



GCSE Science Specimen Papers

Chemistry 4421

Additional Science 4463

ISA and marking guidelines

Revised Chemistry 2 – Rates of Reaction ISA C2/Specimen

Revised Specimen ISA C2 - Chemistry 2 – Rates of Reaction

This ISA relates to Unit C2: Additional Science (4463), and Chemistry (4421) section 12.4

Area of investigation

This work should be carried out during the teaching of the section relating to:

How can we control the rates of chemical reactions?

RISK ASSESSMENT

It is the responsibility of the centre to ensure that a risk assessment is carried out.

The Practical Work

For this part of the investigation candidates may work individually or in groups.

A suggested method is described below but centres may adapt this method to suit their own needs.

The teacher must always complete the ISA Explanation sheet. An ISA Explanation Sheet must be included with each piece of candidates' work that is sent to the moderator. Instructions of a general nature may be given to candidates, but these must not be so prescriptive as to preclude the candidates from making their own decisions.

Candidates should be given the opportunity to carry out an investigation into what factors affect the rate at which limestone reacts with acids. They may choose any independent variable to investigate and any method of doing so.

Candidates need to produce a table for the results and draw a graph or bar chart to show their results. They will need to have collected sufficient data to display in such a format.

(Refer to the Teachers' Guide for further clarification)

The Data Processing

For this part of the investigation candidates must work individually under direct supervision.

Each candidate should draw up his or her own table of results and should process the data in an appropriate way, e.g. charts, graphs, diagrams, line of best fit.

The candidates' work should be collected by the teacher at the end of this session and only returned to the candidates when they undertake the subsequent ISA test.

Candidates' work must **not** be annotated with additional information, either by the teacher or the candidate, which would give them an unfair advantage during the ISA - eg the use of the terms independent/dependent variable.

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature		Date	

Leave blank

General Certificate of Secondary Education
June 2XXX / June xxx



SCIENCE / CHEMISTRY ASCC/CHYC/C1/Specimen
ISA C2/Specimen Rates of Reaction

To be conducted before 4 May 2xxx
For submission in May 2xxx or May 2xxx or May 2xxx

For this paper you must have:

- results tables and charts or graphs from your own investigation.

You may use a calculator.

For Teacher's Use	
Section	Mark
1	
2	
Total (max 34)	

Time allowed: 45 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in **Section 1** and **Section 2**.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The maximum mark for this paper is 34.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

Did this candidate take part in the practical activity?	YES / NO
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Signature of teacher marking this ISA Date

SECTION 1

These questions are about the investigation that you carried out.

Answer all questions in the spaces provided.

1 What were you trying to find out in your experiment?

.....
.....

(2 marks)

2 Name **one** variable that you kept the same

.....
.....

(1 mark)

3 What name is given to variables that are kept the same during an experiment?

Tick the box beside your choice.

- Continuous variable
- Control variable
- Dependent variable
- Discrete variable

(1 mark)

4 Did you need to repeat any of your readings?

Draw a ring around your answer

Yes/No

Give the reason for your answer.

.....
.....

(1 mark)

5 (a) Write down **one** thing that you measured during your experiment.

.....
.....

(1 mark)

b) What piece of equipment did you choose to make this measurement?

.....
(1 mark)

(c) What else could you have used instead of the equipment that you chose?

.....
.....

(d) Was the equipment that you used better or worse than the alternative?

Draw a ring around the answer.

Better/ Worse

Write down the reason for your answer.

.....
.....

(1 mark)

6 Were there any **anomalous** results in your data?

Draw a ring around your answer

Yes/No

Use your results to explain your answer.

.....
.....
.....

(1 mark)

7 What did you find out from your experiment?

.....
.....
.....

(2 marks)

8 Make sure that your results tables, and charts or graphs are handed in with this paper.
You will be awarded up to 6 marks for these.

