Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CHEMISTRY **5070/41**

Paper 4 Alternative to Practical **May/June 2018**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Write your answers in the spaces provided in the Question Paper.
Electronic calculators may be used.

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.

This document consists of **12** printed pages.

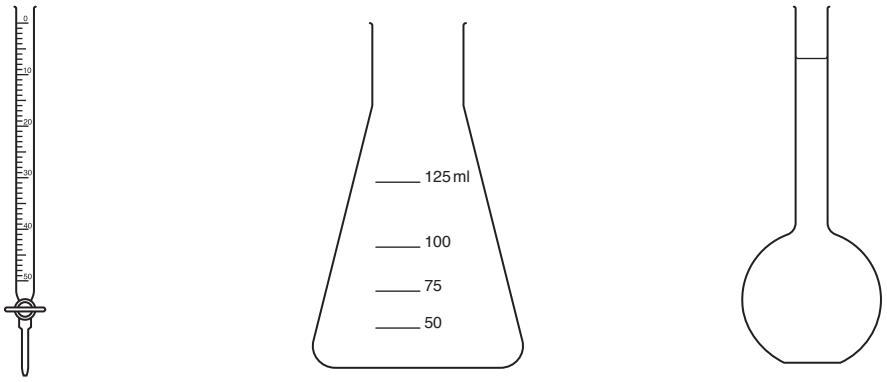
DC (LK/AR) 151301/3

CAMBRIDGE
International Examinations

[Turn over

1 A student does a series of titrations to determine the percentage of ethanoic acid in a sample of vinegar.

Diagrams of some of the apparatus used by the student are shown.



A **B** **C**

(a) Name the three pieces of apparatus.

A .....

B .....

C .....

[3]

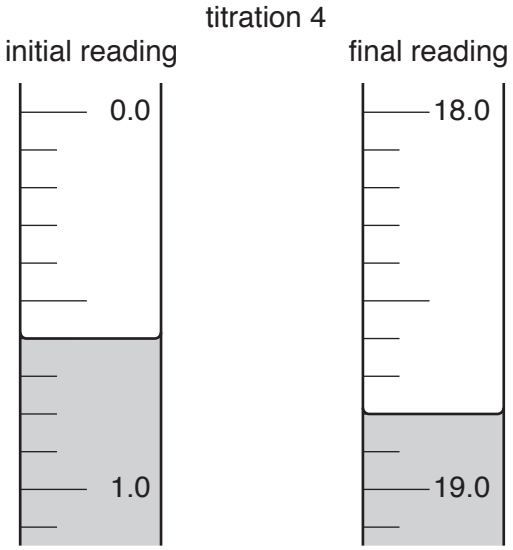
(b) The student measures 5.0 cm^3 of the vinegar into apparatus **C** and makes it up to 250 cm^3 with distilled water.

Apparatus **A** is filled with 0.0250 mol/dm^3 sodium hydroxide.

For each titration, 25 cm^3 of the diluted vinegar is transferred into apparatus **B**, using a measuring cylinder. A few drops of methyl orange indicator are added.

(i) The diagram shows parts of apparatus **A** with the liquid levels at the beginning and end of titration 4.

Record these values in the results table. Calculate and record the volume of 0.0250 mol / dm^3 sodium hydroxide used.



titration number	1	2	3	4
final reading / cm^3	19.0	36.4	19.1	
initial reading / cm^3	0.0	18.4	0.4	
volume of 0.0250 mol/dm^3 sodium hydroxide used / cm^3		18.0		
best titration results (✓)				

[2]

(ii) Complete the results table by calculating the volume of 0.0250 mol / dm^3 sodium hydroxide used for each of titrations 1 and 3. [1]

(iii) In the results table, tick (✓) the best titration results and use them to calculate the average titre.

average titre ..... cm^3 [1]

(iv) Suggest an improvement that the student can make to the method to make the results more accurate. Explain your answer.

.....

.....

.....

.....[2]

(c) A second student does another series of titrations using the same solutions. This stude... obtains an average titre of 18.4 cm^3.

The equation for the reaction that takes place during the titration is shown.

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

(i) Calculate the number of moles of 0.0250 mol/dm^3 sodium hydroxide used.

