TAYLOR'S UNIVERSITY COLLEGE
Wisdom Integrity Excellence

Class	Student Number	Name

CAMBRIDGE A LEVEL PROGRAMME

A2 TRIAL EXAMINATION AUGUST/SEPTEMBER 2009

(June 2008 Intake)

Friday **11 September 2009** **8.30 am – 9.45 am**

CHEMISTRY 9701/52

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 **9** printed pages

[Turn over

1. Hydrogen peroxide is sold commercially as an aqueous solution. Hydrogen peroxide solution decomposes slowly under normal conditions. A student was asked to carry out an experiment to find the concentration of a given aqueous solution.

   The concentration of a solution of hydrogen peroxide can be determined by titration with a solution of potassium manganate (VII) in the presence of dilute sulphuric acid. Half-equations for the redox reactions occurring are given below.

   $$H_2O_2 \rightarrow O_2 + 2H^+ + 2e^-$$

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

   The student diluted the commercial hydrogen peroxide by transferring a 25.0 cm^3 sample to a 250 cm^3 volumetric flask using a pipette. The sample in the flask was made up to the mark with deionised water and shaken well to ensure complete mixing.

   A 25.0 cm^3 portion of the diluted hydrogen peroxide solution was transferred to a conical flask using a pipette. This solution was acidified with dilute sulphuric acid and titrated with a 0.0200 $moldm^{-3}$ solution of potassium manganate (VII). The titration was repeated three times and the results are shown in the table.

Titration number	1	2	3	4
Final burette reading / cm^3	28.10	46.10	27.90	48.75
Initial burette reading / cm^3	0.00	18.20	0.05	20.90
Titre / cm^3				

(a) Deduce an overall equation for the reaction between hydrogen peroxide and manganate (VII) ions in the presence of dilute sulphuric acid.

.....

[1]

(b) State the colour change that occurs at the end point.

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[1]

(c) Identify all the consistent results in the table and use these to determine the mean titre.

[1]

(d) Use your answers from parts (a) and (b) to calculate the number of moles of hydrogen peroxide in 25.0 cm^3 of the diluted solution.

[2]

(e) Use your answer from part (c) to calculate the concentration of hydrogen peroxide in the undiluted commercial solution.
(If you could not complete the calculation in part (c), you should assume a value of 1.45×10^{-3} mol. This is not the correct value).

[2]

(f) Use your answer from part (d) to calculate the concentration, in g dm^{-3}, of hydrogen peroxide in the undiluted commercial solution.
[Ar : H, 1.0; O, 16.0]

[1]

[Turn Over

(g) Assume that the maximum errors for the apparatus used in this experiment were

Volumetric flask	$\pm$ 1 cm^3
Pipette	$\pm$ 0.1 cm^3 (from dilution and titration)
Burette total error	$\pm$ 0.15 cm^3 (from two readings and an end point error)

Calculate the maximum percentage error in using each piece of apparatus and hence the maximum overall apparatus error. Use the mean titre to calculate the error in using the burette.

[2]

(h) Comment on the consistency of the titration results given in the table on page 2.

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[2]

(i) According to the supplier, the commercial solution of hydrogen peroxide had concentration of 0.815 $moldm^{-3}$. Apart from the apparatus error, suggest **two** reasons why the student's value is **lower** than the supplier's value. Assume that the supplier's figure is correct.

Reason 1 .....

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Reason 2 .....

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[2]

[Total : 14]

2. Group II carbonates are white solids which are decomposed by heat. In the equation below Q represents the symbol of any Group II element from Magnesium to Strontium.

$$QCO_3\,(s) \xrightarrow[\Delta]{} QO\,(s) + CO_2(g)$$

You are required to plan an experiment, which makes use of this decomposition, to find the relative atomic mass of Q and hence identify the Group II element in the carbonates. The only apparatus and materials available are:

- a test tube and a test tube holder, Bunsen burner, matches and a heat proof mat.
- a specimen tube containing a suitable mass of group II carbonate;
- a balance.

You must include in your plan

(a) the procedure of the experiment;

[3]

(b) the measurements and results you would tabulate;

[3]

(c) calculations of how the results would be used to identify the Group II element, Q; [Ar : C, 12.0; O, 16.0]

[4]

(d) discussion of **two** possible errors;

[2]

(e) suggest **another** procedure which allows you to identify Q by measuring the volume of CO_2 evolved. Your answer should include a labeled diagram of the apparatus used and a brief description of the method.

[4]

[Total : 16]

[Turn Over

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