GCSE Science Specimen Papers

ISA and marking guidelines

Revised Biology 1 – Fieldwork ISA B1/Specimen
Revised Chemistry 2 - Rates of Reaction ISA C2/Specimen
Revised Physics 3 - Transformers ISA P3/Specimen

Contents:

V 1.1

Revised Biology 1 - Fieldwork ISA B1/Specimen

This ISA relates to Unit B1 Science A(446X), Science B(446x) and Biology (44xx) sections 11.5 and 11.8

Area of investigation
This work should be carried out during the teaching of the section relating to:
What determines where particular species live and how many of them there are?
Or
How do humans affect the environment?

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 should 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.

Students must always carry out a fieldwork investigation related to the distribution of a particular species. They may investigate any factor that may possibly influence the distribution. For example, they might investigate the height of grasses at different distances from a footpath, or they might investigate the distribution of certain indicator plants and link this to the type or acidity of the soil.

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 - e.g. the use of the terms independent/dependent variable.

ISA Explanation Sheet

to accompany Each ISA
(You will need to fill in more than one of these sheets if different students have carried out different methods)

Centre Number						Date Practical Carried Out

ISA Code	**B1/Specimen**	ISA Title	**Fieldwork Investigation**

Name of Teacher	

Independent variable	**Shade or no shade**		Dependent variable	**Height of flowers**

Did you make any changes to the suggested Method?

YES / NO

If Yes - give details of any changes you made to the suggested method, the equipment, chemicals etc. for this investigation.

Method:
Measure the height of flowers in two different areas over a period of time

Any other Information:

Teacher Signature:

Please attach any experimental worksheet or outline used by the candidates to carry out the investigation if available.

Surname		Other Names	
Centre Number						Candidate Number				
Candidate Signature		Date	

Leave blank

General Certificate of Secondary Education
June 2XXX / June xxx

SCIENCE / BIOLOGY SCYC/BLYC/B1/Specimen
ISA B1/Specimen Fieldwork Investigation

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**

Signature of teacher marking this ISA ---------- Date ----------

LEAVE MARGIN BLANK

SECTION 1

These questions are about the investigation that you carried out on fieldwork

Answer all questions in the spaces provided.

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

.....

.....

(2 marks)

2 (a) Write down **one** thing that you measured during your investigation.

.....

.....

(1 mark)

(b) How did you make this measurement?

.....

.....

(1 mark)

3 Why was it necessary to take several measurements within each sample, rather than just one?

.....

.....

(1 mark)

4 How did you decide where to take your samples?

.....

.....

(1 mark)

LEAVE MARGIN BLANK

5 Write down **one** other factor that may have affected the outcome of your investigation.

.....

(1 mark)

6 Explain what you did to control or take account of this other factor.

.....

.....

(1 mark)

7 Were there any random errors in your results?

Draw a ring around your answer.

Yes / No

Use examples from your data to explain your answer.

.....

.....

.....

(2 marks)

8 What did you find out from your investigation?

.....

.....

.....

(2 marks)

9 Do you think that you have enough data to make a conclusion?

Draw a ring your answer.

Yes/No

Use your data to explain your answer

.....

.....

(1 mark)

10 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)

