

New  
Specification

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Centre Number

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Candidate Number

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General Certificate of Secondary Education  
2018

# GCSE Chemistry

Unit 1

Higher Tier



[GCM12]

\*GCM12\*

**WEDNESDAY 13 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.

**You must answer the questions in the spaces provided.**

**Do not write outside the boxed area on each page or on blank pages.**

Complete in black ink only. **Do not write with a gel pen.**

Answer **all five** 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 Question **4(b)(ii)**.

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

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\*20GCM1201\*

1 Nanoparticles have been widely researched in recent years. Carbon nanotubes are made from graphite and have a wide range of applications in medicine.

(a) State the size of a nanoparticle.

\_\_\_\_\_ [1]

(b) (i) Describe in detail the structure and bonding of graphite.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

(ii) State **one** physical property of graphite.

\_\_\_\_\_ [1]

(c) Carbon reacts with oxygen to form carbon dioxide.

Draw a dot and cross diagram to show the bonding in carbon dioxide.

[1]



- (d) Silver nanoparticles help to heal wounds and silver chloride has antiseptic properties. Silver is found in the Periodic Table as shown below.

108
<b>Ag</b>
47

- (i) Complete the table below to show the number of subatomic particles present in an atom of silver.

Subatomic particle	Number of particles
proton	
electron	
neutron	

[1]

- (ii) Draw a labelled diagram of a **chloride ion** which has a mass number of 37. Show clearly the number of each subatomic particle present, the position of each particle and the charge on the ion.

[3]

[Turn over



(e) The table below gives some of the properties of silver and silver chloride.

Property	Silver (Ag)	Silver chloride (AgCl)
Melting point	962 °C	455 °C
Electrical conductivity in solid state	Conducts	Does not conduct
Electrical conductivity when molten	Conducts	Conducts

(i) Explain why silver has a high melting point.

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[2]

(ii) State the type of structure present in silver chloride.

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[1]

(iii) Explain why silver chloride conducts electricity when molten.

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[2]





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2 (a) Lithium metal reacts with oxygen to form lithium oxide.

(i) Write a balanced symbol equation for the reaction of lithium with oxygen.

\_\_\_\_\_ [3]

(ii) Write a half equation for the formation of the lithium ion in this reaction.

\_\_\_\_\_ [2]

(b) Lithium metal also reacts with water.

A teacher carried out a demonstration of this reaction by removing some lithium from a jar, preparing it for the reaction and then adding it to a trough of water. Heat was released and the lithium moved on the surface of the water until it became smaller and disappeared.

(i) Describe **two** ways in which the lithium is prepared for this reaction.

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_ [2]

(ii) State **two** other observations which can be made during this reaction.

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_ [2]

(iii) Name the gas produced in this reaction.

\_\_\_\_\_ [1]



(c) Lithium reacts with fluorine to form lithium fluoride.

(i) Write a half equation for the formation of fluoride ions from a fluorine molecule.

\_\_\_\_\_ [3]

(ii) Explain, in terms of reactivity and electrons, why the reaction of lithium with bromine is less vigorous than the reaction of lithium with fluorine.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

(iii) Complete the table to give the name of the group to which the following elements belong.

Element	Name of group to which it belongs
lithium	
fluorine	

[2]





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\*20GCM1208\*

3 Hydrochloric acid and sulfuric acid are described as strong acids. Strong acids ionise completely in water. The pH of an acid is related to the concentration of hydrogen ions in the acidic solution.

(a) What happens to the pH of an acidic solution when the concentration of hydrogen ions increases?

\_\_\_\_\_ [1]

(b) (i) Complete the ionic equation to show the complete ionisation of sulfuric acid in water.



(ii) Suggest a pH value for a solution of sulfuric acid.

\_\_\_\_\_ [1]

(c) Excess hydrochloric acid in the stomach causes indigestion. The excess acid can be neutralised by taking an antacid tablet containing calcium carbonate.

(i) Write a balanced symbol equation for the reaction of hydrochloric acid with calcium carbonate.

\_\_\_\_\_ [3]

(ii) State **two** observations which can be made during this reaction.