..... moles [1]

(ii) Calculate the number of moles of ethanoic acid present in the 25 cm^3 of diluted vinegar solution transferred into apparatus **B** for each titration.

..... moles [1]

(iii) The diluted vinegar solution is made by making the original 5.0 cm^3 of vinegar up to 250 cm^3 with distilled water.

Calculate the number of moles of ethanoic acid in the original 5.0 cm^3 sample of vinegar.

..... moles [1]

(iv) Calculate the concentration, in mol/dm^3, of ethanoic acid in the original sample of vinegar.

concentration ..... mol/dm^3 [1]

[Total: 13]

2 Solid **L** is a mixture of two compounds. The compounds contain the same positive ion but different negative ions.

The table shows the tests a student does on **L**.

Complete the table by adding the observations for each of tests **(a)** and **(c)** and the conclusion for test **(b)**.

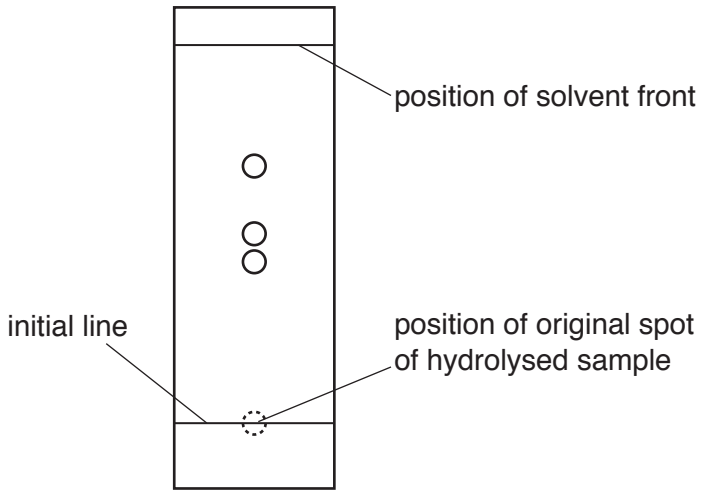
Any gases formed should be named and identified by a suitable test and observation.

test	observations	conclusions	
(a) To a portion of **L** in a boiling tube, dilute hydrochloric acid is added until all the solid has dissolved. The resulting solution is used in tests **(b)** and **(c)**.		**L** contains CO_3^{2-} ions.	[2]
(b) To a portion of the solution from **(a)** in a test-tube, dilute nitric acid is added, followed by aqueous barium nitrate.	A white precipitate is formed.		[1]
(c)(i) To a portion of the solution from **(a)** in a test-tube, aqueous ammonia is added until a change is seen. **(ii)** An excess of aqueous ammonia is added to the mixture from **(i)**.		**L** contains Cu^{2+} ions.	[3]

[Total: 6]

3 A molecule contains four amino acid units. These amino acid units are linked in the same way as in a protein.

A sample of this molecule is hydrolysed. The resulting colourless solution is spotted onto chromatography paper. The paper is placed into a suitable solvent. A diagram of the final chromatogram is shown.



(a) Suggest why the initial line is drawn in pencil and not ink.

.....

.....[1]

(b) Draw a line on the diagram of the chromatogram to show the depth of solvent into which the paper is placed. [1]

(c) Suggest how the chromatogram needs to be treated to make the spots visible.

.....

.....[1]

(d) What effect does hydrolysis have on the sample of the molecule?

.....

.....[1]

(e) Suggest a reason why only three spots are detected on the final chromatogram.

.....

.....[1]

(f) The R_f values of some amino acids, in the solvent used for this experiment, are shown.

amino acid	R_f value
alanine	0.38
leucine	0.73
phenylalanine	0.68
arginine	0.20
valine	0.61

(i) State how an R_f value is calculated.

.....

.....

.....[2]

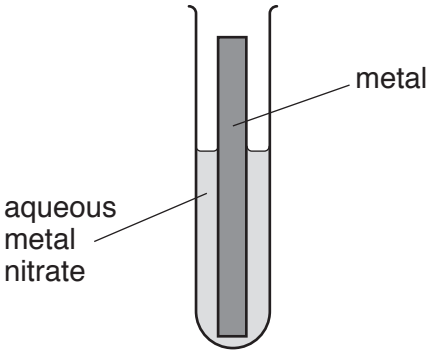
(ii) State which one of the amino acids, listed in the table, is present on the chromatogram.