18

LEAVE MARGIN BLANK

SECTION 2

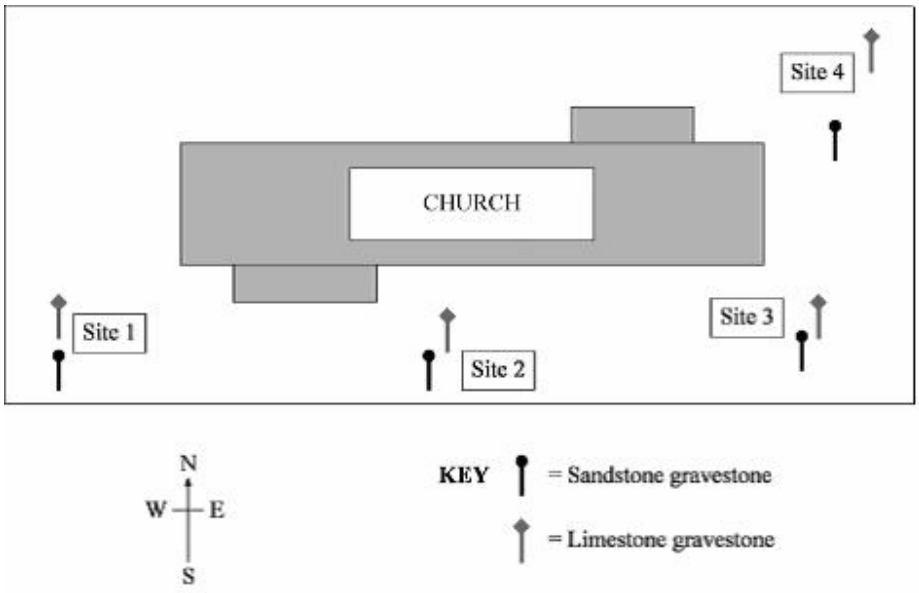
These questions are about an investigation that may be similar to the one you did.

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

These questions are about an investigation into the distribution of snails in a churchyard. It was carried out by Sally.

Read Sally's report, look at the tables of data and then answer the questions that follow.

"I wanted to find out whether snails in a churchyard are evenly distributed or not. In the churchyard there are two sorts of stone grave: limestone and sandstone. I predict that I shall find more snails around the limestone grave. This is because limestone is calcium carbonate and that is what the snails shells are made of.
I picked 4 pairs of stone graves. I tried to find a limestone and a sandstone one as close together as I could. I chose 4 different positions around the church. Here is a plan to show where they were."



Limestone number	Number of snails counted on each side				Total number
	East	West	North	South	
1	9	2	0	2	13
2	2	0	0	2	4
3	1	4	6	0	9
4	7	15	1	1	24
Totals	***19***	***21***	***7***	***5***	***52***
Mean number of snails per gravestone					***13***

Sandstone number	Number of snails counted on each side				Total number
	East	West	North	South	
1	5	3	0	0	8
2	2	1	0	3	6
3	0	4	6	0	10
4	3	4	4	1	12
Totals	***10***	***12***	***10***	***4***	***36***
Mean number of snails per gravestone					

11 Sally chose to investigate whether the type of stone grave affected the distribution of snails.

What kind of variable is the type of stone grave?

Tick the box beside your choice.

A categoric variable ☐

A control variable ☐

A dependent variable ☐

A discrete variable ☐

(1 mark)

12 Sally chose 4 pairs of stone graves.

Why was this better than just choosing one pair?

.....

(1 mark)

13 In each pair, Sally found a sandstone and a limestone grave that were as close together as possible.

Why was this a sensible thing to do?

.....

.....

(1 mark)

Turn over ▶

LEAVE MARGIN BLANK

14 Work out the mean number of snails per sandstone stone grave.
Write your answer in the box in the table.

(1 mark

15 Describe **one** pattern that you can see in the results.

.....

.....

.....

(2 marks)

16 It might have been easier to see any differences if Sally had presented her results graphically.

Describe one way of showing these results graphically. Explain whether you would use a bar chart or a line graph, and what you would plot on each axis.

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)

17 Is there any evidence to suggest that Sally's prediction is correct, and that snails do prefer limestone to sandstone?

Draw a ring around your answer.

Yes/No

Explain your answer.

.....

.....

(1 mark)

LEAVE MARGIN BLANK

18 Suggest **one** other factor that could be influencing the distribution of snails.

.....

.....

