TAYLOR'S
COLLEGE

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Class	Student Number	Name

CAMBRIDGE A LEVEL PROGRAMME

A2 TRIAL EXAMINATION AUGUST/SEPTEMBER 2010

(June 2009 Intakes)

Friday **3 September 2010** **8.30 am – 9.45 am**

CHEMISTRY 9701/53

PAPER 5 Planning, analysis and evaluation 1 hour 15 minutes

Candidates answer on the Question Paper

READ THESE INSTRUCTIONS FIRST

Write your name, class and student number in the spaces at the top of this page.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples , paper clips , highlighters, glue or correction fluid.

Answer **all** questions.
You are advised to show all working in calculations
Use of a Data Booklet is unnecessary.

At the end of the examination , fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **8** printed pages

[Turn over

1. The concentration of a solution of sodium ethanedioate ($Na_2C_2O_4$) can be determined by titration with aqueous potassium manganate (VII) in the presence of dilute sulphuric acid. The reaction mixture in the flask should be heated to 60 °C, otherwise the reaction is slow. The half-equations for the reaction are given below.

$$C_2O_4^{2-} \rightarrow 2CO_2 + 2e^-$$

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$

Sodium ethanedioate is available commercially as an aqueous solution containing approximately 35 g dm^{-3} of sodium ethanedioate. This solution is too concentrated for use in a titration, and must be diluted before use. Sodium ethanedioate solution is toxic, and potassium manganate (VII) is a powerful oxidizing agent.

Questions

You are provided with a 0.0200 mol dm^{-3} solution of potassium manganate (VII). Describe an experiment you could perform to determine the exact concentration of a solution containing approximately 35 g dm^{-3} of sodium ethanedioate.

Your answer must include:

- A balanced equation for the reaction between ethanedioate ions and potassium manganate (VII) in the presence of dilute sulphuric acid.
- A calculation of the approximate concentration, in mol dm^{-3}, of the sodium ethanedioate solution provided.
- The list of apparatus needed to carry out this experiment.
- Essential practical details of how you would perform the titration. You do **not** need to describe the preparation of the diluted solution, but include a brief description of how you would heat the reaction mixture in the flask to 60 °C.
- An explanation of how you would use your results to calculate the exact concentration of the **original** sodium ethanedioate solution provided.
  (A 25 cm^3 portion of this diluted solution should give a titre of about 25 cm^3 of 0.0200 mol dm^{-3} potassium manganate (VII) solution. The solution is diluted to 5 times for a 25 cm^3 titre.)
- Details of the potential hazards and the relevant safety precautions.

[Turn over

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[15]

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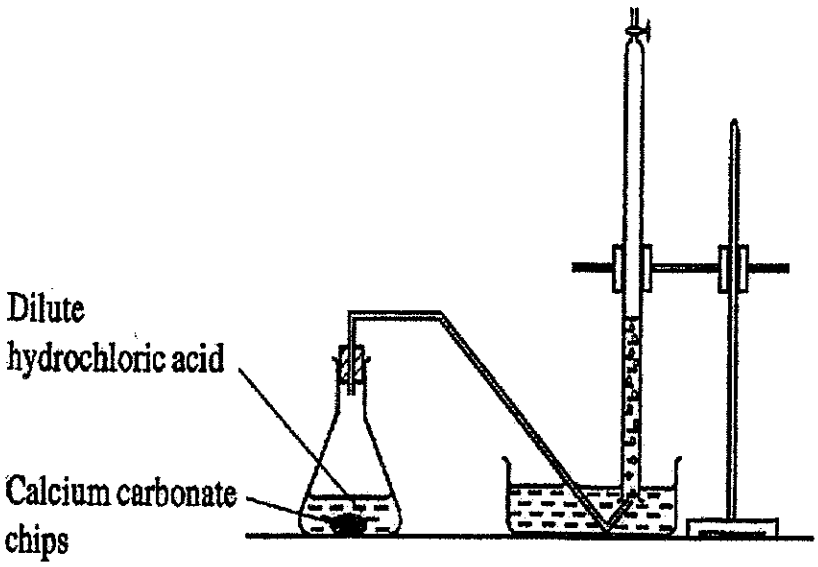
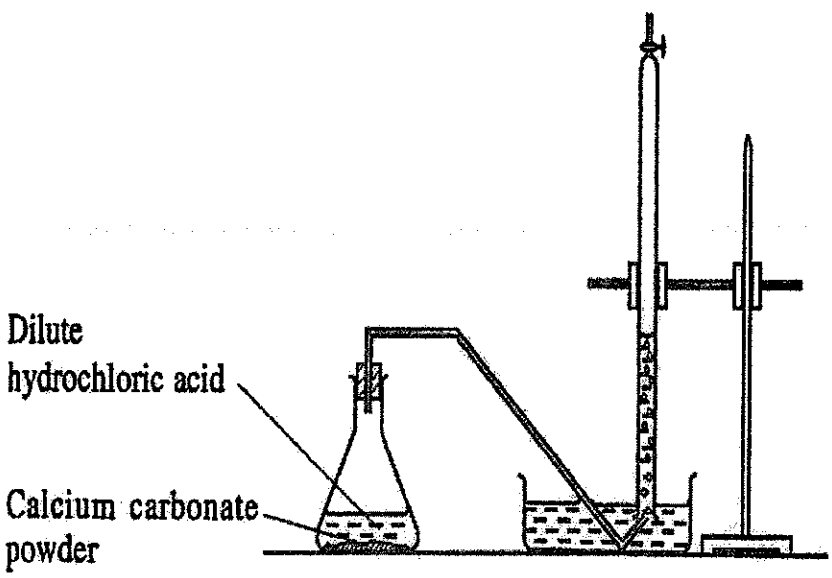
2. The diagrams below show two experiments to investigate one factor that affect the rate of a reaction.