Your answer should include measurements from the diagram and a calculation to justify your decision.

.....[2]

[Total: 9]

4 A student investigates the order of reactivity of four metals by placing samples of each metal in aqueous solutions of the metal nitrates as shown.



A results table is shown in which 'yes' indicates that a reaction took place and 'no' indicates there was no reaction.

metal	aqueous copper(II) nitrate	aqueous tin(II) nitrate	aqueous magnesium nitrate	aqueous zinc nitrate
copper		no	no	no
tin	yes		no	no
magnesium	yes	yes		yes
zinc	yes	yes	no	

(a) Describe what the student observes when zinc is placed into aqueous copper(II) nitrate.

.....

.....

.....

.....[2]

(b) **(i)** Use the experimental results to deduce the order of reactivity of these four metals.

..... most reactive

.....

.....

..... least reactive [1]

(ii) Explain how the results support this order of reactivity.

.....

.....

.....

.....[2]

(c) The order of reactivity of these four metals can also be found by measuring the temperature change when each metal reacts with dilute hydrochloric acid.

Describe how you would do this experiment.

Your description should include:

- the measurements you need to take
- the variables you need to keep constant
- an explanation of how the order of reactivity can be deduced from your results.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

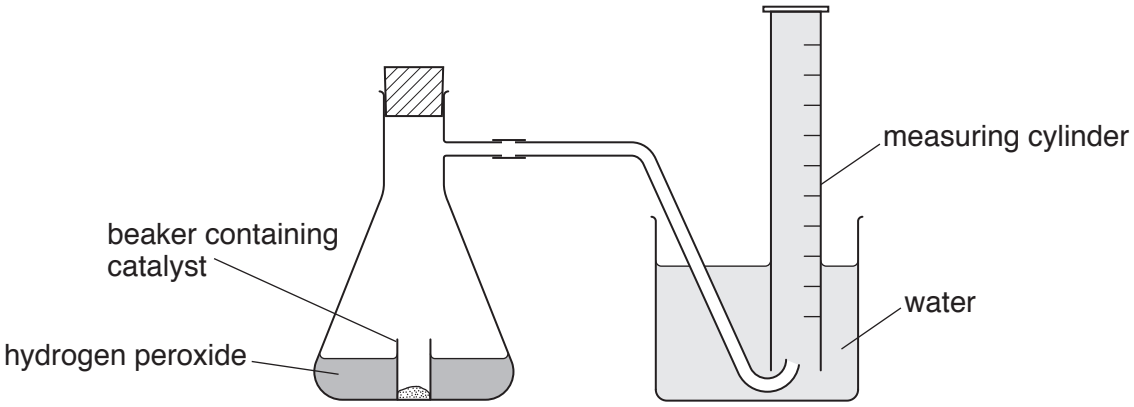
.....

.....[5]

[Total: 10]

5 In the presence of a catalyst, hydrogen peroxide, H_2O_2, decomposes into water and oxygen.

A student uses the apparatus shown to investigate the rate of decomposition of samples of hydrogen peroxide at two different temperatures.



The experiment starts when the flask is tipped so that the catalyst comes into contact with the hydrogen peroxide.

(a) The oxygen gas is collected in the measuring cylinder.

(i) What property of oxygen gas allows it to be collected by this method?

.....[1]

(ii) Name an alternative piece of apparatus that could be used to collect and measure the volume of oxygen gas.

.....[1]

(iii) Give a test and observation to identify oxygen.

test .....