(1 mark)

19 Suggest **one** way in which Sally could improve the reliability of her results.

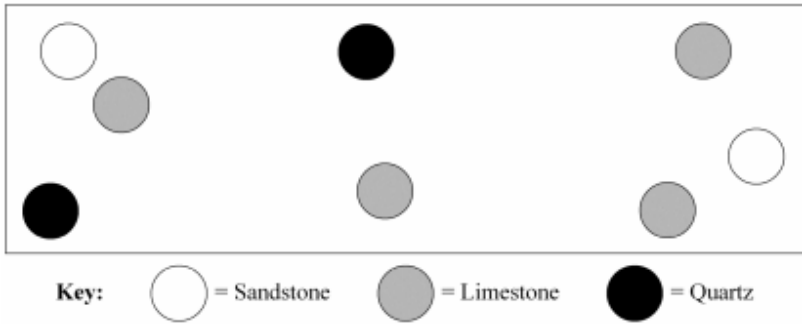
.....

.....

(1 mark)

After her field investigation, Sally carried out a test in the laboratory.
She put several pieces of rock into a large tray.
She then put 15 snails into the tray and recorded which piece of rock they went to.

Plan of tray with rocks:



Results:

Type of rock	Number of snails
Sandstone	4
Limestone	10
Quartz	1

20 What is the advantage of carrying out this second experiment?

.....

.....

(1 mark)

LEAVE MARGIN BLANK

21 Why did Sally put some samples of quartz rock into the tray?

Tick the box beside your choice.

To act as a control experiment ☐

To provide extra shelter for the snails ☐

To separate the limestone from the sandstone ☐

To find out whether snails liked quartz ☐

(1 mark)

22 Did Sally carry out a fair test in this second experiment?

Draw a ring around your choice.

Yes/No

Explain your answer.

.....

.....

(1 mark)

16

END OF QUESTIONS

GCSE Science - Investigative Skills Assignment - Marking Guidelines

Biology 1/Specimen – Fieldwork

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 Independent variable correctly named	e.g. the number of daisies growing e.g. at different distances from the footpath	1 mark 1 mark
2 (a) **2 (b)**	May be the dependent or independent variable	e.g. number of daisies, distance from footpath	1 mark
	Correct method of measurement	This will be dependent upon the answer to part (a), e.g. counting them, using a ruler	1 mark
3	Idea of allowing for random errors/ to be able to spot anomalous results/ to improve reliability		1 mark
4	Reason given for choice of sample sites		1 mark
5	Suitable factor given, e.g. soil/ amount of sunlight/ wet or dry conditions		1 mark
6	Suitable explanation, e.g. tried to make sure that this condition was the same in all test sites		1 mark
7	Suitable data quoted as an example, e.g. Yes, because the data at point X did not fit into the rest of the pattern/ there was quite a bit of scatter about the mean e.g. No, because all the data was very close to a best fit line	(No mark for simply choosing Yes or No)	1 mark

8	Simple statement, e.g. the number of daisies did vary with distance from the footpath Further detail, e.g. the further away from the footpath, the more daisies there were		1 mark 1 mark
9	Reason given, e.g. Yes, because I can see a clear pattern/ relationship between the variables or e.g. No, because I need more data at point X/ there are some anomalous results that need repeating	(No mark for simply choosing Yes or No)	1 mark
10	**Table:** Correct headings AND units all correct for all measured variables **Graph:** • 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 If the wrong type of graph/ bar chart is drawn, maximum = 3 marks	Table with incomplete headings or units for the measured variables = 1 mark e.g. all headings present = 1 e.g. all units present = 1 Accept axes reversed It may not always be necessary to show the origin Scales should be such that the plots occupy at least one third of each axis Allow **one** plotting error out of each 5 points plotted Allow error carried forward from incorrect plots If wrong type of graph/chart, maximum 3 marks If the independent variable is: *continuous* should draw a *best fit line graph* *categoric* should draw a *bar chart* *discrete* allow either a bar chart or a line graph	2 marks 1 mark 1 mark 1 mark 1 mark

