New Specification

Rewarding Learning

71

Candidate Num

General Certificate of Secondary Education
2012

Science: Chemistry

Unit C1

Foundation Tier

[GCH11]

GCH11

TUESDAY 12 JUNE, MORNING

TIME

1 hour 15 minutes.

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 six** questions.

INFORMATION FOR CANDIDATES

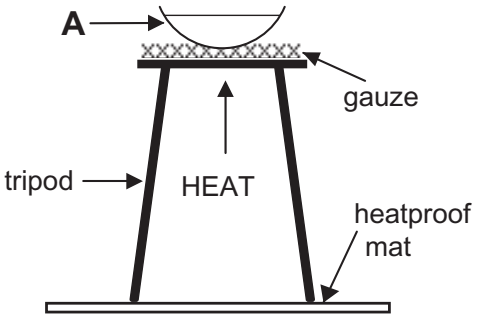
The total mark for this paper is **80**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in questions **3(c) and 5(a)(i)**.
A Data Leaflet which includes a Periodic Table of the Elements is provided.

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

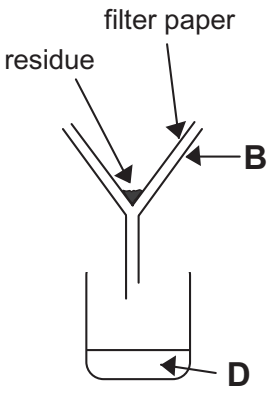
1 Mixtures may be separated in the laboratory in many different ways.

(a) Three different methods of separating mixtures are shown below.

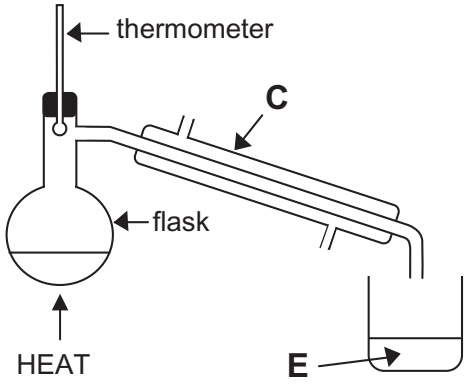
Method 1



Method 2



Method 3



(i) Name the pieces of apparatus labelled **A**, **B** and **C**.

A _____

B _____

C _____ [3]

(ii) Which method would be most suitable for removing sand from a mixture of sand and water?

_____ [1]

(iii) Explain fully why Method 2 would **not** be suitable to separate copper(II) sulfate from copper(II) sulfate solution.

_____

_____ [1]

(iv) What general term is used for liquid **D** collected in Method 2 and liquid **E** collected in Method 3?

