Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.										/			Signature	

Paper Reference(s)

4335/03 4437/08

Examiner's use only

Team Leader's use only

London Examinations IGCSE

Chemistry – 4335

Paper 3

Science (Double Award) – 4437

Paper 8

Foundation and Higher Tiers

Friday 28 May 2010 – Morning

Time: 1 hour 15 minutes

Question Number	Leave Blank
1	
2	
3	
4	
Total	

Materials required for examination
Ruler, pencil and calculator

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname and initial(s) and your signature.
The paper reference is shown at the top of this page. Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Show all stages in any calculations and state the units. Calculators may be used.
Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (~~☒~~) and then mark your new answer with a cross (☒).

Information for Candidates

The total mark for this paper is 50. The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 4 questions in this question paper.
There are 16 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

Write your answers neatly and in good English.

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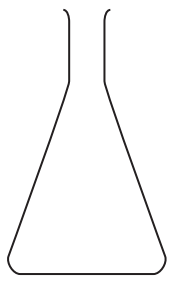
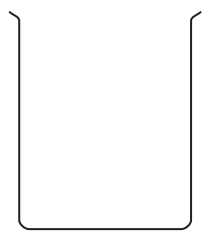
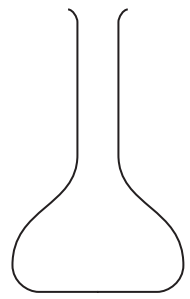
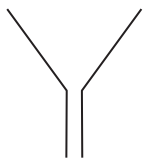
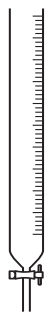
1. An oven cleaner contains the alkali sodium hydroxide.

(a) A solution of the oven cleaner in distilled water is titrated with hydrochloric acid. Some of the following pieces of apparatus are used in this experiment.

A 	**B** 	**C** 	**D** 
E 	**F** 	**G** 	**H** 

Choose from the letters **A** to **G** to identify the pieces of apparatus in the table below.

Name of apparatus	Letter
Beaker	
Burette	
Conical flask	
Funnel	
Pipette	

(5)

(b) It is important to wear eye protection when using an alkali.
What property of alkalis makes this safety precaution necessary?

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(1)

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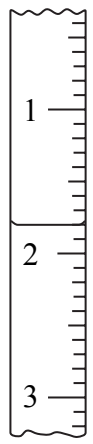
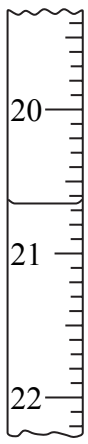
(c) The diagrams show the readings on the burette before and after a student added the hydrochloric acid in one titration.

before



after



Use the diagrams to help you complete the table.

Burette reading after adding acid (cm^3)	
Burette reading before adding acid (cm^3)	
Volume of acid added (cm^3)	

(3)

Turn over

Leave blank

(d) A second student did the titration four times.
The table shows the results.

Burette reading after adding acid (cm^3)	21.10	20.90	21.80	40.95
Burette reading before adding acid (cm^3)	0.30	0.80	1.45	20.50
Volume of acid added (cm^3)	20.80	20.10	20.35	20.45
Titration results to be used (✓)				

(i) Which titration results should be used to calculate the average volume of acid added? Place ticks (✓) in the table.

(1)

(ii) Use your ticked results to calculate the average volume of acid added.

(2)

Q1

(Total 12 marks)

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2. Zinc carbonate decomposes when heated to form zinc oxide and carbon dioxide.

$$ZnCO_3(s) \rightarrow ZnO(s) + CO_2(g)$$

A student investigated this reaction using the following method.

1. Weigh a clean dry crucible.
2. Add some zinc carbonate powder and reweigh the crucible and contents.
3. Heat the crucible and contents for five minutes.
4. Allow the crucible and contents to cool and then reweigh.
5. Repeat steps 3 and 4 until the mass of the crucible and contents is unchanged.

