

# Controlled Assessment – Science A ISA

## BU1.x Microorganisms ~ Specimen

For moderation in May 20yy

### Teachers' Notes

This ISA relates to Science A

#### Section B1.1.2 Keeping Healthy

##### *Topic of investigation*

Section B1.1.2c: The body has different ways of protecting itself against pathogens.

##### Overview

Candidates should:

- plan practical ways to answer scientific questions and test hypotheses
- devise appropriate methods for the collection of numerical and other data
- assess and manage risks when carrying out practical work
- collect, process, analyse and interpret primary and secondary data including the use of appropriate technology
- draw evidence-based conclusions
- evaluate methods of data collection and the quality of the resulting data.

Candidates should be given the hypothesis:

**'The survival and growth of microorganisms depends upon the concentration of disinfectant.'**

The teacher should describe the context in which the investigation is set and outline the hypothesis that is to be investigated.

In Section 1 of the ISA Candidates will be required to provide a full plan of the method that they have chosen to use.

Once the candidates have researched and written up their own plan in Section 1 of the ISA, they should carry out their investigation providing that this is workable, valid, safe, and manageable in the laboratory.

Candidates need to test the hypothesis. They should research **two** possible methods to investigate it, and develop a detailed plan for one of these methods.

Candidates will need to decide which variables need to be controlled in order to investigate the hypothesis and research a method that could be used, with particular reference to hazards and risk assessment.

**Important:** In this ISA, candidates will need to be given the results of one other group in the class or a set of results from a laboratory technician or the teacher.

##### Risk Assessment

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

## Stage 1 – Planning (Limited control)

Teachers should provide the candidates with a Candidate Research Notes Form with the hypothesis and context written on them.

Candidates should be given the opportunity to plan an investigation to test the hypothesis. The investigation should be set in a context by the centre. Examples of suitable contexts could include the need for sterile equipment in hospitals or the use of hand cleaning gels. Whichever context is chosen, the teacher must take care to present it in such a way that it does not limit the candidates' choice of method for the investigation.

Candidates should then independently research an appropriate plan to test the hypothesis and decide for themselves factors such as the range, interval and number of repeat readings that they should take, and the variables that need to be controlled. They should use at least **two** sources for this research.

Candidates will need to undertake independent research to identify **two** methods that could be used. During this time they may make up to **one** A4 side of their **own** Candidate Research Notes for use during Section 1 and Section 2 of the ISA. The Candidate Research Notes sheet must be used for this purpose.

For their research candidates may use technology such as the internet or CD-ROMs, textbooks or any other appropriate sources of information. They should also research how the results of the investigation might be useful in the specified context.

There is no set time allocation for this research, but it is anticipated that it should take no longer than three hours of work. This research may be done in the laboratory or elsewhere.

The teacher should check and sign the Candidate Research Notes before allowing the candidate to use them during the completion of Section 1 of the ISA. These must be checked to ensure that they do not include plagiarised text or a pre-prepared draft. The candidate may use their Candidate Research Notes while completing Section 1 and Section 2 of the ISA. When the candidate has completed Section 2, the notes should be stapled to the ISA.

## Stage 2 - Reporting on the planning research (High control)

**For this stage, candidates must work individually under direct supervision**

After the Stage 1 planning session, candidates should be given Section 1 of the ISA and should work on their own, under controlled conditions, to answer it. Candidates should take their Candidate Research Notes into the formal assessment period.

**Section 1 will require candidates to:**

- consider the variables (independent, dependent and control) that they will need to manage during the investigation
- report on their research into how to test the hypothesis they have been given
- write a detailed plan of their chosen method
- identify possible hazards and write down how the risks may be minimised
- draw a blank table suitable for the method they have planned.

Candidates may choose to use technology to draw the table, e.g. a computer spread sheet.

**This must be done under the direct supervision of the teacher**, and may be done at any convenient time between the planning session in Stage 1 and the completion of Section 1 of the ISA.

While answering Section 1 of the ISA, candidates must **not** be allowed to use notes, textbooks, the internet or any other source of help apart from their **own** Candidate Research Notes.

### **Stage 3 – Practical Work (Limited control)**

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

Candidates may work in groups to carry out their plans, but each candidate must contribute to the collection of data.

Candidates may use appropriate technology during the practical work, e.g. data loggers or sensors.

If the teacher deems that the plan produced by the candidate is invalid, unworkable, unsafe, unmanageable or for any other reason unsuitable, then the teacher may provide a method. An example of a suitable method is attached to these notes.

Candidates may use their own blank table for the results providing that this has already been marked by the teacher. Alternatively the teacher may provide a blank table for the results:

- if the table produced by the candidate is inadequate - in which case the candidate would not be able to score full marks for producing a table
- if the candidate carries out an investigation from a method provided by the teacher, or the teacher prefers that the candidate use a particular format - in which case the candidate would be able to score full marks for producing their own table.

### **Stage 4 – Processing primary data (High control)**

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

Candidates should be given back their table of results, **or** a table containing the pooled results of the class, and asked to display these on a bar chart or line graph. Candidates must decide for themselves which format is the more appropriate for any particular investigation. Candidates may use appropriate technology to do this, e.g. a graph-drawing program on a computer.

If a candidate chooses to use a computer, this must be done under the direct supervision of the teacher and must be printed straight away.

Candidates should not be allowed to take their results and chart or graph away: the teacher must collect them at the end of the lesson.

### **Stage 5 – Analysing results (High control)**

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

AQA will provide a Secondary Data Sheet.

The candidates should also be given a table of results from other candidates in the class, or the teacher's results. Candidates should use the results of others to analyse the validity of their own results.