SECTION 2			
11	A categoric variable		1 mark
12	One pair may not be typical/ idea of improved reliability		1 mark
13	So that other factors will be constant	Other factors may be named, e.g. shade/ soil type/ wetness	1 mark
14	9		1 mark
15	Any suitable pattern, e.g. snails seem to prefer west, east, north, south in that order	If simply states more snails on limestone than on sandstone, award 1 mark. Cannot really have a pattern when only 2	2 marks
16	bar chart number of snails on y axis type of stone/direction on x axis Quality of written communication - correct use of any two technical terms, eg dependent variable/ independent variable; continuous variable / categoric variable; axis.		1 mark 1 mark 1 mark 1 mark
17	Yes, more snails on limestone	(No mark for simply choosing Yes or No)	1 mark
18	eg sun/shade/moisture/type of vegetation/type of soil		1 mark
19	More repeats and calculate new mean		1 mark
20	Idea of checking with alternative data		1 mark
21	To act as a control experiment		1 mark
22	No. more limestone pieces than sandstone or quartz put in		1 mark

V 1.1

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**

Signature of teacher marking this ISA ---------- Date ----------

LEAVE MARGIN BLANK

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)

LEAVE MARGIN BLANK

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?

.....

.....

(1 mark)

(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 ▶

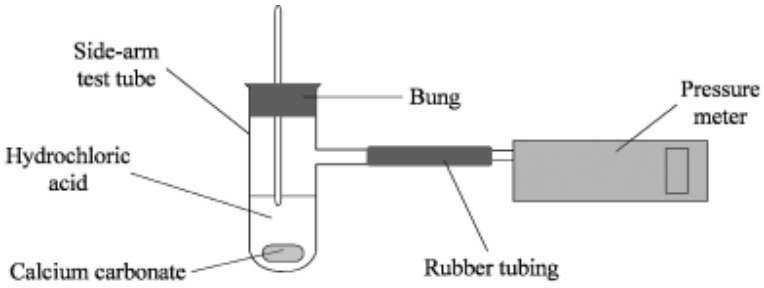
18

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)

LEAVE MARGIN BLANK

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 ▶

LEAVE MARGIN BLANK

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)

LEAVE MARGIN BLANK

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 Independent variable correctly named	e.g. the rate of reaction/ volume of gas produced in a certain time e.g. when the concentration of acid was changed/ when the temperature was changed	1 mark 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 **5d**	Suitable alternative suggested, e.g. Spring balance/ beaker/ digital thermometer		1 mark
	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 Further detail, e.g. the higher the concentration/ temperature, the faster the rate of reaction		1 mark 1 mark

8	**Table:** Correct headings AND units all correct for all measured variables **Graph:** • 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	Table with incomplete headings or units for the measured variables = 1 mark e.g. all headings present = 1 e.g. all units present = 1 Accept axes reversed It may not always be necessary to show the origin Scales should be such that the plots occupy at least one third of each axis Allow **one** plotting error out of each 5 points plotted Allow error carried forward from incorrect plots If wrong type of graph/chart, maximum 3 marks If the independent variable is: • *continuous,* should draw a *best fit line graph* • *categoric,* should draw a *bar chart* • *discrete,* allow either a bar chart or a line graph	2 marks 1 mark 1 mark 1 mark 1 mark

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

V 1.1

Revised Specimen ISA Physics 3 - Transformers

This ISA relates to: Unit P3 Physics (4451) section 13.9

Area of investigation
This work should be carried out during the teaching of the section relating to:
How do transformers work?

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 concerning transformers. They may use pre-wound, commercially available coils, or may wind their own coils. They may investigate any aspect of transformers, e.g. the link between the turns ratio and the ratio of the voltages, or the efficiency.

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 - e.g. the use of the terms independent/dependent variable.

ISA Explanation Sheet

to accompany Each ISA
(You will need to fill in more than one of these sheets if different students have carried out different methods)

Centre Number						Date Practical Carried Out	

ISA Code	**P3/Specimen**	ISA Title	**Transformers**

Name of Teacher	

Independent variable		Dependent variable	

Did you make any changes to the suggested Method?

