

New
Specification

Rewarding Learning

General Certificate of Secondary Education
2012

Centre Number

71

Candidate Number

Science: Chemistry

Unit C1

Foundation Tier

[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.

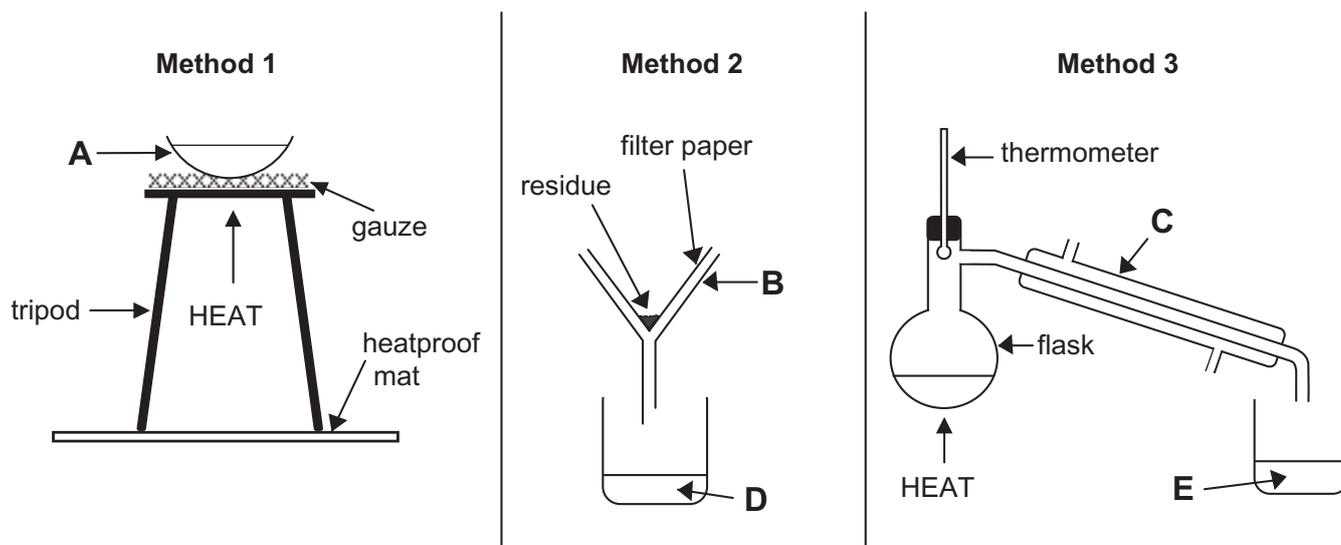
| For Examiner's use only | |
|-------------------------|-------|
| Question Number | Marks |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |

| | |
|--------------------|--|
| Total Marks | |
|--------------------|--|



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

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



(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]

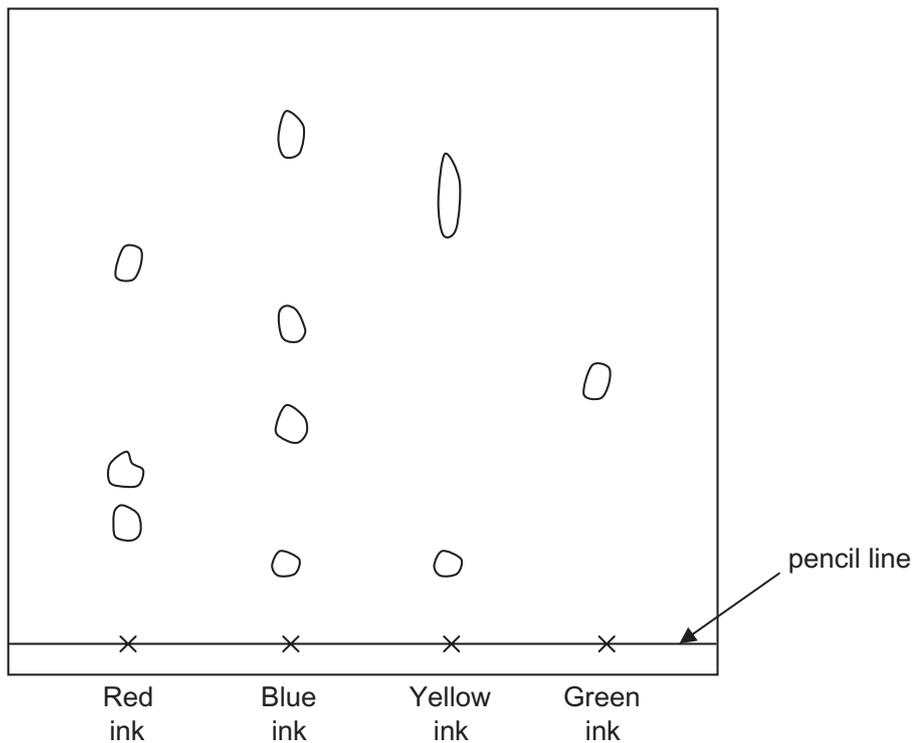
(iv) What general term is used for liquid **D** collected in Method 2 and liquid **E** collected in Method 3?

