



General Certificate of Secondary Education
2018

Centre Number

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Candidate Number

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GCSE Chemistry

Unit 1

Higher Tier



[GCH12]

GCH12

WEDNESDAY 13 JUNE, MORNING

TIME

1 hour 30 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 100.

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 **1(a)** and **2(d)(ii)**.

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

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20GCH1201

- 1 (a)** The modern Periodic Table, like Mendeleev's Periodic Table, has elements arranged in periods and groups.

Describe the **differences** between the modern Periodic Table and Mendeleev's Periodic Table.

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

[illegible]

[6]



(b) Lithium is found in Group 1 of the Periodic Table.

(i) State how lithium is stored and explain why it is stored in this way.

[2]

(ii) Before reacting lithium with water, a risk assessment is carried out. Give two safety precautions, apart from wearing safety glasses, which must be included in this risk assessment.

1.

2.

[2]

(iii) Write a balanced symbol equation for the reaction of lithium with water.

[3]

[Turn over



(c) The table below shows some of the physical properties of the halogens.

(i) Complete the table.

	State at room temperature	Colour
fluorine	gas	yellow
chlorine	gas	
bromine		red-brown
iodine		

[4]

(ii) Write a balanced symbol equation for the reaction between chlorine and potassium iodide solution.

[3]

(iii) Write a half equation for the reaction of the chlorine molecule in (c)(ii).

[3]





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(Questions continue overleaf)

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[Turn over



20GCH1205

- 2 Commercial cold packs used to treat sports injuries contain salts such as calcium nitrate and ammonium nitrate.



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- (a) Ammonium nitrate may be formed from the reaction of ammonia solution with nitric acid. Nitric acid is a strong acid.

- (i) What is meant by the term strong acid?

[1]

- (ii) The table below shows two indicators. Complete the table to show the colour of the indicator with nitric acid and with ammonia solution.

Indicator	Colour with nitric acid	Colour with ammonia solution
blue litmus		
phenolphthalein		

[4]



(b) The reaction of ammonia with nitric acid is exothermic.

(i) Write a balanced symbol equation for the reaction of ammonia with nitric acid.

_____ [2]

(ii) Describe how you would show practically that the reaction between ammonia and nitric acid is exothermic.

_____ [2]

(c) Calcium nitrate may be formed in the neutralisation reaction between calcium hydroxide solution and nitric acid.

(i) Write an ionic equation for the neutralisation reaction including state symbols.

_____ [3]

(ii) What common name is given to calcium hydroxide solution?

_____ [1]

(d) Calcium nitrate may also be formed from the reaction of solid calcium carbonate with nitric acid.

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

_____ [3]

[Turn over]

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(ii) Describe how you would prepare a pure, dry sample of calcium nitrate crystals from solid calcium carbonate and nitric acid.

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

[illegible]

[6]

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20GCH1208



3 Bicycle frames may be made from a variety of materials including metals, such as aluminium and titanium, and non-metals such as carbon.

(a) The element carbon has several allotropes including graphite.

(i) Draw a **labelled** diagram to show the structure and bonding of graphite.

[4]

(ii) Explain why graphite has a high melting point.

[3]

[Turn over



(b) Complete the table below which gives information about some atoms and ions.

Formula of atom or ion	Particle	Number of protons	Number of electrons	Number of neutrons
C	carbon atom		6	6
	oxide ion	8		8
		13	10	14

[5]

(c) Carbon reacts with a plentiful supply of oxygen to form carbon dioxide. Draw a dot and cross diagram to show the bonding in a molecule of carbon dioxide.

[1]



(d) The bonding in metals such as aluminium and titanium is known as metallic bonding.

(i) Describe in detail the bonding and structure of a metal.

[4]

(ii) Metals may be used in the manufacture of bicycle frames because they are malleable. State the meaning of the term malleable and explain why metals are malleable.

[4]

(iii) State one other physical property of aluminium that makes it suitable for use in bicycle frames.

[1]

[Turn over

11097.04R



20GCH1211

- 4 Iodine is an important mineral for health, especially during pregnancy as it plays a vital role in the development of a baby's brain. A supplement containing potassium iodide is often recommended for adults with iodine deficient diets.

(a) The solubility of potassium iodide at a range of temperatures is given in the table below.

Temperature (°C)	Solubility of potassium iodide (g/100g H ₂ O)
20	144
30	152
40	160
50	168
60	176

- (i) Determine if a solution containing 680 g of potassium iodide in 500 g of water at 20 °C is saturated or unsaturated. **Show evidence to support your answer.**

[2]

- (ii) On heating a saturated solution of potassium iodide containing 25 g of water from 30 °C to a higher temperature, the solution dissolved a further 4 g of potassium iodide and remained saturated. Determine the temperature to which the solution was heated. **Show all your working out.**

Temperature _____ °C [3]



(iii) State the colour of potassium iodide solution.

[1]

(b) Describe how a flame test is carried out on a sample of solid potassium iodide and state the expected result.

[4]

(c) (i) Describe a chemical test to show that iodide ions are present in a sample of solid potassium iodide and state the result for a positive test.

[3]

(ii) Write a balanced ionic equation for the test for iodide ions.

[2]

[Turn over]

11097.04R



20GCH1213

5 (a) Iron has a relative atomic mass of 56 and is found in many different compounds and ores.

(i) What is meant by the term relative atomic mass?

[2]

(ii) $\text{Fe}_3(\text{CO})_{12}$ is a compound which contains iron. What is the empirical formula of this compound?

[1]

(iii) 1 mole of hydrated iron(II) sulfate contains 7 moles of water of crystallisation. Write the formula of hydrated iron(II) sulfate.

[1]

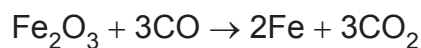
(iv) Calculate the percentage of water of crystallisation present in hydrated iron(II) sulfate.

(Relative atomic masses: H = 1; O = 16; S = 32; Fe = 56)

Percentage of water _____ % [3]



- (b) In industry, iron is obtained from the ore haematite (Fe_2O_3) through a reaction with carbon monoxide. The equation for this reaction is:



- (i) Calculate the mass of iron, in tonnes, that can be obtained when 16 000 kg of Fe_2O_3 react with excess carbon monoxide.

(Relative atomic masses: O = 16; Fe = 56)

Mass of iron _____ tonnes [6]

- (ii) Calculate the percentage yield of this reaction if 10.2 tonnes of iron are obtained.

Percentage yield _____ % [2]

[Turn over]

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20GCH1215

- (c) Iron pyrite is another ore of iron and it contains 46.5% iron and 53.5% sulfur by mass. Determine the empirical formula of iron pyrite.

Show all your working out.

(Relative atomic masses: S = 32; Fe = 56)

_____ [3]

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Question Number	Marks
1	
2	
3	
4	
5	

Total Marks	
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Examiner Number

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