YES / NO

Any other Information:

Teacher Signature:

Please attach any experimental worksheet or outline used by the candidates to carry out the investigation if available.

Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature		Date	

Leave blank

General Certificate of Secondary Education
June 2xxx / June 2xxx

PHYSICS **PHYC / P3.3**
ISA P3.3 Transformer

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**

Signature of teacher marking this ISA ---------- Date ----------

LEAVE MARGIN BLANK

SECTION 1

These questions are about the investigation that you carried out on transformers.

Answer all questions in the spaces provided.

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

.....

.....

.....

(2 marks)

2 In your investigation:

(a) Which was the **dependent** variable?

.....

(1 mark)

(b) What kind of a variable was this?

Draw a ring around the word that best describes your independent variable.

CATEGORIC CONTINUOUS DISCRETE ORDERED

(1 mark)

3 (a) What was the **range** of values that you chose for the independent variable?

The range was from..... .....to ....

(1 mark)

(b) Was this a sensible range to choose? **Yes/No**

Draw a ring around the answer.

Give a reason for your answer.

.....

.....

(1 mark)

(c) If you had more time, is there any section within that range where you would like to get more results?

Draw a ring around the answer.

Yes / No

Give a reason for your answer.

.....

.....

.....

(1 mark)

4 In your experiment you would have used at least one kind of meter (ammeter, voltmeter or ohmmeter).

(a) Was the **range** over which this instrument was capable of measuring suitable?

Yes / No

Draw a ring around the answer.

Give a reason for your answer.

.....

.....

(1 mark)

(b) Was the **sensitivity** of this instrument suitable?

Yes/No

Draw a ring around the answer.

Give a reason for your answer.

.....

.....

(1 mark)

5 Before you carried out your experiment, either you or your teacher would have carried out a preliminary test.

What was the reason for doing this?

.....

.....

(1 mark)

Turn over ▶

LEAVE MARGIN BLANK

6 What did you find out from your investigation?

....

....

....

(2 marks)

7 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)

18

SECTION 2

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

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

Kate is on work experience in the research department of a company that manufactures transformers.

The manufacturer is developing a new transformer for an audio speaker system.
Kate has to find out how the efficiency of the transformer varies when the *load* applied to the secondary coil is changed.

The *load* is the device connected to the secondary coil, e.g. a speaker. The value of the load is measured in ohms.

Here is a table of Kate's results. The efficiency has been multiplied by 100 to make it a percentage.

Load at secondary in Ω	Efficiency (%)
2	12.15
5	28.4
10	43.5
20	54.0
40	65.6
75	59.9
100	55.3
125	50.3
146	45.6
200	36.9
500	17.0

8 Complete the following sentence.

In this data set, the.....is the independent

variable and the .....is the dependent variable.

(1 mark)

9 Write down **one** variable that Kate should have controlled or monitored during the investigation.

.....

(1 mark)

Turn over ▶

10 Look at the first column in the table, headed **Load at secondary**.

(a) Describe the way in which the **interval** of these readings changes over the range.

.....

.....

(1 mark)

