Name:

Date:

C8 - Test 5

CHEMICAL ANALYSIS

Advanced

GCSE

CHEMISTRY

AQA - Combined Science

Mark

Grade

Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

Information

- The marks for the questions are shown in brackets

1. Some students investigated the compounds in a green lettuce leaf and a red cabbage leaf.

The students placed each leaf in boiling ethanol and then tested each leaf for starch.

(a) The boiling point of ethanol is 78 °C

Ethanol is flammable so should not be directly heated with a Bunsen burner.

Give **one** way ethanol can be boiled safely.

Do **not** refer to wearing goggles in your answer.

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_____

(1)

(b) Describe how the students could test the leaves for starch.

Give the result if starch is present.

Test _____

_____

Result _____

(2)

(c) The students used paper chromatography to investigate the coloured pigments in both types of leaf.

Explain how paper chromatography causes the different pigments to separate.

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(3)

Table 1 shows the students' results. The distance the solvent and each pigment moved was measured from the start line.

Table 1

	Green lettuce		Red cabbage	
	Distance moved in mm	R_f value	Distance moved in mm	R_f value
Solvent front	120	–	113	–
Yellow-green pigment	18	0.15	14	0.12
Bright green pigment	24	0.20	Not found	Not found
Yellow pigment	40	0.33	46	0.41
Orange pigment	120	1.00	113	1.00

Table 2 shows the known R_f value ranges of some pigments.

Table 2

Pigment	**R_f value**
Carotene	0.89 &minus 0.98
Pheophytin a	0.42 &minus 0.49
Pheophytin b	0.33 &minus 0.40
Chlorophyll a	0.24 &minus 0.30
Chlorophyll b	0.20 &minus 0.26
Xanthophyll	0.04 &minus 0.28

(d) One pigment was found in the green lettuce leaf, but was **not** found in the red cabbage leaf.

Describe why it is **not** possible to be certain what this pigment is.

Use the information in **Table 1** and **Table 2** to help you.

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_____

(1)

(e) The experiment was repeated and the solvent front travelled 140 mm from the start line.

Calculate the range of distances where the pigment carotene would be seen.

Use the equation for calculating R_f values and the information in **Table 2** to help you.

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From _____ mm to _____ mm

(5)

(f) Different coloured pigments absorb light at different wavelengths.

Explain how plants could have evolved to contain more than one pigment in their leaves.

(6)

(Total 18 marks)

2. Limestone is used as a building material. Acid rain erodes limestone.

(a) Limestone contains calcium carbonate.
The symbol equation for the reaction of calcium carbonate with hydrochloric acid is shown.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

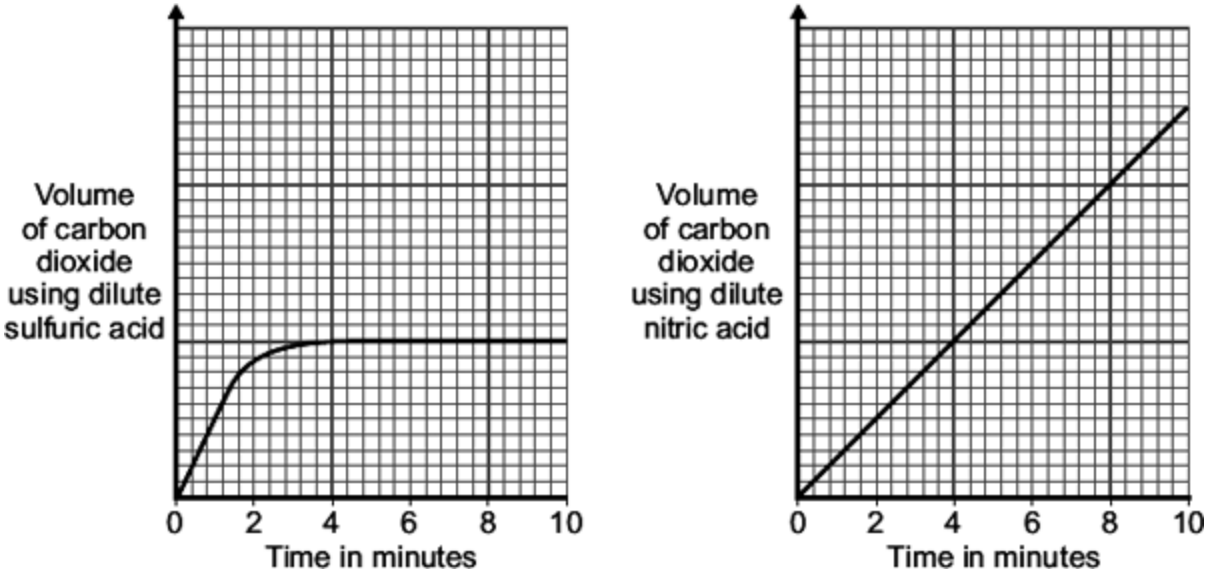
Describe a test to show that carbon dioxide is produced in this reaction.

Give the result of the test.

(2)

(b) Gases from vehicle exhausts produce sulfuric acid and nitric acid.

A student investigated the reaction of these two acids with calcium carbonate (limestone).
The type of acid was changed but all other variables were kept the same.
The student measured the volume of carbon dioxide produced each minute for a total of 10 minutes. He did this first for the reaction between dilute sulfuric acid and a cube of calcium carbonate (limestone).
The student repeated the experiment using dilute nitric acid in place of the dilute sulfuric acid.
The results are shown below.



(i) State **two** variables that must be kept the same for this investigation.

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(2)

(i) Reacting calcium carbonate with sulfuric acid gave different results to nitric acid.

The symbol equations for the reaction of calcium carbonate with sulfuric acid and with nitric acid are shown below.

$CaCO_3(s) + H_2SO_4(aq) \rightarrow CaSO_4(s) + H_2O(l) + CO_2(g)$

$CaCO_3(s) + 2HNO_3(aq) \rightarrow Ca(NO_3)_2(aq) + H_2O(l) + CO_2(g)$

Describe how the results for sulfuric acid are different **and** use the symbol equations to explain this difference.

(3)

(Total 7 marks)