Complete the table below, by adding the name of the type of structure of each substance. The first one is done for you.

Substance	Type of structure
diamond	giant covalent
graphite	
carbon dioxide	

[2]

Graphite is used in pencil leads.

(e) Explain, with reference to the structure of graphite, why it is used in pencil leads.

_____

_____

_____

_____ [2]

Examiner Only

Marks	Remark

7 Describe the structure and bonding in a metal and explain why metals are ductile.

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

[6]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

8 Metals, such as lead, conduct electricity in the solid state. Electrolytes, such as lead(II) bromide, conduct electricity when molten.

(a) Complete the table below which gives information about how lead and lead(II) bromide conduct electricity.

Substance	Name of particle which moves and carries the charge	Effect on the substance due to the passage of electricity
lead		
lead(II) bromide		

[4]

(b) The following questions are about the reaction that happens at the anode during the electrolysis of molten lead(II) bromide.

(i) What is an anode?

_____ [1]

(ii) Write a half equation to describe the reaction at the anode.

_____ [2]

(iii) What can be observed at the anode?

_____

_____ [2]

THIS IS THE END OF THE QUESTION PAPER

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