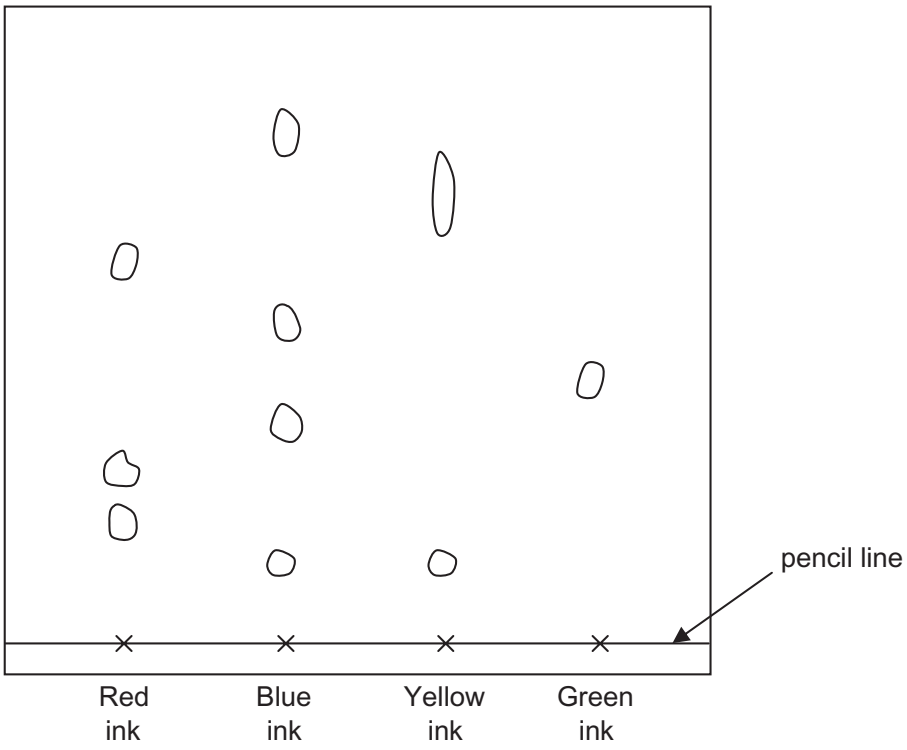
D _____

E _____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(b) A student analyses four different inks using paper chromatography. The inks are spotted along a pencil line. The chromatography paper is placed in a solvent and the coloured components in the inks separate out. The resulting chromatogram is shown below.



(i) Which ink contains four different components?

_____ [1]

(ii) Which ink contains the most soluble component?

_____ [1]

(iii) Which **two** inks contain one common component?

_____ [1]

Examiner Only	
Marks	Remark

2 The non-metals oxygen and chlorine can form compounds with most metallic elements and also with some other non-metallic elements.

(a) Magnesium metal reacts with oxygen gas to form the ionic compound magnesium oxide.

(i) Complete the table below to show the electronic configuration of magnesium and oxygen before and after bonding.

	magnesium	**oxygen**
Electronic configuration before bonding		
Electronic configuration after bonding		

[4]

(ii) State the charge of a magnesium ion and an oxide ion.

Magnesium ion _____

Oxide ion _____ [2]

(iii) Magnesium oxide has a melting point of 2852 °C. Explain why magnesium oxide has a very high melting point.

_____

_____

_____ [2]

(b) Non-metallic elements form compounds with each other by bonding covalently.

(i) Explain what you understand by a single covalent bond.

_____

_____ [2]

(ii) Draw a **dot and cross diagram** to show the covalent bonding in hydrogen chloride, HCl.

[3]

Examiner Only	
Marks	Remark

3 **(a)** A new element was added to the Periodic Table on February 19, 2010. It was officially named Copernicium, after a famous scientist and astronomer called Nicolaus Copernicus, and it was given the chemical symbol Cn. The position of Copernicium in the Periodic Table is shown below.

							H										He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	**Cn**						

(i) What is meant by the term element?

_____

_____ [1]

(ii) In which period of the Periodic Table is Copernicium (Cn) found?

_____ [1]

(iii) From your knowledge of the Periodic Table, state if Copernicium is a metal or non-metal.

_____ [1]

Examiner Only	
Marks	Remark

(b) In the Periodic Table elements with similar properties appear in the same group. Some of the groups in the Periodic Table have names.

Examiner Only

Marks	Remark

(i) Complete the table below by inserting the correct name for each group and state the number of electrons in the outer shell of atoms of elements in this group.

Group number	Name of group	Number of electrons in outer shell of atom
1		
2		

[4]

(ii) Potassium belongs to Group 1 of the Periodic Table. State how potassium should be stored.

_____ [1]

(iii) Before demonstrating the reaction of potassium with water, a risk assessment must be carried out. State **two** safety precautions, apart from wearing safety glasses, which must be included in the risk assessment for reacting potassium with water.

1. _____

_____

2. _____

_____ [2]

(c) The table below shows information about the reactions of Group 2 elements with water.

Element	Reactivity with water	Name of products on reaction with water
Beryllium	No reaction	No products
Magnesium	Reacts very slowly with cold water	Magnesium hydroxide and hydrogen
Calcium	Reacts moderately with cold water	Calcium hydroxide and hydrogen
Strontium	Reacts rapidly with cold water	Strontium hydroxide and hydrogen
Barium	Reacts very rapidly with cold water	Barium hydroxide and hydrogen

Use the information in the table, and your own knowledge of Group 1 elements, to compare and contrast the reactions of Group 1 and Group 2 elements with water.

In your answer compare:
- the products formed
- the reactivity of the Group 1 elements compared to the Group 2 elements and
- the trend in reactivity down both groups.