Candidates should be given Section 2 of the ISA.

They should also be given:

- their own table of results
- a set of results obtained by other people
- a reminder of the context in which the investigation was set
- their own chart or graph
- the Secondary Data Sheet supplied by AQA
- their own Candidate Research Notes

The teacher should have recorded the marks for each candidate's table and graph/chart before these are given back. This will ensure that a candidate cannot gain an unfair advantage by making any alterations to them at this stage.

<p><b>Any candidate who does not take an active part in the practical work cannot score any marks for Section 2 of the ISA.</b></p>
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**Section 2 will require candidates to:**

- analyse their own results
- draw a conclusion
- match their achieved results to the original hypothesis that was given to them
- analyse the validity of their own results by using the results of others
- evaluate the method of collection and the quality of the resulting data
- establish the validity of their results by comparing their results with those of others
- analyse further secondary data drawn from the same topic area as their original investigation
- relate their findings to the context set in the ISA.

## Science A - BU1.x Microorganisms (Specimen)

This method could be used to investigate the following hypothesis:

**“The survival and growth of microorganisms depends upon the concentration of disinfectant.”**

You will need to prepare a table for the results.

### Equipment:

Nutrient broth pre-inoculated with safe bacteria (labelled “safe bacteria”)

5 test tubes

Syringes or other means of measuring volumes of 0.5 cm<sup>3</sup> and 5 cm<sup>3</sup>

5 sterile nutrient agar plates

Incubator at 25 °C

Disinfectant solution, diluted to double normal working strength (refer to label on bottle used)

Means of labelling tubes and agar plates

Inoculating loop

Bunsen burner

### Method:

1. Label 5 test tubes ‘1’ to ‘5’.
2. Put 10 cm<sup>3</sup> of the disinfectant into test tube 1.
3. Remove 5 cm<sup>3</sup> from test tube 1 into test tube 2.
4. Add a further 5 cm<sup>3</sup> of water to test tube 2.
5. Remove 5 cm<sup>3</sup> from test tube 2 into test tube 3.
6. Add a further 5 cm<sup>3</sup> of water to test tube 3.
7. Repeat this process to make test tubes 4 and 5.
8. Remove 5 cm<sup>3</sup> of solution from test tube 5 and discard it.
9. Add 0.5 cm<sup>3</sup> of “safe bacteria” to each of the five test tubes. Shake gently to mix them.
10. Using sterile techniques spread samples from each test tube onto the agar in separate prepared Petri dishes of sterile nutrient agar.
11. Label the dishes, and then place them in the incubator at 25 °C for 2 – 3 days.
12. After 2 – 3 days count and record the number of colonies of bacteria on each agar plate.



# ISA Explanation Sheet

This sheet should accompany each ISA

Centre Number	9	8	7	6	5	Date Practical Carried Out	<i>April 2011</i>
ISA Code	<i>BU1.x</i>					Name of Teacher	<i>Sally Avalon</i>
ISA Title	<i>Microorganisms (specimen)</i>						

Did the candidates use their own plans?

**YES**

If NO give details of any changes you made for this investigation.

Any other Information:

Teacher

Signature: *S. Avalon*

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

For use with: GCSE Science A Route 1 (4405) GCSE Science A Route 2 (4406)  
Additional Science Route 1 (4408) Additional Science Route 2 (4409)  
Biology (4401) Chemistry (4402) Physics (4403)

SCA4P AS4P BL4P CH4P PH4P 

Centre Number 98765

Centre Name *The Blue School Thetford*Candidate name *Jay S Flude*

Candidate Number 1234

Investigation Title *Microorganisms (specimen)*ISA Code: *BU1.x*

The only notes the candidate takes into the Controlled Assessment are to be written in the spaces on the back of this sheet.

This sheet should be given to the teacher for checking before it is used in Section 1 of the ISA.

When Section 1 of the ISA has been completed, this sheet should be retained by the teacher for subsequent use with Section 2.

When Section 2 of the ISA has been completed, this sheet should be stapled to it.

### Declaration

I confirm that these are the only preparation notes used in the Controlled Assessment.

*Sally Avalon**Jay S Flude*Date 21<sup>st</sup> April

*This form can be downloaded from the Secure Key Materials area in e-AQA*

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<p><b>Hypothesis</b>  <i>The survival and growth of microorganisms depends upon the concentration of disinfectant.</i></p>
<p><b>Research sources</b>  1. <i>AQA Science by Jim Breithaupt, Ann Fullick, Patrick Fullick published by Nelson Thornes</i>  2. <i>Internet <a href="http://www.selah.k12.wa.us/SOAR/SciProj2003/CharleyW.html">http://www.selah.k12.wa.us/SOAR/SciProj2003/CharleyW.html</a></i></p>
<p><b>Method(s)</b>  1. <i>Mix different amounts of disinfectant and water (5cm<sup>3</sup>). Add bacteria (1cm<sup>3</sup>). Leave for 5 minutes. Spread onto agar (heat loop). Incubator. Count colonies.</i>  2. <i>Mix different amounts of disinfectant and water. Dip in filter paper pieces. Pat filter paper onto agar that has bacteria on it. incubator. Measure width of circle where bacteria are killed.</i></p>
<p><b>Equipment</b>  <i>Disinfectant, water, bacteria, clock pipettes, loop, incubator, tape</i></p>
<p><b>Risk assessment issues</b>  <i>sterilise loop,  tape up the dish  don't open dish</i></p>
<p><b>Context:</b>  <i>Cleaning kitchen surfaces</i>  <b>Relating the investigation to the context</b>  <i>Cleaning kitchen surfaces is important or you can pass bacteria from food like meat to bread when your making sandwiches. Chicken has salmonella and you can get bad food poisoning. So you have to use disinfectant strong enough to kill the bacteria or you might die.</i>  <i>Bottle of disinfectant under the sink in our kitchen says it kills 99% of all known germs</i></p>

