



Rewarding Learning

General Certificate of Secondary Education
2018

Centre Number

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Candidate Number

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GCSE Chemistry

Unit 1

Higher Tier

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| MV18 |
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[GCH12]

WEDNESDAY 13 JUNE, MORNING

Time

1 hour 30 minutes, plus your additional time allowance.

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 on blank pages.

Complete in black ink only.

Answer **all five** questions.

Information for Candidates

The total mark for this paper is 100.

Figures in brackets printed at the end of each question 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.

(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 marks]

(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. [2 marks]

1. _____

2. _____

(iii) Write a balanced symbol equation for the reaction of lithium with water. [3 marks]

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

(i) Complete the table. [4 marks]

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

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

(iii) Write a half equation for the reaction of the chlorine molecule in (c)(ii). [3 marks]

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



(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 mark]

- (ii) The table below shows two indicators. Complete the table to show the colour of the indicator with nitric acid and with ammonia solution. [4 marks]

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

- (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 marks]

- (ii) Describe how you would show practically that the reaction between ammonia and nitric acid is exothermic. [2 marks]

(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 marks]

(ii) What common name is given to calcium hydroxide solution? [1 mark]

(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 marks]

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 marks]

(ii) Explain why graphite has a high melting point. [3 marks]

(b) Complete the table below which gives information about some atoms and ions. [5 marks]

| 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 |

(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 mark]

(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 marks]

(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 marks]

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

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 marks]

- (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.** [3 marks]

Temperature _____ °C

- (iii) State the colour of potassium iodide solution. [1 mark]

- (b) Describe how a flame test is carried out on a sample of solid potassium iodide and state the expected result. [4 marks]

(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 marks]

(ii) Write a balanced ionic equation for the test for iodide ions. [2 marks]

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 marks]

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

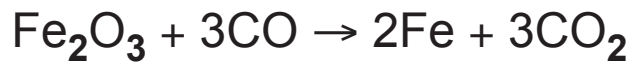
(iii) 1 mole of hydrated iron(II) sulfate contains 7 moles of water of crystallisation. Write the formula of hydrated iron(II) sulfate. [1 mark]

(iv) Calculate the percentage of water of crystallisation present in hydrated iron(II) sulfate. [3 marks]

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

Percentage of water _____ %

(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. [6 marks]

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

Mass of iron _____ tonnes

(ii) Calculate the percentage yield of this reaction if 10.2 tonnes of iron are obtained. [2 marks]

Percentage yield _____ %

(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. [3 marks]

Show all your working out.

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

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

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

Examiner Number

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