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

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

[6]

4 Bath crystals are a mixture of water soluble solids which are added to bathwater for health benefits.

Examiner Only	
Marks	Remark

'An image of a packet of bath crystals has been removed'

(a) (i) Some of the solids present in bath crystals are shown in the table below.

Complete the table.

(Relative atomic masses: O = 16; Na = 23; P = 31)

Solid	Formula	Relative formula mass
sodium hexametaphosphate	$Na_6P_6O_{18}$	
sodium chloride		58.5

[2]

(ii) The molecular formula of sodium hexametaphosphate is shown in the table. What is the empirical formula of sodium hexametaphosphate?

_____ [1]

(b) Bath crystals also contain Epsom salts (hydrated magnesium sulfate) which relax muscles, reduce inflammation and help muscle function.

Examiner Only	
Marks	Remark

'An image of a packet of Epsom Salts has been removed'

0.05 moles of magnesium sulfate crystals were prepared in the laboratory by reacting 6.3 g of magnesium carbonate with sulfuric acid, as shown in the equation below.

$$MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + H_2O + CO_2$$

(Relative atomic masses: C = 12; O = 16; Mg = 24; S = 32)

(i) Calculate the mass of magnesium sulfate present in 0.05 moles of magnesium sulfate.

_____ g [2]

(ii) Calculate the number of moles present in 6.3 g of magnesium carbonate, $MgCO_3$.

_____ [2]

(c) Epsom salts contain water of crystallisation and have the formula $MgSO_4.7H_2O$.

(Relative atomic masses: H = 1; O = 16; Mg = 24; S = 32)

(i) What is meant by the term water of crystallisation?

_____

_____ [2]

(ii) Calculate the relative formula mass of Epsom salts $MgSO_4.7H_2O$.

_____ [1]

(iii) Use the value calculated in **(c)(ii)** to find the percentage of water of crystallisation in Epsom salts.

_____ % [2]

Examiner Only	
Marks	Remark

5 Calcium chloride is a salt and a common food additive. It is usually labelled as E509 and is found in a wide variety of foods including chocolate.

'An image of a Cadbury Crunchie bar has been removed'

(a) Calcium chloride solution may be prepared from solid calcium carbonate and dilute hydrochloric acid.

(i) Describe fully how a solution of calcium chloride may be prepared from solid calcium carbonate and dilute hydrochloric acid.

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

[6]

Examiner Only

Marks	Remark

[Turn over

(ii) Write a balanced symbol equation for the reaction between calcium carbonate and hydrochloric acid.

_____ [3]

(iii) Describe the process of obtaining pure, dry crystals of hydrated calcium chloride from a solution of calcium chloride.

_____

_____

_____

_____

_____

_____

_____

_____ [3]

(b) Calcium chloride may also be prepared by neutralising calcium hydroxide solution with dilute hydrochloric acid. Calcium hydroxide solution is an alkali.

(i) What do you understand by the term alkali?

_____ [1]

(ii) Write a balanced symbol equation for the reaction between calcium hydroxide and hydrochloric acid.

_____ [3]

(iii) What common name is used for calcium hydroxide solution?

_____ [1]

(iv) Name the gas which can be detected using calcium hydroxide solution.

_____ [1]

Examiner Only	
Marks	Remark

(c) A solution of 0.015 mol/dm^3 hydrochloric acid was tested using a pH meter, red and blue litmus and universal indicator paper. The results are given below.

Test	Result
pH meter	1.82
red litmus	red
blue litmus	red
universal indicator paper	red

(i) Explain how the result with universal indicator may be converted into a pH value.

_____

_____ [1]

(ii) Explain why the result with red litmus is not conclusive for the presence of an acid.

_____

_____ [1]

(iii) Based on the results in the table, select **two** pieces of evidence which would suggest that hydrochloric acid is a strong acid. Explain your answer.

_____

_____

_____

_____

_____ [2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

6 Some chemical compounds such as potassium chloride dissolve very well in water and are said to have a high solubility.

(a) What is meant by the term solubility?

_____

_____

_____

_____ [4]

(b) A student carried out a series of experiments to determine the solubility of potassium chloride over a range of temperatures. The results were plotted on a graph and the solubility curve is shown opposite.