1. \_\_\_\_\_

\_\_\_\_\_

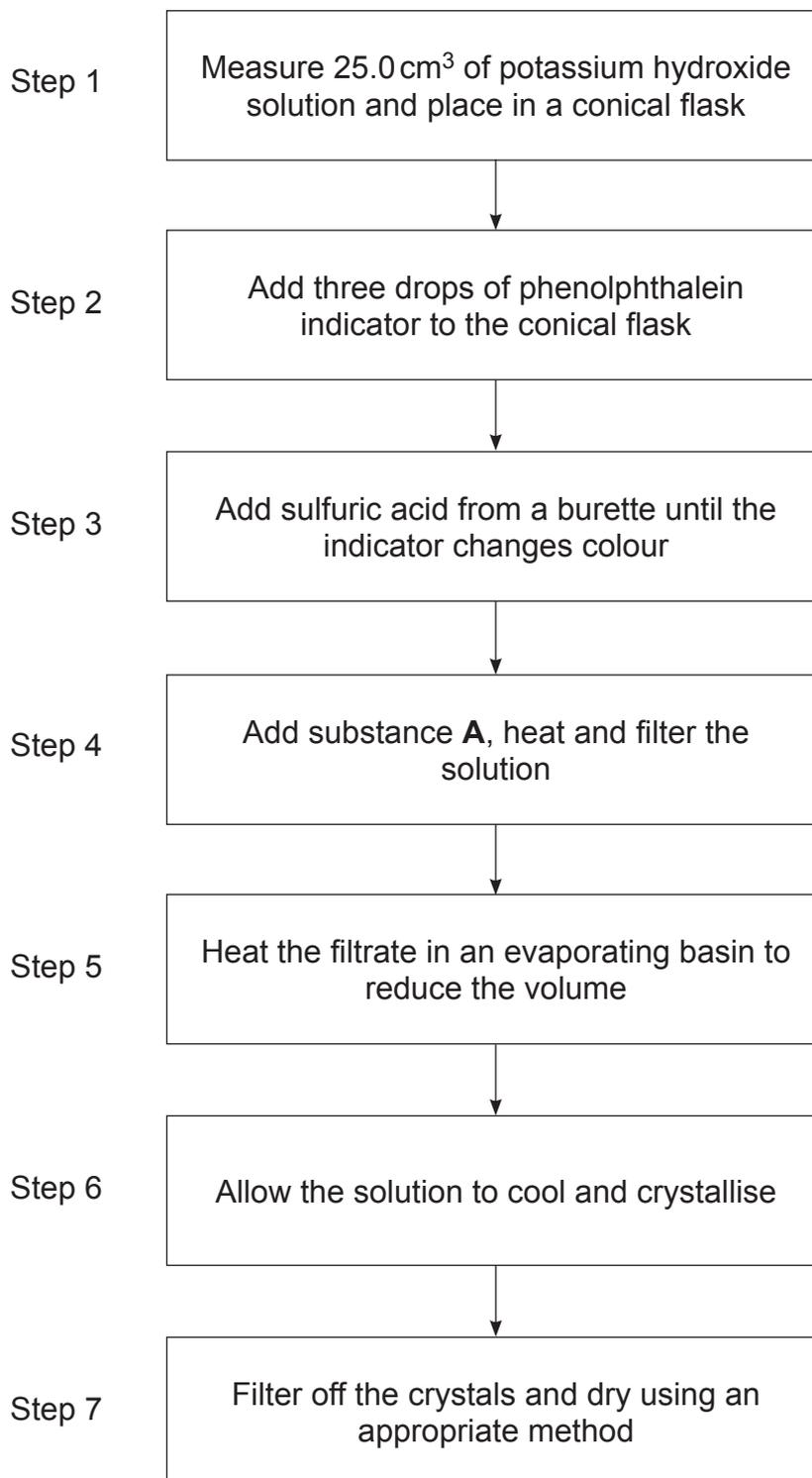
2. \_\_\_\_\_

\_\_\_\_\_ [2]

[Turn over



(d) A pure, dry sample of the salt potassium sulfate may be prepared by reacting potassium hydroxide solution with dilute sulfuric acid. The method used is summarised in the flow chart below.



11545



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- (i) Name the piece of apparatus used to measure 25.0 cm<sup>3</sup> of potassium hydroxide solution in Step 1.

\_\_\_\_\_ [1]

- (ii) State the colour change observed in Step 3.

From \_\_\_\_\_ to \_\_\_\_\_ [2]

- (iii) Name substance **A** in Step 4.

\_\_\_\_\_ [1]

- (iv) Explain why crystals form on cooling the solution in Step 6.