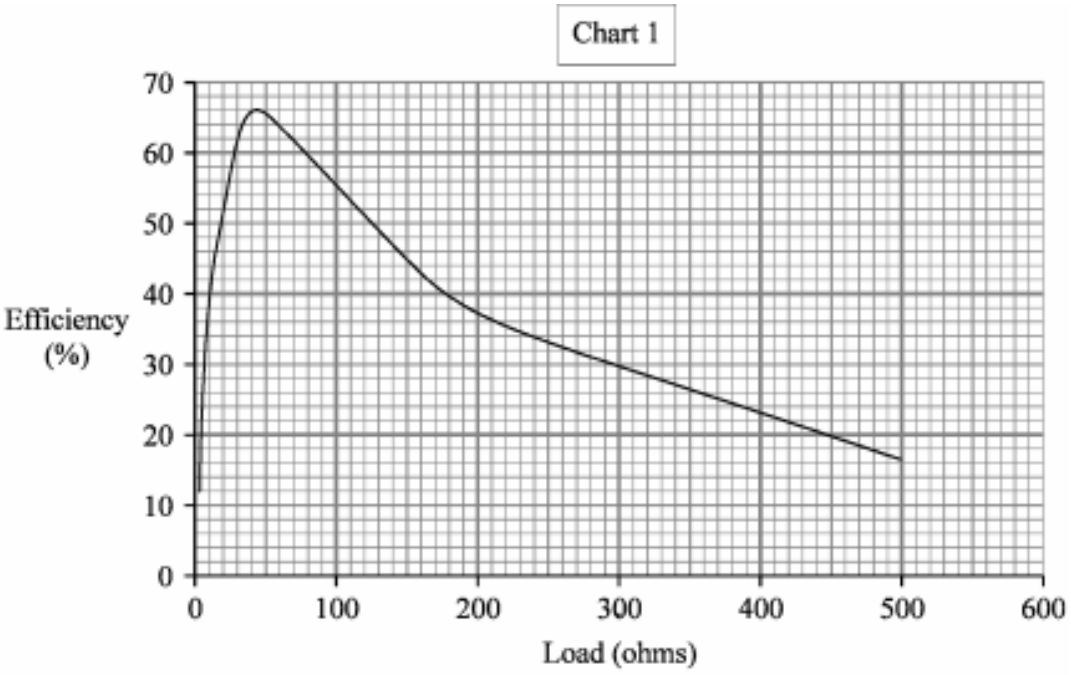
(b) Use the table to explain why Kate should have taken more readings between 20 Ω and 75 Ω.

.....

.....

(1 mark)

11 Kate produced two different charts of these results:



(a) Describe in detail what Chart 1 tells you about the relationship between output load and efficiency.

.....

.....

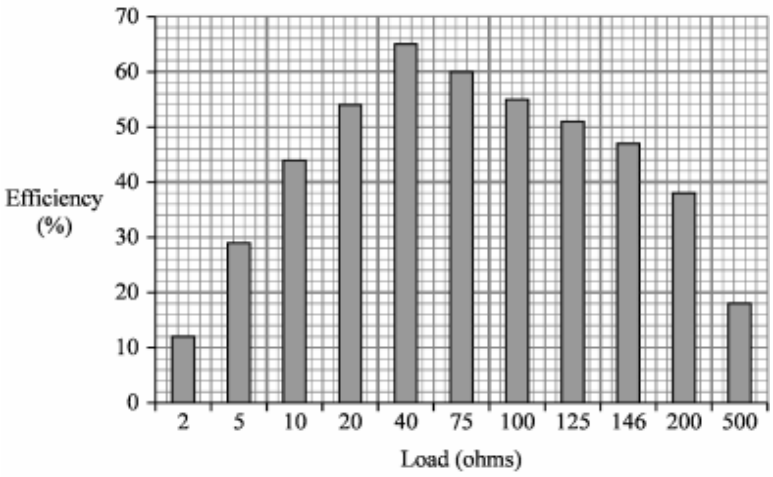
.....

.....

(2 marks)

(b)

Chart 2



Explain **two** reasons why Chart 2 is a **bad** way to present the results.

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)

Turn over ▶

12 Kate's supervisor looked at the table of results and said that it was a poor way of reporting.

He said that Kate had not quoted any *measurements* of the outcome, but had only quoted a *calculated* result of the efficiency. This also meant that he did not know if Kate had repeated any of the tests.

(a) Why would it have been important for Kate to repeat the tests?

.....

.....

(1 mark)

(b) In fact Kate had done each test 3 times. What should she have done with these results?

Tick the box beside your choice.

Chosen the best set and discarded the others	☐
Taken an average of all three sets	☐
Discarded any anomalous results and averaged the rest	☐
Taken the middle value out of each set	☐

(1 mark)

(c) Explain why it is important to show actual results as well as calculated values.