Centre Number	9	8	7	6	5	Candidate Number	1	2	3	4	For Teacher's Use	
Surname	Flude					Other Names	Jay Sue					
<b>Notice to Candidate.</b> The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.											Section	Mark
<b>Candidate Declaration.</b> I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment.											Section 1 (/20)	
Candidate Signature	<i>Jay S Flude</i>					Date	<i>April 4<sup>th</sup> 2011</i>				Section 2 (/30)	
											TOTAL (max 50)	



General Certificate of Secondary Education

June 20yy

# Science A (Specimen) SCA4P/BU1.X

Controlled Assessment ISA BU1.x Microorganisms Section 1

For moderation in May 20yy

<p><b>You will need</b></p> <ul style="list-style-type: none"> <li>Your Candidate Research notes</li> <li>A pencil and a ruler</li> </ul> <p>You may use a calculator.</p>
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**Time allowed:** 45 minutes

**Instructions**

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer all 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 marks for questions are shown in brackets.
- The maximum mark for Section 1 is 20.
- The maximum mark for the Controlled Assessment Unit is 50.
- You are reminded of the need for good English and clear presentation in your answers.

<p><b>Details of additional assistance (if any).</b> Has the candidate received any help or information from anyone other than the subject teacher(s) in the production of this work? If the answer is yes give the details below or on a separate page.</p> <p>Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p>
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<p><b>Teacher Declaration:</b> I confirm that the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied that to the best of my knowledge the work produced is solely that of the candidate.</p> <p>Signature of teacher .....<i>Sally Avalon</i>..... Date .....<i>April 2011</i>.....</p>
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## SECTION 1

Hypothesis: **'The survival and growth of microorganisms depends upon the concentration of disinfectant.'**

- 1 Think about the research that you did to find out how to test this hypothesis.  
Identify **two** sources that you used for your research.

- AQA Science by Jim Breithaupt, Ann Fullick, Patrick Fullick published by Nelson Thornes*
- Internet <http://www.selak.k12.wa.us/SOAR/SciProj2003/CharleyW.html>*

Which of these sources was the more useful?  
Why was this source better than the other source?

*The internet was the best because it gave me some good ideas about how to do the investigation. I had to change the independent variable from type of disinfectant (in the one on the internet) to concentration of disinfectant for my experiment.*

*The book was not so good because it only talked about killing bacteria and antibiotics and didn't give a method.*

(3 marks)

- 2 In this investigation, you will need to control some variables.  
Write down **one** variable that will need to be controlled.

*I will need to find out how much of the bacteria to use.....*

Describe **briefly** how a preliminary investigation could help you to find a suitable value for the control variable.

You should explain how the results of this preliminary investigation will help you to decide on the best value for the control variable.

*If I use too much there will be bacteria all over the agar and I won't be able to count it and if I don't use enough the difference in the results won't be noticeable.*

*I could set up 10 petri dishes with agar in them. Put 0.1cm<sup>3</sup> of bacteria in one, 0.2cm<sup>3</sup> of bacteria in the next, and so on up to 1.0cm<sup>3</sup> of bacteria. I'd put them in the incubator for two days at 25C then look at them. The best amount will be the one where the colonies are spread out just enough to count them easily.....*

(3 marks)

- 3 In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

From the research you have done, describe in detail how you are going to do your investigation.

You should include:

- the equipment you plan to use
- how you will use the equipment
- the measurements you are going to make
- how you will make the investigation a fair test
- a risk assessment.

*Equipment:*

*Escherichia coli in culture solution; disinfectant solution; 12 petri dishes with agar in; loop; pipettes; test tubes; sticky tape; incubator.*

*Plan:*

- 1. Use a pipette to measure out 5cm<sup>3</sup> of disinfectant into one test tube, 4cm<sup>3</sup> into another test tube, then 3, 2, and 1. Add water to the tubes so you have 5cm<sup>3</sup> in each tube. Put 5cm<sup>3</sup> of water into another tube. Label all the tubes so you know what's in them*
- 2. Get another pipette and put 1cm<sup>3</sup> of bacteria solution into all the tubes. Let them stand for five minutes.*
- 3. Put the amount of bacteria solution you found in the preliminary experiment into six of the petri dishes.*
- 4. Spread it out in each dish using a loop. You have to put the loop in the flame each time before you use it.*
- 5. Put the lid on the dishes and tape them up, put the tape across the dish not around the lid.*
- 6. Repeat steps 3, 4 and 5 for the other petri dishes.*

**Continue your answer on the next page**



4 In your research you will have found other methods you could have used.

Outline **one other** method you could have used.

Explain why you decided **not** to use this method.

*I could of dipped filter paper pieces into the disinfectant solution and put them on the agar jelly in the dish with bacteria and then put it in the incubator.*

*I didn't do this because I wouldn't have got much disinfectant on the filter paper pieces so my results wouldn't be very good and it would be hard measuring the bacteria with a ruler.*

.....

.....

.....

(3 marks)

5 Make sure that you hand in your Candidate Research Notes and your blank table for the results with this paper.

You will be awarded up to 2 marks for your table.