The student did the experiment four times, starting with different masses of zinc carbonate, and recorded her results in a table.

	Mass in grams recorded in each experiment			
	1	**2**	**3**	**4**
Mass of empty crucible	19.3	20.1	20.4	19.8
Mass of crucible and zinc carbonate before heating	25.2	25.9	26.5	25.4
Mass of crucible and contents after heating for five minutes	24.8	24.1	24.9	23.4
Mass of crucible and contents after heating for a total of ten minutes	23.9	23.9	24.4	23.4
Mass of crucible and contents after heating for a total of fifteen minutes	23.5	23.9	24.4	23.4

(a) Why does the mass of the crucible and contents decrease during heating?

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(1)

Leave blank

(b) The reason for Step 5 in the method is to check whether the decomposition of zinc carbonate is complete.

(i) In which experiment was it not necessary to heat for a third period of five minutes? Explain your choice.

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(2)

(ii) In which experiment should the student have heated for a fourth period of five minutes? Explain your choice.

.....

.....

(2)

(c) Use the results from Experiment 3 in the table to calculate the following masses.

(i) The mass, in grams, of zinc carbonate used.

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.....

(1)

(ii) The mass, in grams, of zinc oxide obtained.

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(1)

(Total 7 marks)

Q2

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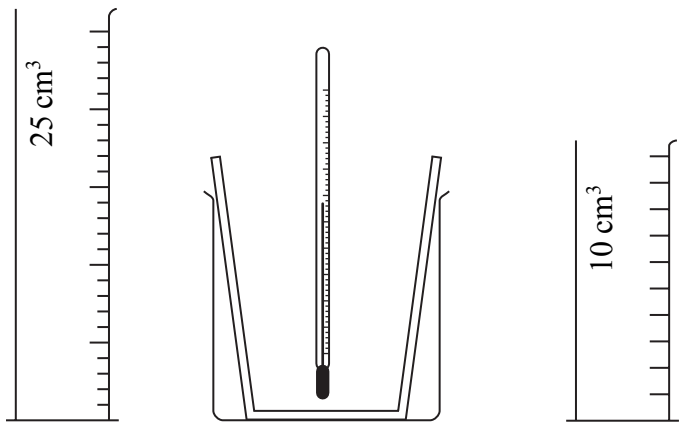
3. When aqueous sodium hydroxide is added to dilute nitric acid an exothermic reaction takes place.

The following apparatus is used in an experiment to measure the temperature increase.



A student used the following method.

- Using a measuring cylinder, add 25 cm^3 aqueous sodium hydroxide to the polystyrene cup and record the temperature.
- Using a different measuring cylinder, add 5 cm^3 dilute nitric acid to the cup and stir the mixture.
- Record the temperature of the mixture.
- Add a further 5 cm^3 dilute nitric acid, stir the mixture and record the temperature.
- Continue adding 5 cm^3 portions of dilute nitric acid until a total of 35 cm^3 has been added.

(a) Why is it better to mix the solutions in a polystyrene cup rather than in a glass beaker?

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(1)

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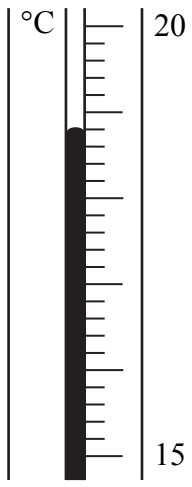
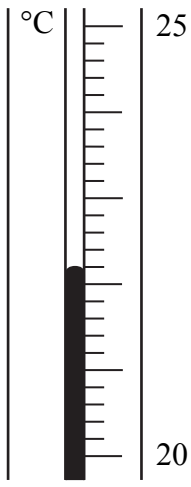
(b) These are the thermometer readings in one experiment before and after adding 5 cm^3 dilute nitric acid.

Temperature before adding acid



Temperature after adding acid



Write down the temperatures shown and work out the temperature increase.