(6 marks)

Turn over ►

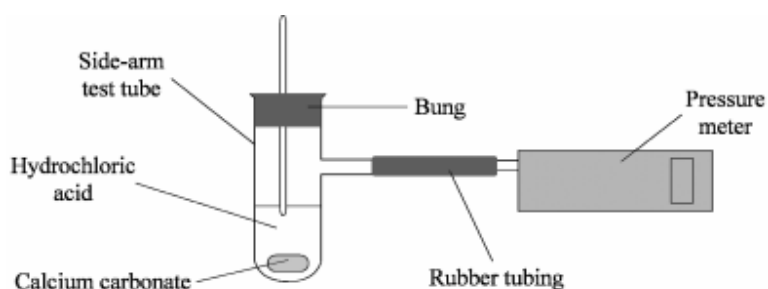
SECTION 2

These questions are about an investigation that may be similar to the one you did.

Answer **all** questions in the spaces provided.

These questions are about **Arpita's investigation** into the reaction between hydrochloric acid and calcium carbonate (limestone).

Arpita wanted to find out if the **rate** of reaction depended upon the **concentration** of the acid. She used 5 different concentrations of acid, and measured the maximum pressure of the carbon dioxide gas produced, using the apparatus shown below.



She made sure that she weighed out exactly the same mass of calcium carbonate for each experiment. She also monitored the temperature of the acid.

She then calculated the **rate** of gas pressure change

She repeated this procedure a further two times.

The results of her first set of tests are shown in the table below.

Table 1

Acid concentration	Rate (kPa/s) ⁻¹	Acid Temperature °C	
		Before	After
1st Test			
0.2M	0.05	28	30
0.4M	0.17	28	29
0.5M	0.20	27	29
0.6M	0.53	27	34
0.8M	0.34	27	28
1.0M	0.40	28	29

9 Write down one way in which Arpita made this a fair test.

.....

.....

(1 mark)

10 Arpita measured the temperature of the acid before and after the reaction.
Why did she do this?

.....
.....

(1 mark)

11 What sort of a variable was the acid concentration in this experiment?
Tick the box beside your choice.

- A categoric variable
- A continuous variable
- A dependent variable
- A discrete variable

(1 mark)

12 There appears to be an anomalous result in Arpita's table.

(a) Put a circle around this result in **Table 1**.

(1 mark)

(b) Suggest **one** reason why this result was anomalous.

.....
.....

(1 mark)

(c) Do you think that this error was a **random** error or a **systematic** error?
Explain your answer.

I think it was a error because

(1 mark)

13 Arpita carried out the experiment 3 times for each concentration.
Why did she do this?

.....

(1 mark)

Turn over ►

14 Arpita calculated the mean of the three tests for each concentration.

(a) What should Arpita have done with the anomalous result when calculating the mean?

.....
(1 mark)

(b) Arpita calculated her means to 3 significant figures.

Do you think this was the right thing to do?

Tick the box beside your choice.

No, because her original results were only to 2 significant figures

No, because her calculator would have shown more significant figures

Yes, because averages are always shown to 3 significant figures

Yes, because she averaged 3 sets of results

(1 mark)

15 What would be the best way for Arpita to show her mean results graphically?

Tick the box beside your choice.

Bar chart

Line graph

Pie chart

Scatter graph

(1 mark)

16 Arpita decided to measure the pressure difference in her experiment.

What would be the advantage of repeating the experiment using a different method?

.....

.....
(1 mark)

17 After her experiment, Arpita says, “I now know for a fact that higher concentrations of all acids make limestone dissolve more quickly.”

Her friend Arpan says, “That is just your opinion. You can’t know that for a fact.”

Who do you think is right? Is Arpita’s statement a fact or an opinion?

*To gain full marks in this question you should write your ideas in good English.
Put them into a sensible order and use the correct scientific words.*

.....

.....

.....

.....

.....

.....

.....

(4 marks)

18 Many buildings are made of limestone (calcium carbonate).

How could results of experiments like Arpita’s be used to persuade governments to reduce the amount of industrial pollution released into the atmosphere?

.....

.....