Experiment I



Experiment II



The reaction in the experiments is represented by the following equation:

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

a) What is the factor that influences the rate of reaction in both experiments?

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..... [1]

b) State **two** controlled variables in both experiments.

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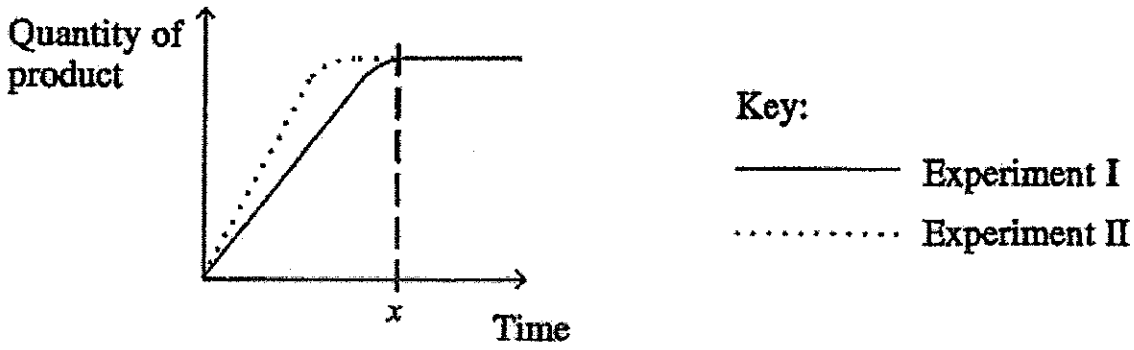
..... [2]

The results for both experiments are represented by the following graph.



c) Based on the above graph, which experiment has a higher rate of reaction?
Explain how does the graph show this?

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d) What has happened to the reactants at the time *x*?
Why are both curves at the same level after time *x*?

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..... [2]

e) What is the conclusion for both experiments?

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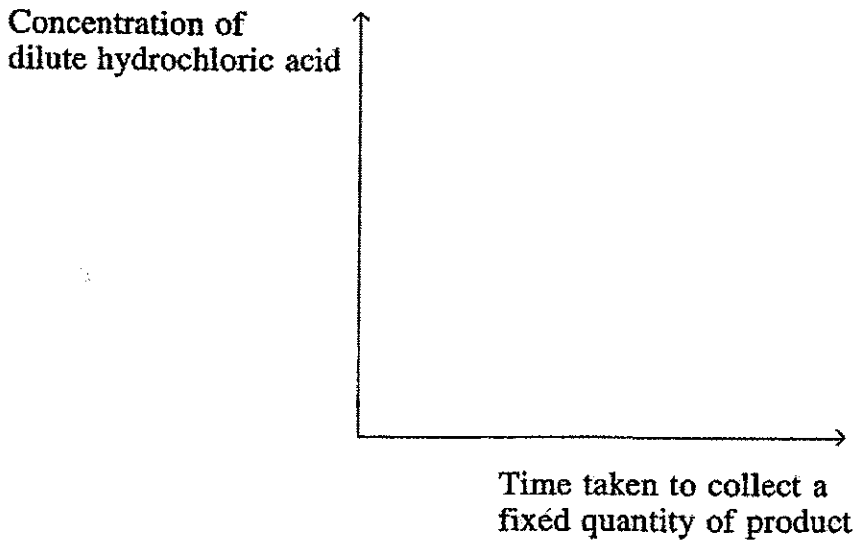
f) Another experiment is carried out using excess calcium carbonate powder and dilute hydrochloric acid with different concentrations.

Sketch the curve of concentration of dilute hydrochloric acid against the time taken to collect a fixed quantity of the product.



[1]

g) For the both experiments, suggest **one** major source of error and describe a method of reducing this error.

Major source of error

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Method for reducing this error

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.... [2]

ASSESSMENT OF PLANNING SKILLS

Copper carbonate decomposes on strong heating,
$CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$

Copper carbonate reacts with hydrochloric acid,
$CuCO_3(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + CO_2(g) + H_2O(l)$

Carbon dioxide, CO_2, is an acidic oxide.
Copper oxide, CuO, is a basic oxide.

Malachite is a rock containing a high percentage of copper carbonate.
You are to plan an experiment to determine the % of copper carbonate in a specimen of malachite.
In your plan you may use any equipment normally found in a school laboratory.

You may assume that any other material present in the malachite is unaffected by heating and is neither acidic nor basic.

In your plan you must include masses, volumes, concentrations of materials used as appropriate.

You will need to use some or all of the following information.
[Cu, 63.5; C, 12.0; O, 16.0]
1 mole of any gas occupies a volume of approximately 24.0 dm^3 at room temperature and pressure.

Plan

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[4]
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