(2 marks)

<i>Strength of disinfectant %</i>	<i>Amount of water used (cm<sup>3</sup>)</i>	<i>Amount of disinfectant used (cm<sup>3</sup>)</i>	<i>Number of bacteria that grew in dish 1</i>	<i>Number of bacteria that grew in dish 2</i>	<i>Average</i>
<i>0</i>	<i>5</i>	<i>0</i>			
<i>20</i>	<i>4</i>	<i>1</i>			
<i>40</i>	<i>3</i>	<i>2</i>			
<i>60</i>	<i>2</i>	<i>3</i>			
<i>80</i>	<i>1</i>	<i>4</i>			
<i>100</i>	<i>0</i>	<i>5</i>			

**END OF QUESTIONS**

Centre Number	9	8	7	6	5	Candidate Number	1	2	3	4	For Teacher's Use	
Surname	Flude					Other Names	Jay Sue					
<b>Notice to Candidate.</b> The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.											Section	Mark
<b>Candidate Declaration.</b> I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment.											Section 1 (/20)	
Candidate Signature	<i>Jay S Flude</i>					Date	<i>7<sup>th</sup> April</i>				Section 2 (/30)	
											TOTAL (max 50)	



General Certificate of Secondary Education

June 20yy

## Science A (Specimen)

### Controlled Assessment ISA BU1.x Microorganisms Section 2

For moderation in May 20yy

**For this paper you must have**

- Results tables and charts or graphs from your investigation
  - A set of results obtained by other people
  - Your Candidate Research Notes
  - The Secondary Data Sheet
  - A pencil and ruler
- You may use a calculator

**Time allowed** 50 minutes

**Instructions**

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** 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 marks for questions are shown in brackets.
- The maximum mark for Section 2 is 30.
- The maximum mark for the Controlled Assessment Unit is 50.
- You are reminded of the need for good English and clear presentation in your answers.

**Details of additional assistance (if any).** Has the candidate received any help or information from anyone other than the subject teacher(s) in the production of this work? If the answer is yes give the details below or on a separate page.

Yes  No

**Did the candidate take an active part in the practical?**

Yes  No

**Teacher Declaration:**

I confirm that the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied that to the best of my knowledge the work produced is solely that of the candidate.

Signature of teacher .....*Sally Avalon*..... Date .....*10<sup>th</sup> April*.....

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**SECTION 2**

Hypothesis: **'The survival and growth of microorganisms depends upon the concentration of disinfectant.'**

**1(a)** What were the variables in the investigation that you did?

The independent variable was *the concentration of disinfectant I used*  
The dependent variable was *the number of bacteria that grew on each dish*  
One control variable was... *the temperature of the incubator*

(3 marks)

**1 (b)** Look at your results.

Did you repeat any of the results in your investigation?

Explain why you did or did not repeat any of your results.

Your explanation should include examples from your results.

*I didn't need to repeat any of my results. I did my experiment twice and the results are about the same each time. I expected that the second time would not give me the same results as the first time because when you take some of the solution you get different numbers of bacteria in it because it's not mixed evenly.*

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

(3 marks)

**1 (c)** In your investigation you changed the concentration of disinfectant.

What was the range of this variable?

The range was from..... *100 %* ..... to..... *0%* .....

If you had been able to use another value of this variable, either within or outside this range, what value would you have chosen?

Give a reason for your answer.

*I could have done 50% because it's in the middle and the 60% one is a bit off the line, so doing 50% would have helped check it.*

.....  
.....

(3 marks)

**1(d)** Do your results support the hypothesis that you investigated?  
You should use any pattern that you can see in your results to support your answer  
You should include examples from your results.

*Yes my results do support the hypothesis because when there I used stronger disinfectant I got less bacteria and when I used weaker disinfectant I got more bacteria. The most bacteria grew when there was no disinfectant.*

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

(3 marks)

**1 (e)** You have been given a set of results obtained by other people.  
Do these results **other** results show that this investigation is reproducible?  
Explain your answer using examples from the results.

*Yes. All the class got the same sort of results.*

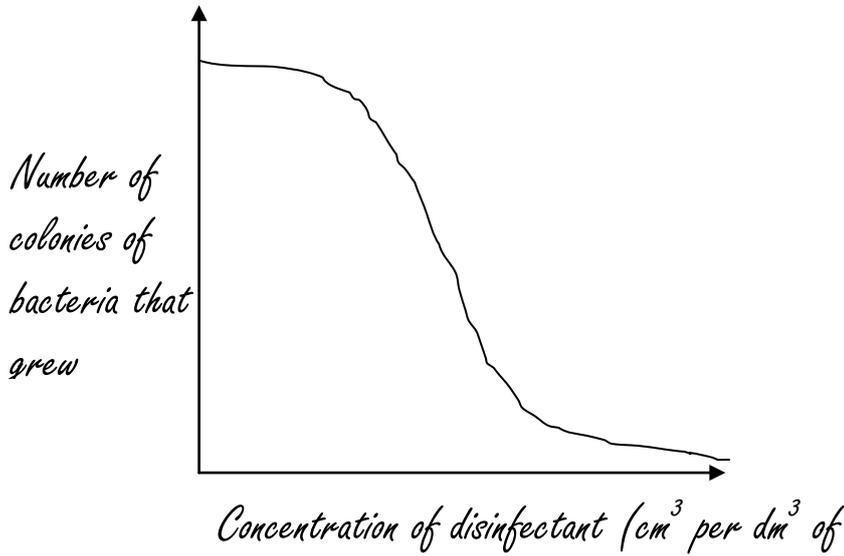
.....  
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(3 marks)

2 You have been given a Secondary Data Sheet that provides results from similar investigations.

2(a) Draw a sketchgraph of the results in Case Study 1.

The graph should show how the number of colonies of bacteria varies with the concentration of disinfectant.