(i) Describe how the solubility of potassium chloride varies with temperature.

_____

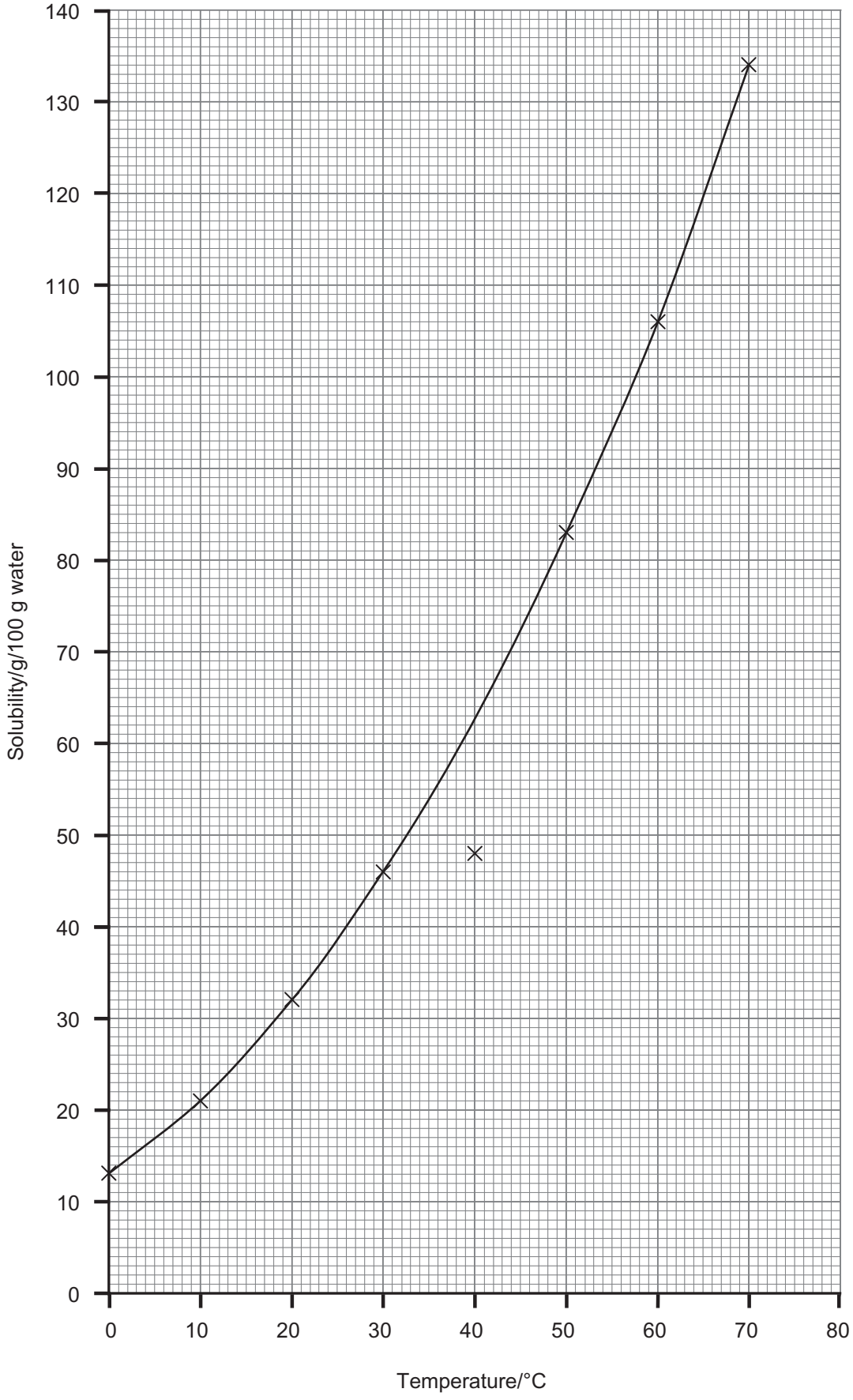
_____ [1]

(ii) Which temperature value should the student repeat?

_____ [1]

(iii) From the graph determine the solubility of potassium chloride at 55 °C.

_____ [1]



THIS IS THE END OF THE QUESTION PAPER