

# Chemical Equations: Gases

## Question Paper

Level	International A Level
Subject	Chemistry
Exam Board	Edexcel
Topic	Chemistry Lab Skills 1
Sub Topic	Chemical Equations: Gases
Booklet	Question Paper

Time Allowed:

26 minutes

Score:

/21

Percentage:

/100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

1 An organic compound, **Z**, has only one –OH group.

- (a) State the test which confirms the presence of an –OH group and give the result of a positive test.

(2)

Test.....

Result.....

- (b) Name **two** series of organic compounds, with different general formulae, each of which has one –OH group.

(1)

..... and .....

- (c) Neither red nor blue litmus paper changed colour when used to test an aqueous solution of **Z**. A different sample of **Z** was warmed with a mixture of aqueous potassium dichromate(VI) and sulfuric acid. No change was observed.

What can be deduced about the identity of the functional group in **Z** from each of these observations? Justify your answer.

(2)

Test with litmus paper

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Warming with aqueous potassium dichromate(VI) and sulfuric acid

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- (d) **Z** was investigated by measuring the volume of carbon dioxide formed on complete combustion.

A sample of 0.10 mol of **Z** produced 9.6 dm<sup>3</sup> of carbon dioxide.

Under the conditions of the experiment, the molar volume of a gas is 24 dm<sup>3</sup> mol<sup>-1</sup>.

Use this information to calculate the number of carbon atoms in one molecule of **Z**. Use the result of your calculation and your deduction in (c) to draw the displayed formula of **Z**. Show your working.

(3)

- (e) **Z** has several isomers, only some of which contain an –OH group.

- (i) Give **one** piece of evidence from their mass spectra which would show that two compounds could be isomers.

(1)

- (ii) How could infrared spectroscopy be used to show that two isomers of **Z** both have an –OH group? You are not required to give wavenumber values.

(1)

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(Total for Question 1 = 10 marks)

- 2 A white powder is the carbonate of an element in Group 2. Its formula can be written  $\text{XCO}_3$ .  
0.150 g of the pure carbonate was mixed with excess dilute hydrochloric acid.

The following reaction occurred.



- (a) Describe the test for carbon dioxide.

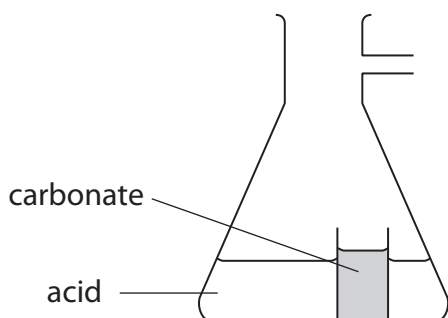
(1)

Test .....

Observation .....

- (b) The carbonate and dilute hydrochloric acid were mixed in a conical flask with a side arm. Complete the diagram below to show how to collect the carbon dioxide and measure its volume.

(2)



- (c) The volume of carbon dioxide, measured at room temperature and pressure, was  $41 \text{ cm}^3$ . Calculate the number of moles of gas formed.

[The molar volume of a gas under these conditions is  $24 \text{ dm}^3 \text{ mol}^{-1}$ .]

(1)

(d) Use your answer to (c), and the mass of the carbonate used, to calculate the molar mass of  $XCO_3$ . (2)

(e) Deduce the value which this experiment gives for the relative atomic mass of **X**. Suggest which Group 2 metal is most likely to be **X**. (1)

(f) Suggest why less gas is collected than expected. You should assume that the reaction is complete and no gas escapes. (1)

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(g) What would be observed when a flame test is carried out on  $XCO_3$ ? (1)

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(h) A student attempted to determine the molar mass of other carbonates of Group 2 by the method used in this question.

The student measured the volume of gas produced by each carbonate, but replaced hydrochloric acid with sulfuric acid.

Explain why the results of the student's experiments would give very inaccurate values for the molar mass of some carbonates of Group 2. (2)

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