D _____

E _____ [2]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

- (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]

Examiner Only

Marks Remark

(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.

(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]

Examiner Only

Marks Remark

- (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 |
| | |

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

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

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- (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 | $\text{Na}_6\text{P}_6\text{O}_{18}$ | |
| 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]

Examiner Only

Marks Remark

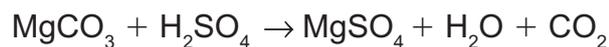
- (b) Bath crystals also contain Epsom salts (hydrated magnesium sulfate) which relax muscles, reduce inflammation and help muscle function.

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

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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.



(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]

| 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

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?

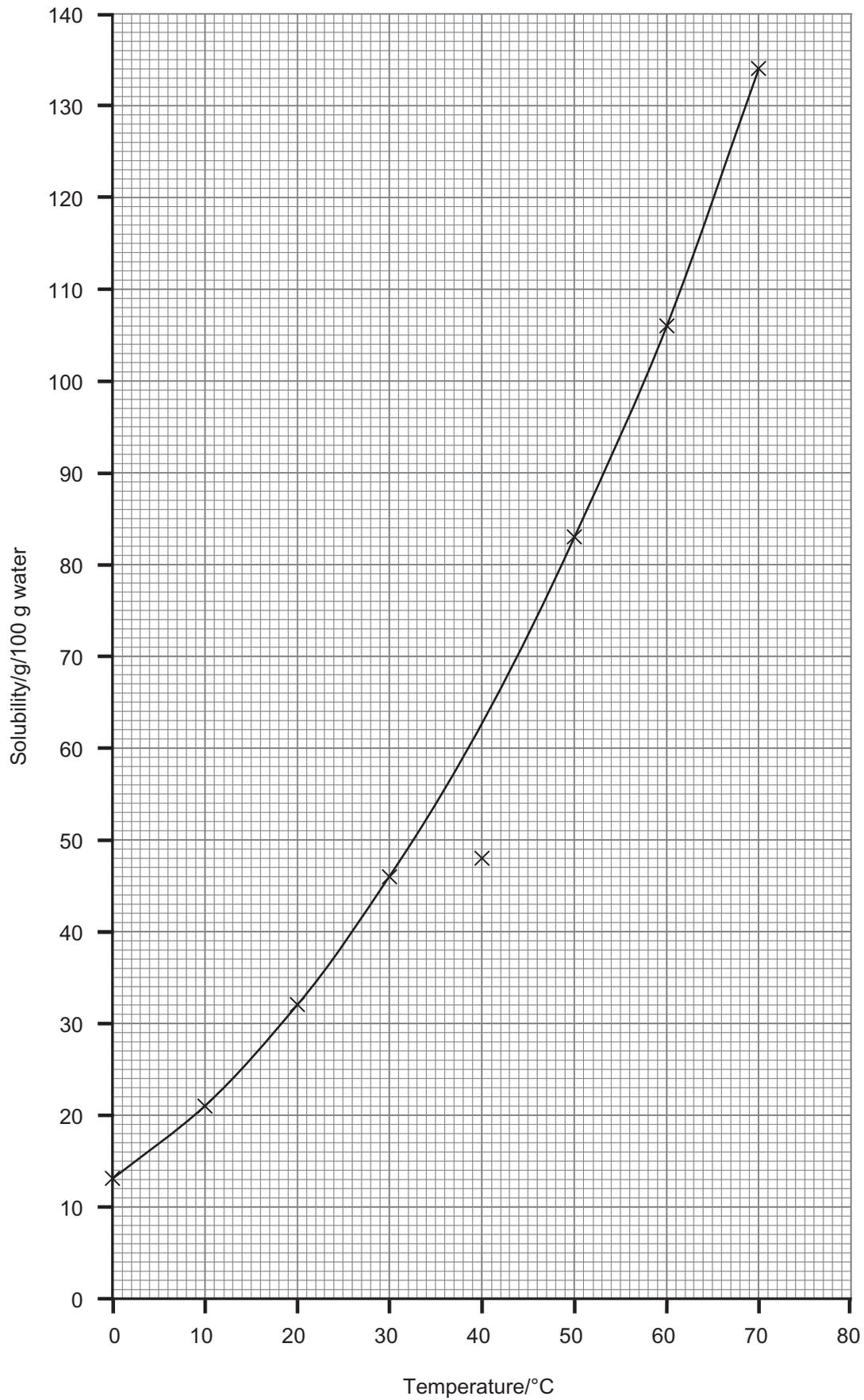
[1]

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

[1]

Examiner Only

Marks Remark



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