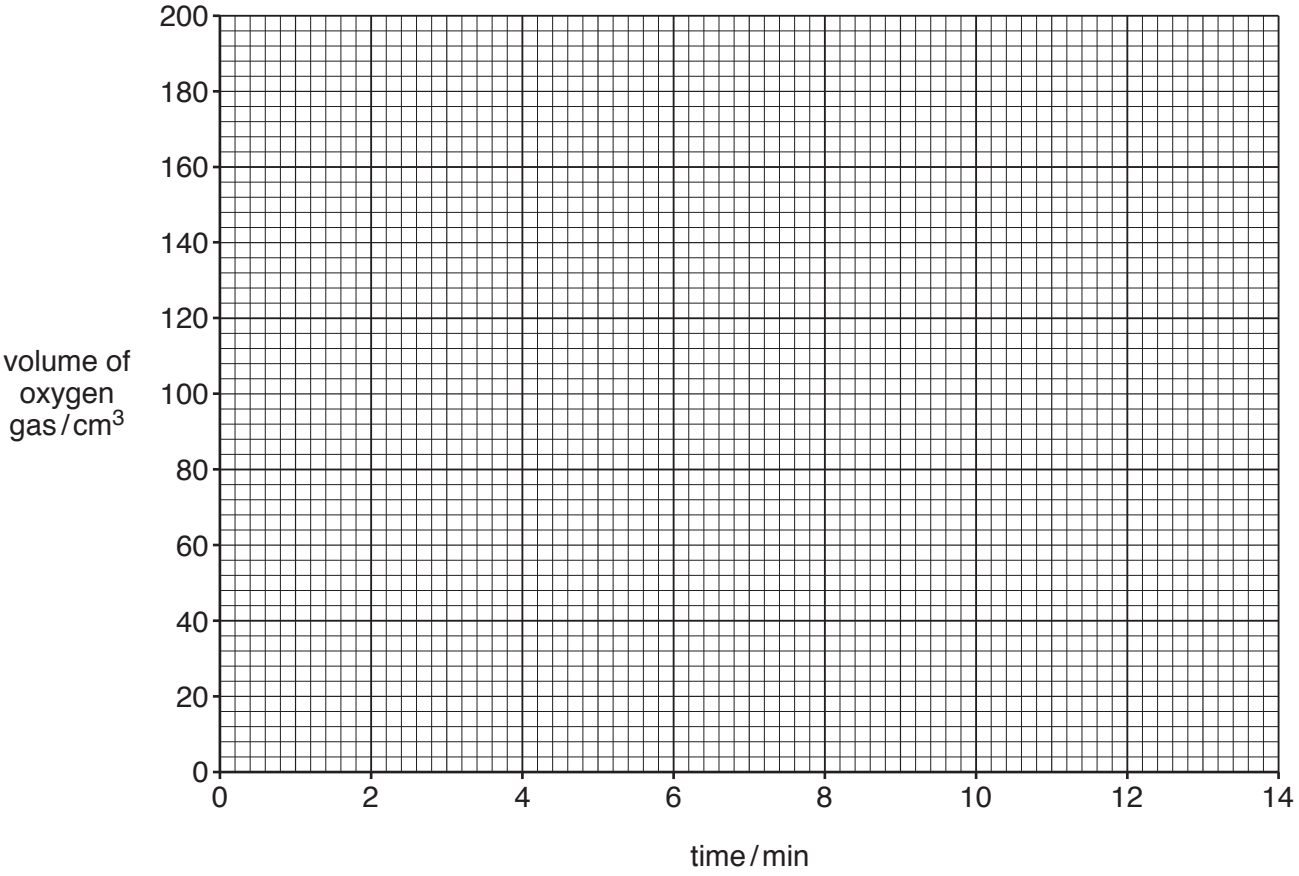
observation.....

[2]

(b) The results obtained for the first experiment, at 25 °C, are shown.

time / min	0	2	4	6	8	10	12	14
volume of oxygen gas / cm^3	0	40	50	91	97	99	100	100

(i) Plot the results on the grid.



[2]

(ii) Draw a circle around the anomalous point on the graph. [1]

(iii) Use the points to draw a curve of best fit. [1]

(iv) The student repeats the experiment at 50 °C. All other variables are kept constant.

Draw a second curve on the grid to represent the results that are obtained at this higher temperature.

Explain your answer.

.....

.....

.....

.....

[4]

[Total: 12]

6 Mixtures can be separated in various ways depending on the physical properties of the... components.

A student is supplied with two different mixtures. The first is a mixture of two solids, sodium chloride and sand. The second is a mixture of two liquids, ethanol and butanol.

For each mixture, describe a method to obtain a pure sample of each substance in the mixture. In your description you should include the names of any techniques and apparatus used.

(a) solid sodium chloride and sand

.....

.....

.....

.....

.....

.....

.....

.....[5]

(b) ethanol and butanol

.....

.....

.....

.....

.....

.....

.....

.....[5]

[Total: 10]