(2 marks)

Hypothesis: **'The survival and growth of microorganisms depends upon the concentration of disinfectant.'**

2 (b) Look at Case Studies 1, 2 and 3.

Explain whether or not the results in Case Studies 1, 2 and 3 support the hypothesis you were given.

To gain full marks your explanation should include appropriate examples from the results in Case Studies 1, 2, and 3.

*The results for case study 1 and case study 2 both support the hypothesis. Because less bacteria grow when the disinfectant is stronger.*

*But case study 3 is about using different disinfectants and doesn't look at how strong they were. You should have used different strengths of the disinfectants in case study 3 to test the hypothesis.*

.....

.....

.....

(3 marks)

2 (c) Look at Case Study 4.

A hospital worker who saw the results advised:

“The hospital can use ‘Ger-off’ at 90% concentration to make sure most bacteria are killed.”

Do you agree with this advice?

Explain your answer.

*I don't think it would be a good idea because even at 100% Ger-off doesn't kill many staphylococcus and staphylococcus is a common bacteria that you get in hospitals. But it would be good at killing Listeria bacteria and nearly all the E.coli. Hospitals need to kill MRSA and the new disinfectant hasn't been tried on MRSA*

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

(3 marks)

3 How could the results from your investigation be useful in the context that you have researched?

You may use information from your Candidate Research Notes to help you to answer this question.

*I found out that it is important to use strong disinfectant to kill all the bacteria. Most disinfectant bottles say 'kills 99% of all known bacteria' but there are still lots we don't know about, so we don't know if they are killed or not. If we add water to disinfectant it isn't so useful at killing bacteria and then we might get food poisoned. You have to make sure you clean the kitchen after having fresh meat or chicken because you can get salmonella.*

(3 marks)

4 Make sure that you hand in your Candidate Research Notes, results tables, and chart or graph with this paper.

You will be awarded up to 4 marks for your chart or graph.

(4 marks)

**END OF QUESTIONS**

*Results Table.*

*Jay S Flude Teacher Miss Avalon*

<i>Strength of disinfectant %</i>	<i>Amount of water used (cm<sup>3</sup>)</i>	<i>Amount of disinfectant used (cm<sup>3</sup>)</i>	<i>Number of bacteria that grew in the dish</i>	<i>Number of bacteria that grew in the dish</i>	<i>Average number</i>
<i>0</i>	<i>5</i>	<i>0</i>	<i>56</i>	<i>68</i>	<i>62</i>
<i>20</i>	<i>4</i>	<i>1</i>	<i>58</i>	<i>42</i>	<i>50</i>
<i>40</i>	<i>3</i>	<i>2</i>	<i>29</i>	<i>33</i>	<i>31</i>
<i>60</i>	<i>2</i>	<i>3</i>	<i>32</i>	<i>22</i>	<i>27</i>
<i>80</i>	<i>1</i>	<i>4</i>	<i>5</i>	<i>12</i>	<i>9</i>
<i>100</i>	<i>0</i>	<i>5</i>	<i>2</i>	<i>0</i>	<i>1</i>

**Group 1 results**

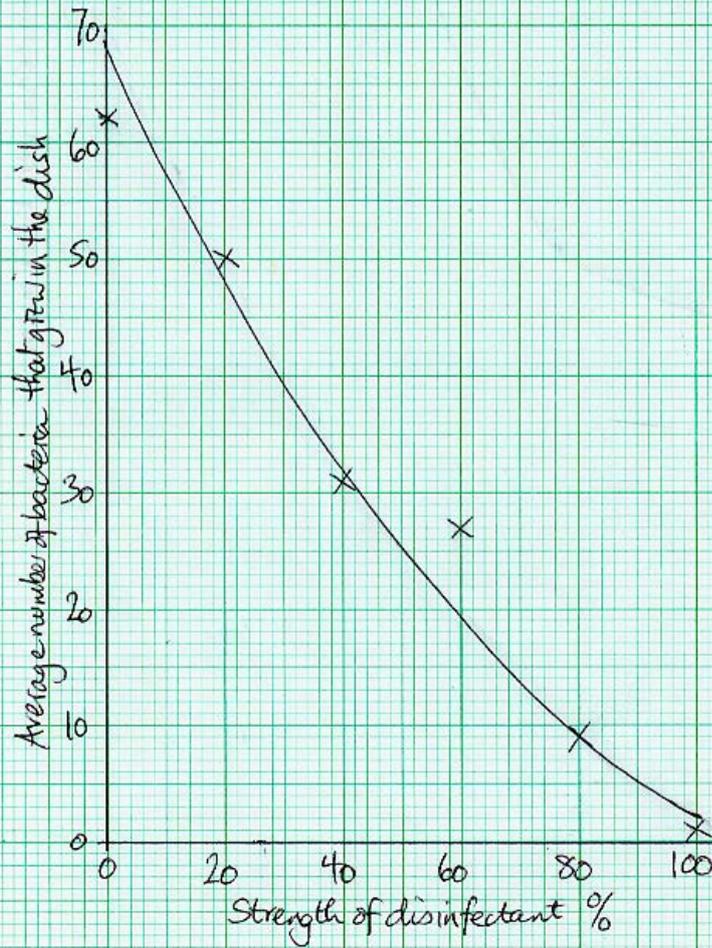
<b>% concentration of disinfectant</b>	<b>Number of bacteria that grew in the dish</b>
<i>0</i>	<i>126</i>
<i>20</i>	<i>88</i>
<i>40</i>	<i>32</i>
<i>60</i>	<i>10</i>
<i>80</i>	<i>4</i>
<i>100</i>	<i>0</i>