.....

.....

(1 mark)

13 Why is it important that transformers should be as efficient as possible?

.....

.....

(1 mark)

LEAVE MARGIN BLANK

14 The supervisor said, "If we publish Chart 2, our customers may think we have produced an excellent transformer. But if we hide the real data, the company will be accused of being *biased*."

(a) What did he mean by using the word *biased*?

.....

.....

(1 mark)

(b) Why might a manufacturer sometimes want to present a biased report?

.....

.....

(1 mark)

END OF QUESTIONS

GCSE Science - Investigative Skills Assignment - Marking Guidelines

Physics 3/Specimen – Transformers

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 Independent variable correctly named	e.g. voltage at secondary e.g. the voltage at primary/ turns ratio	1 mark 1 mark
2 (a)	Correct variable identified	e.g. the voltage at secondary	1 mark
2 (b)	Continuous		1 mark
3 (a) **3 (b)**	Correct range identified	Units not essential, but must be correct if included	1 mark
3 (c)	Reason given, e.g. YES, because e.g. it gave a good variation in the output variable Or, NO, because e.g. there was little variation in output variable	No mark for choosing Yes or No	1 mark
	Reason given, e.g. NO, because e.g. there were sufficient results to come to a conclusion Or, YES, because, e.g. there was a gap in the results where the pattern was uncertain	No mark for choosing Yes or No	1 mark

4 (a)	Reason given, e.g. YES because e.g. all readings fitted onto scale Or, NO because e.g. needed readings higher than scale	No mark for choosing Yes or No	1 mark
4 (b)	Reason given, e.g. YES because significant difference between all readings Or NO because e.g. hardly any change in readings	(No mark for simply choosing Yes or No)	1 mark
5	Suitable suggestion,	e.g.to determine suitable range or choice of measuring instrument	1 mark
6	Simple statement, Further detail,	e.g. the voltage at primary/ turns ratio did affect the output voltage e.g. the greater the voltage at primary, the greater the voltage at secondary	1 mark 1 mark
7	**Table:** Correct headings AND units all correct for all measured variables **Graph:** • 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	Table with incomplete headings or units for the measured variables = 1 mark e.g. all headings present = 1 e.g. all units present = 1 Accept axes reversed It may not always be necessary to show the origin Scales should be such that the plots occupy at least one third of each axis Allow **one** plotting error out of each 5 points plotted Allow error carried forward from incorrect plots If wrong type of graph/chart, maximum 3 marks If the independent variable is: • *continuous,* should draw a *best fit line graph* • *categoric,* should draw a *bar chart* • *discrete,* allow either a bar chart or a line graph	2 marks 1 mark 1 mark 1 mark 1 mark

SECTION 2			
8	Independent = load Dependent c= efficiency	Both must be correct	1 mark
9	Any valid, e.g. primary voltage, primary current, number of turns, temperature of coils		1 mark
10 (a) **10 (b)**	Close together at the start, getting further apart		1 mark
	Because this is where the peak of the graph lies		1 mark
11 (a)	Simple statement More detail	e.g. Efficiency generally falls e.g. but rises (rapidly) to start with	1 mark 1 mark
11 (b)	Any three from: • Chart 2 is a bar chart • Continuous variable better on a line graph • Scale on x axis is non linear • distorts where the peak occurs Quality of written communication - correct use of any **two** technical terms, e.g. linear/ non-linear; dependent variable / independent variable; continuous variable / categoric variable; axis.		3 marks 1 mark
12 (a)	Mean results would be more reliable	Accept: enables anomalies to be seen	1 mark
12 (b)	Discarded any anomalous results and averaged the rest		1 mark
12 (c)	e.g. to enable others to judge the work better/ spot any anomalous results/ see range of random errors		1 mark
13	Conserve energy/ prevent overheating		1 mark
14 (a)	Idea of being influenced by non-scientific factors, e.g. commercialism		1 mark
14 (b)	For financial/ commercial gain		1 mark