Temperature before adding acid .....°C

Temperature after adding acid .....°C

Temperature increase .....°C

(3)

(c) The teacher suggested using a burette instead of a measuring cylinder to add the volumes of nitric acid because all of the acid needed can be placed in the burette at the start of the experiment.
Suggest one other advantage of using a burette.

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(1)

(d) A second student used the same method, but followed the teacher's suggestion and added the dilute nitric acid from a burette.

The table shows her results.

Volume of acid added (cm^3)	0	5	10	15	20	25	30	35
Temperature of mixture (°C)	18.0	20.8	23.5	24.2	29.0	28.6	27.6	26.5

The results show that the temperature increases at first, but then decreases.

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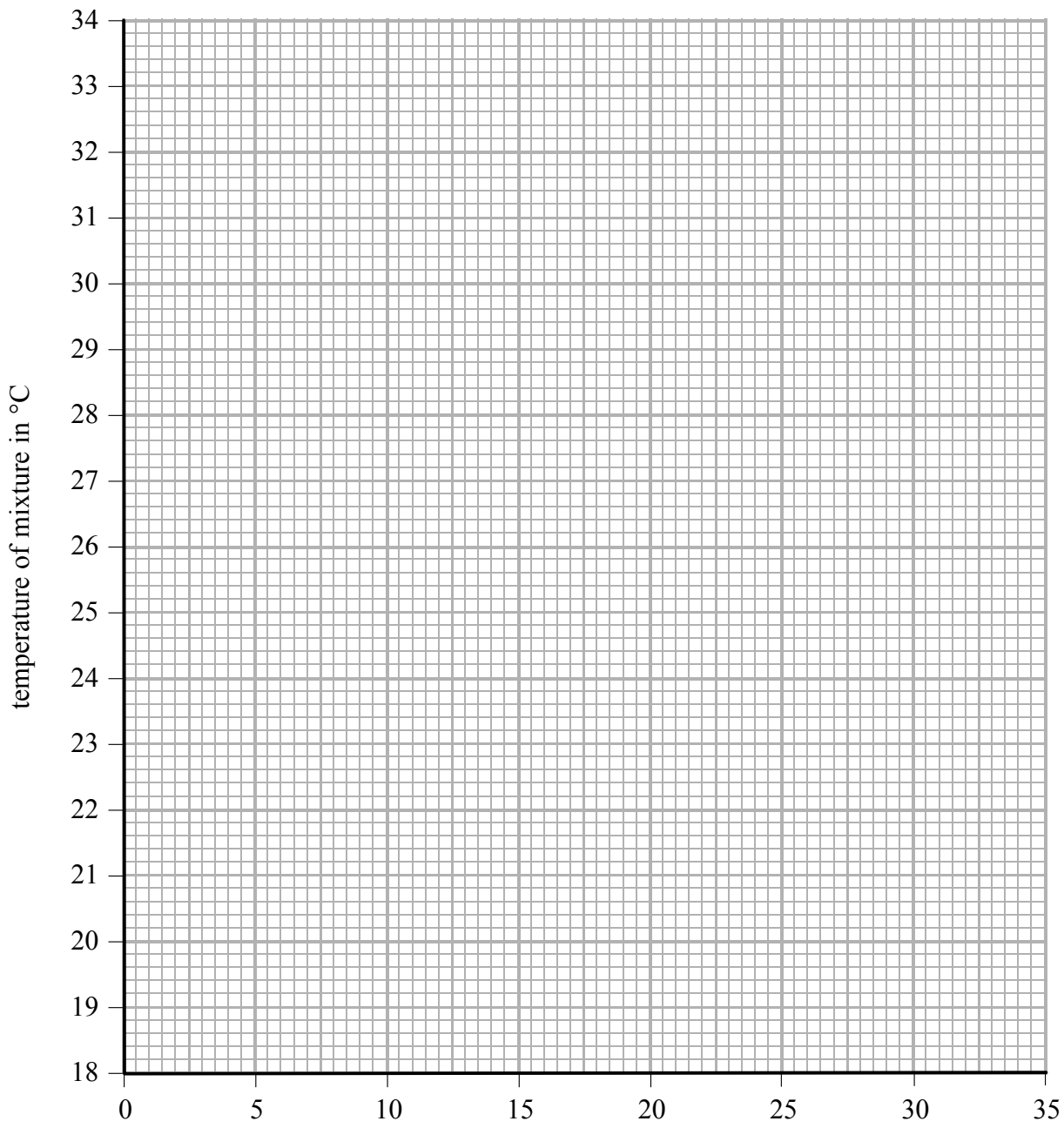
Plot these results on the grid.