**Group 3 results**

<b>% concentration of disinfectant</b>	<b>Number of bacteria that grew in the dish</b>
<i>0</i>	<i>246</i>
<i>10</i>	<i>258</i>
<i>20</i>	<i>222</i>
<i>30</i>	<i>187</i>
<i>40</i>	<i>156</i>
<i>50</i>	<i>122</i>
<i>60</i>	<i>65</i>
<i>70</i>	<i>29</i>
<i>80</i>	<i>13</i>
<i>90</i>	<i>10</i>
<i>100</i>	<i>3</i>

Jay S Flade Form 10P  
Microorganisms ISA

Science teacher Miss Avalon



## Science A

## BU1.x Microorganisms (Specimen)

## Case Study 1

A group of students did an investigation to find out if concentration of disinfectant affects the growth of bacteria.

They used the same disinfectant and species of bacteria each time. They controlled other relevant variables

These are their results.

Concentration of disinfectant in $\text{cm}^3$ per $\text{dm}^3$ of water	Number of colonies of bacteria that grew
0	88
10	84
20	34
30	8
40	0
50	0

## Case Study 2

A company makes a new hand-wash. The hand-wash can be diluted with water to make different concentrations.

The company asks one of its scientists to test the effect of using different concentrations of the hand-wash on killing bacteria.

The scientist's results are shown in the table.

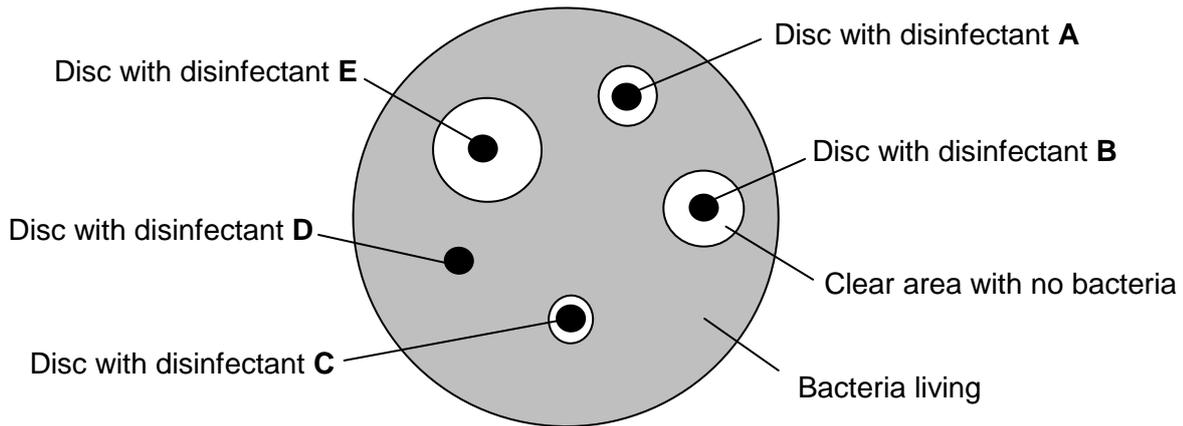
Percentage concentration of hand-wash	Number of bacterial colonies that grew			
	Test 1	Test 2	Test 3	Mean
0	147	151	146	148
25	62	88	63	71
50	36	32	33	34
75	14	18	15	16
100	0	0	0	0

### Case Study 3

Students dipped small discs of filter paper into five disinfectants, **A**, **B**, **C**, **D** and **E**. All the disinfectants were diluted to the manufacturer's recommended strength.

Each disc of filter paper was placed onto agar in a Petri dish in which one type of bacteria was growing. The dish was incubated at 25°C for two days.

The diagram shows the results.

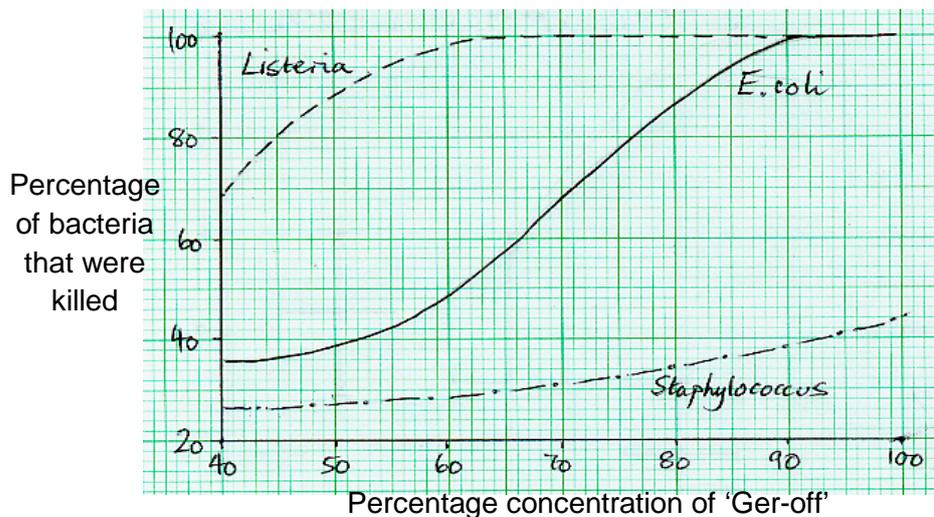


### Case Study 4

Scientists in a hospital laboratory investigated how well different concentrations of a new disinfectant, 'Ger-off', kills bacteria.

They recorded the percentage of bacteria killed at different concentrations of 'Ger-off'.

The graph shows the results.