(1 mark)

END OF QUESTIONS

GCSE Science - Investigative Skills Assignment - Marking Guidelines

Chemistry 2/Specimen – Rates of reaction

For use in May xxxx or May xxxx

Please mark in red ink, and use one tick for one mark. Each part of each question must show some red ink to indicate that it has been seen.

Subtotals for each part of each question should be written in the right-hand margin.

Enter the marks for **Section 1** and **Section 2** and the **total mark** on the front cover of the answer booklet.

The teacher must sign and date the front cover of the ISA.

The papers must be kept in a secure place and must **not** be returned to the candidates

Section 1			
Question	Answer	Additional guidance	Marks
1	Dependent variable correctly named	e.g. the rate of reaction/ volume of gas produced in a certain time	1 mark
	Independent variable correctly named	e.g. when the concentration of acid was changed/ when the temperature was changed	1 mark
2	Correct control variable, e.g. temperature, concentration		1 mark
3	Control variable		1 mark
4	e.g. no, because the pattern seemed consistent, or yes, because I obtained an anomalous result	No mark for yes or no, mark is for correct reason,	1 mark
5a	e.g. mass of calcium carbonate/ volume of acid/ temperature of solution		1 mark
5b	e.g. top pan balance/ measuring cylinder/ mercury-in-glass thermometer	Answer to this part must be consistent with answer to part (a)	1 mark
5c	Suitable alternative suggested, e.g. Spring balance/ beaker/ digital thermometer		1 mark
5d	Reason given, e.g. More precision/ accuracy		1 mark
6	Reason given, e.g. No, because all the results were very close to the line of best fit or e.g. Yes, because the result at X did not fit the pattern	(No mark for simply choosing Yes or No)	1 mark
7	Simple statement, e.g. the concentration/ temperature did affect the rate of reaction		1 mark
	Further detail, e.g. the higher the concentration/ temperature, the faster the rate of reaction		1 mark

8	<p>Table: Correct headings AND units all correct for all measured variables</p> <p>Graph:</p> <ul style="list-style-type: none"> • X axis: suitable scales chosen and labelled with quantity and units • Y axis: suitable scales chosen and labelled with quantity and units • Points or bars plotted correctly to within ± 1 mm • Suitable line drawn on graph or bars correctly labelled on bar chart 	<p>Table with incomplete headings or units for the measured variables = 1 mark e.g. all headings present = 1 e.g. all units present = 1</p> <p>Accept axes reversed</p> <p>It may not always be necessary to show the origin</p> <p>Scales should be such that the plots occupy at least one third of each axis</p> <p>Allow one plotting error out of each 5 points plotted</p> <p>Allow error carried forward from incorrect plots</p> <p>If wrong type of graph/chart, maximum 3 marks</p> <p>If the independent variable is:</p> <ul style="list-style-type: none"> • <i>continuous</i>, should draw a <i>best fit line graph</i> • <i>categoric</i>, should draw a <i>bar chart</i> • <i>discrete</i>, allow either a bar chart or a line graph 	<p>2 marks</p> <p>1 mark</p> <p>1 mark</p> <p>1 mark</p> <p>1 mark</p>
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SECTION 2			
9	Any valid, e.g. same mass of limestone		1 mark
10	Idea of monitoring a control variable		1 mark
11	A continuous variable		1 mark
12a	Result for 0.6M circled		1 mark
12b	Temperature had increased much more than the others		1 mark
12c	Random, because it is the only one that does not fit a pattern	(No mark for choosing random)	1 mark
13	Improves reliability of the mean	Accept: enables anomalous results to be seen	1 mark
14a	Discarded it/ repeated it		1 mark
14b	no, because her original results were only to 2 significant figures		1 mark
15	Line graph		1 mark
16	Idea of checking reliability		1 mark
17	Arpan is right. it is an opinion only one kind of acid tested cannot generalise from a single test Quality of written communication: correct use of any two technical terms, e.g. fact/opinion; generalise; evidence; conclusion, experiment, test, hypothesis		1 mark 1 mark 1 mark 1 mark
18	Idea that increased concentrations will speed up rate of erosion/decay of buildings		1 mark