\_\_\_\_\_  
\_\_\_\_\_ [1]

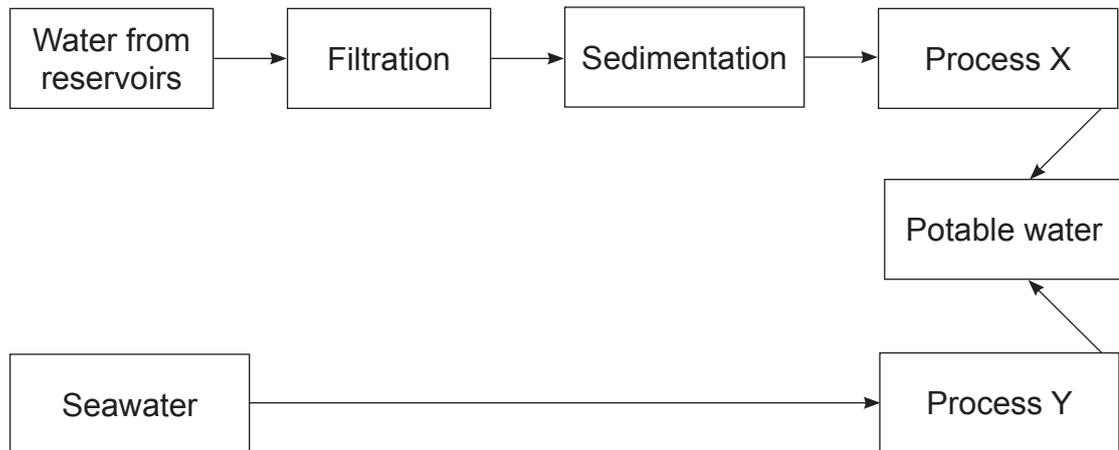
- (v) Suggest a suitable method of drying the crystals in Step 7.

\_\_\_\_\_ [1]

[Turn over



- 4 (a) Seawater and water from reservoirs can be made potable as shown in the diagram.



- (i) Why is aluminium sulfate added during the sedimentation stage?

\_\_\_\_\_ [1]

- (ii) Name Process X and Process Y.

Process X: \_\_\_\_\_

Process Y: \_\_\_\_\_ [2]

- (iii) State the purpose of Process X.

\_\_\_\_\_ [1]

- (b) Orange juice is not considered by chemists to be a pure substance.

- (i) What is meant by the term pure substance?

\_\_\_\_\_ [1]





(c) A sports drink contains some dissolved magnesium chloride and sodium chloride salts. When silver nitrate solution is added to a sample of the sports drink a precipitate is formed.

(i) What colour is the precipitate?

\_\_\_\_\_ [1]

(ii) Write an ionic equation, with state symbols, for the formation of the precipitate.

\_\_\_\_\_ [3]

(iii) Describe how you would prove that the sports drink contains magnesium ions.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]



- 5 Natron is a naturally occurring mixture of hydrated sodium carbonate ( $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ ) and sodium hydrogencarbonate ( $\text{NaHCO}_3$ ) along with small quantities of sodium chloride and sodium sulfate.

(a) Calculate the percentage of oxygen, by mass, in  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

Percentage of oxygen = \_\_\_\_\_ % [2]

- (b) Hydrated sodium carbonate loses water of crystallisation over time. A student weighed out 4.90 g of an old sample of hydrated sodium carbonate  $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$ .

2.65 g of solid remained after heating to constant mass.

Calculate the value of x in  $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$

x = \_\_\_\_\_ [4]

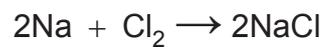
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\*20GCM1215\*

- (c) Sodium reacts with chlorine to form sodium chloride. Calculate the theoretical yield of sodium chloride, in grams, when 28.4 g of chlorine reacts completely with sodium.



Theoretical yield = \_\_\_\_\_ g [3]



- (d) In the laboratory sodium sulfate can be prepared by the reaction of sodium hydrogencarbonate and magnesium sulfate.



Identify the limiting reactant when 16.8 g of sodium hydrogencarbonate reacts with 6.0 g of magnesium sulfate and calculate the maximum mass of sodium sulfate obtained.

Limiting reactant is \_\_\_\_\_

Maximum mass of sodium sulfate = \_\_\_\_\_ g [5]

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Question Number	Marks
1	
2	
3	
4	
5	

<b>Total Marks</b>	
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Examiner Number

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