**BU1.x Microorganisms (Specimen) ISA - Marking Guidelines**

**GCSE Science – Controlled Assessment ISA – Marking Guidelines**

**Science ISA – BU1.x Microorganisms (Specimen)**

**For moderation in May 20yy or January 20zz**

Please mark in red ink. 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 for Section 1. Fasten both sections together with the results table(s) and the graphical work and the Candidate's Research Notes.

The teacher must sign and date the front covers of Section 1 and Section 2 of the ISA.

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

These Marking Guidelines are necessarily generic. Additional guidance on how to relate these generic Marking Guidelines to particular investigations is given below the generic section.

Read through the whole of the candidate's answer and use the Marking Guidelines below to arrive at a 'best fit' mark.

**SECTION 1**

	<b>0 marks</b>	<b>1 mark</b>	<b>2 marks</b>	<b>3 marks</b>
<b>Q. No. 1</b>	No creditworthy response	Two relevant sources are clearly identified.	Two relevant sources are clearly identified.  The usefulness of the sources is commented on.	Two relevant sources are clearly identified.  The usefulness the sources is explained and a detailed comparison made.

**Additional Guidance**

*An identified source is referred to by title and author or for websites at least the name of the web site should be quoted.  
Any identified source should be capable of being accessed by the moderator.  
A clear comment on only one of the sources may be sufficient to gain 3 marks if the answer implies a comment on the other source.  
If candidates have taken part in peer discussion as part of their research, simply stating this is not sufficient to qualify for quoting a source. Similarly reference to their own notes or exercise book alone is insufficient.*

**BU1.x Microorganisms (Specimen) ISA - Marking Guidelines**

SECTION 1				
	0 marks	1 mark	2 marks	3 marks
<b>Q. No. 2</b>	No creditworthy response	A suitable control variable is stated.	<p>A suitable control variable is stated.</p> <p>Only one value to be investigated in the preliminary experiment is suggested</p> <p>The dependent variable is stated, but details concerning its measurement are incomplete</p>	<p>A suitable control variable is stated.</p> <p>The limits of the range to be investigated in the preliminary experiment are appropriate.</p> <p>A statement concerning how the dependent variable values obtained could be used to determine the best value for the control variable has been made</p>
<b>Additional Guidance</b>	<p><i>A suitable method may involve measuring the extent of growth of colonies of bacteria after different time intervals, and then comparing the results.</i></p> <p><i>The way in which the results could be used may refer to deciding whether there is sufficient growth of colonies to allow clear identification of each colony as a separate entity.</i></p>			

## BU1.x Microorganisms (Specimen) ISA - Marking Guidelines

SECTION 1				
<b>Q. No. 3</b>	<p>In this question candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.</p> <p>Candidates will be required to use good English, organise information clearly and use specialist terms where appropriate.</p> <p>In order to attain a mark within a certain level, <b>both</b> the science <b>and</b> the QWC must be considered.</p> <p>Read through the whole of the candidate’s answer and use the Marking Guidelines below to arrive at a ‘best fit’ mark, as candidates may meet some criteria but not others in a mark range.</p>			
	0 marks	1, 2 or 3 marks	4, 5 or 6 marks	7, 8 or 9 marks
	<p>No creditworthy response</p>	<p>Some of the necessary equipment is stated.</p> <p>The method described is weak but shows some understanding of the sequence of an investigation.</p> <p>The measurements to be made are stated.</p> <p>An appropriate hazard is identified, but the corresponding risk assessment and control measure is weak or absent.</p> <p>The answer is poorly organised, with almost no specialist terms and little or no detail given.</p> <p>The answer shows very weak spelling, punctuation and grammar.</p>	<p>Most of the necessary equipment is stated.</p> <p>The method described will enable valid results to be collected.</p> <p>The measurements to be made are stated and a at least one control variable is given.</p> <p>Any significant hazards are identified, together with a corresponding control measure but the risk assessment is weak or absent.</p> <p>The answer has some structure and organisation, use of specialist terms has been attempted but not always correctly, and some detail is given.</p> <p>The answer shows reasonable spelling, punctuation and grammar although there may still be some errors.</p>	<p>Most of the necessary equipment is stated.</p> <p>The method described will enable valid results to be collected.</p> <p>The measurements to be made are stated and the significant control variables are clearly identified, with details of how they will be monitored or controlled.</p> <p>Any significant hazards are identified, together with an assessment of the associated risks and corresponding control measures.</p> <p>The answer is coherent and written in an organised, logical sequence, containing a range of relevant specialist terms used correctly.</p> <p>The answer shows almost faultless spelling, punctuation and grammar.</p>
<b>Additional Guidance</b>	<p><i>Typical hazards with associated risk reduction might include: once incubated the plates should not be opened to prevent possible spread of pathogens that may have grown.</i></p> <p><i>It may be possible to credit a clearly labelled diagram for some of the marks.</i></p>			

**BU1.x Microorganisms (Specimen) ISA - Marking Guidelines**

<b>SECTION 1</b>				
	<b>0 marks</b>	<b>1 mark</b>	<b>2 marks</b>	<b>3 marks</b>
<b>Q. No. 4</b>	No creditworthy response	An alternative method is outlined briefly although some of the necessary steps may not be clear.	An alternative method is outlined briefly.  A simple suggestion is given as to why this alternative method would not have been as good as the one chosen.	An alternative method is outlined briefly.  An explanation is given as to why this alternative method would not have been as good as the one chosen.
<b>Additional Guidance</b>	<p><i>Full detailed plans are not required for the alternative method.</i></p> <p><i>Suggestions regarding lack of specific, named equipment are sufficient as a sensible explanation.</i></p>			
<b>Table for the results</b>				
	<b>0 marks</b>	<b>1 mark</b>	<b>2 marks</b>	
<b>Q. No. 5</b>	No table or a table with incomplete headings or units for the measured variables.  Fewer than half of the required elements are present.	A table with incomplete headings or units for the measured variables.  At least half of the required elements should be present.	Correct headings and units present for all measured variables.	
<b>Additional Guidance</b>	<p><i>The table should be able to accommodate all the variables that the candidate is going to measure or record during the investigation.</i></p> <p><i>There is no need for the candidate to include columns for repeats, means or derived values.</i></p>			