Draw a straight line of best fit through the points that show a temperature increase up to 29.0 °C.
Draw a second straight line of best fit through the remaining points.
Make sure that the two lines cross each other.



(4)

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(e) The point where the lines cross indicates the maximum temperature reached during the experiment.

(i) What is the maximum temperature, in °C, reached during the experiment?

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(1)

(ii) What volume, in cm^3, of dilute nitric acid completely reacts with the 25 cm^3 of aqueous sodium hydroxide?

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(1)

(f) One of the results is anomalous. It shows a temperature lower than it should be. The teacher asked some other students to suggest a reason for this anomalous result. Here are their suggestions.

Student	Suggestion
A	More than 5 cm^3 of acid was added
B	The concentration of the acid was wrong
C	She added 5 cm^3 of aqueous sodium hydroxide instead of 5 cm^3 of dilute nitric acid
D	She did not stir the mixture
E	She waited too long before adding the 5 cm^3 of acid

(i) Circle on the graph the result that is anomalous.

(1)

(ii) Explain why Student A's suggestion is not correct.

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(1)

(iii) Explain why Student B's suggestion is not correct.

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(1)

Leave blank

(iv) Explain why Student C's suggestion is not correct.

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(1)

(v) Explain why Student D's suggestion might be correct.

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(1)

(vi) State, with a reason, whether Student E's suggestion is correct or not.

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(1)

Leave blank

(g) A third student used the same method and recorded these results.

Volume of aqueous sodium hydroxide used = 25 cm^3

Starting temperature of aqueous sodium hydroxide = 18.5°C

Maximum temperature of mixture = 30°C

Volume of nitric acid used to give maximum temperature = 20 cm^3

The quantity of heat, in joules, produced in this experiment can be calculated using this equation:

heat produced = total volume of mixture × 4.2 × temperature increase

Calculate:

(i) the total volume, in cm^3, of the mixture

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(1)

(ii) the temperature increase in °C

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(1)

(iii) the heat produced

in joules .....

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in kilojoules .....

.....

(2)

Q3

(Total 21 marks)

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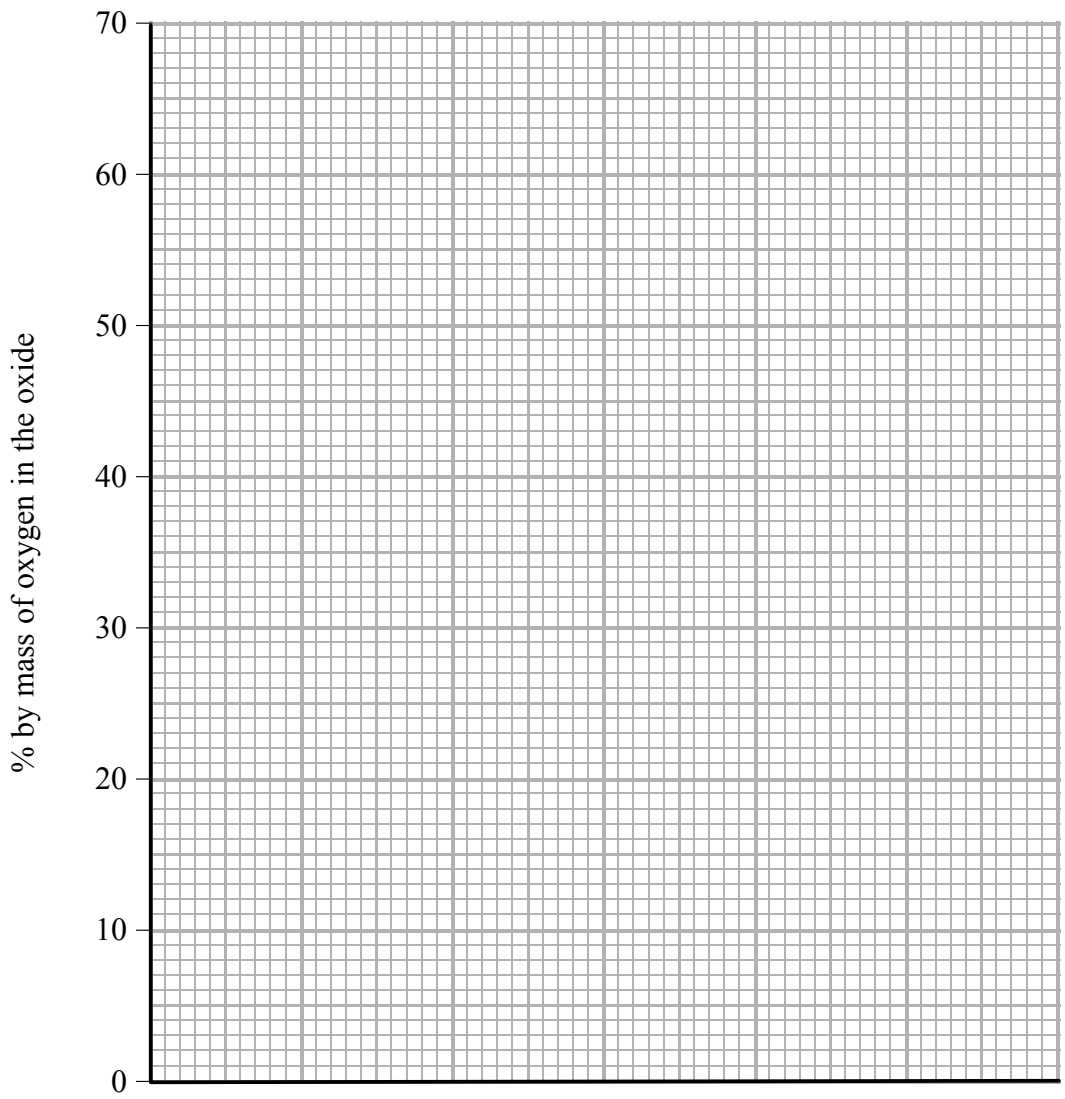
4. As part of his project on oxides, a student used information from the Periodic Table to calculate the percentage of oxygen by mass in the first five Group 2 metal oxides.
He presented his results in a table.

Formula of oxide	Relative formula mass	% by mass of oxygen
BeO	25	64
MgO	40	40
CaO	56	29
SrO	104	15
BaO	153	10

(a) Draw a bar chart to show the % by mass of oxygen for the five oxides.



(3)

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(b) The teacher asked the student some questions.
Suggest a suitable answer to each question.

(i) Why is a line graph of % by mass of oxygen against relative formula mass not a valid way to present the data?

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(1)

(ii) What is the relationship between the % by mass of oxygen in the oxide and the relative formula mass of the oxide?

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(1)

(c) The teacher told the student that he should have done some experimental work for this part of the project.
The teacher suggested that a suitable experiment to determine the % by mass of oxygen in an oxide would be the combustion of magnesium.

Outline the procedure, including measurements and calculations, that you could use to obtain a value for the % by mass of oxygen in magnesium oxide.

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(5)

Q4

(Total 10 marks)

TOTAL FOR PAPER: 50 MARKS

END