## BU1.x Microorganisms (Specimen) ISA - Marking Guidelines

SECTION 2				
Q. No. 1 (a)	0 marks	1 mark	2 marks	3 marks
	No creditworthy response	Any <b>one</b> variable correctly identified.	Any <b>two</b> variables correctly identified.	All <b>three</b> variables correctly identified.
<b>Additional Guidance</b>	<p><i>The independent variable is the concentration of disinfectant used.</i></p> <p><i>Examples of dependent variables are: the number of colonies of bacteria that grow, or the cloudiness of nutrient broth.</i></p> <p><i>Examples of control variables are: the volume of disinfectant used, the temperature of incubation, or the time of incubation.</i></p>			
SECTION 2				
Q. No. 1 (b)	0 marks	1 mark	2 marks	3 marks
	No creditworthy response	<p>There is a correct statement regarding whether or not any measurements were repeated.</p> <p>There is mention of the presence or absence of anomalous results or minor variations.</p>	<p>There is a correct statement regarding whether or not any measurements were repeated.</p> <p>There is reference to either anomalous results or to systematic or random errors with reference to their own results.</p>	<p>There is a correct statement regarding whether or not any measurements were repeated.</p> <p>There is reference to either anomalous results or to systematic or random errors with reference to their own results, and the effects that these would cause</p>
<b>Additional Guidance</b>	<p><i>If the candidate answers “Yes”, they may refer to clearly anomalous results that need repeating, or to the fact that not all the points lie comfortably on a line of best fit (random errors) or to a systematic error, therefore needing more result to calculate a mean.</i></p> <p><i>If the candidate answers “No”, they may refer to eg all points on the graph lying close to the best fit line.</i></p> <p><i>Reference to lack of time may be allowed for 1 mark at the teacher’s discretion, but should be annotated.</i></p>			

**BU1.x Microorganisms (Specimen) ISA - Marking Guidelines**

<b>SECTION 2</b>				
	<b>0 marks</b>	<b>1 mark</b>	<b>2 marks</b>	<b>3 marks</b>
<b>Q. No. 1 (c)</b>	No creditworthy response	At least one end of the range is correctly stated.  Another value of the independent variable is suggested, although it may not be appropriate.	The range is correctly stated, according to the candidate's own results.  Another appropriate value of the independent variable is suggested.  The reason for the additional value is unclear or inappropriate.	The range is correctly stated, according to the candidate's own results.  Another appropriate value of the independent variable is suggested.  The reason for the additional value is clear and appropriate.
<b>Additional Guidance</b>	<p><i>An appropriate extra reading will usually be one of the following:</i></p> <ul style="list-style-type: none"> <li>• <i>an intermediate reading to fill in a gap, perhaps where the trend line becomes unclear</i></li> <li>• <i>a reading outside the range already investigated, perhaps to see if the trend continues.</i></li> </ul>			
<b>SECTION 2</b>				
	<b>0 marks</b>	<b>1 mark</b>	<b>2 marks</b>	<b>3 marks</b>
<b>Q. No. 1 (d)</b>	No creditworthy response	A valid statement is made about whether or not the results support the hypothesis.	A valid statement is made about whether or not the results support the hypothesis.  The answer includes <b>either</b> a reference to a pattern <b>or</b> some examples from the results.	A valid statement is made about whether or not the results support the hypothesis.  The answer includes a reference to a pattern <b>and</b> some examples from the results.
<b>Additional Guidance</b>	<p><i>The candidate's statement(s) must match the candidate's own results.</i></p> <p><i>An example of a pattern might be "The stronger the concentration of disinfectant, the more bacteria were killed".</i></p> <p><i>An example of results quoted in support might be "At 20% concentration the bacteria count was 50, but at 100% concentration all bacteria were killed".</i></p>			

**BU1.x Microorganisms (Specimen) ISA - Marking Guidelines**

<b>SECTION 2</b>				
	<b>0 marks</b>	<b>1 mark</b>	<b>2 marks</b>	<b>3 marks</b>
<b>Q. No. 1 (e)</b>	No creditworthy response	A simple correct statement is made as to whether or not the results are reproducible.	A simple correct statement is made as to whether or not the results are reproducible.  A simple explanation is given, supported by an example from the results (this may be a qualitative example referring to a pattern on the results).	A simple correct statement is made as to whether or not the results are reproducible.  A detailed explanation is given, supported by at least <b>two</b> examples from the results.
<b>Additional Guidance</b>	<i>Note that the answer should refer to the class or teacher's results, and not simply to the expected result.</i>			

<b>SECTION 2</b>			
	<b>0 marks</b>	<b>1 mark</b>	<b>2 marks</b>
<b>Q. No. 2 (a)</b>	No creditworthy response	Both axes labelled with the variables (ignore any units given).	Both axes labelled with the variables (ignore any units given)  and an appropriate line has been drawn.
<b>Additional Guidance</b>	<i>Accept axes drawn either way round, ie it does not matter which axis the concentration is on. The line should be a curve approximately matching the pattern shown by the data in Case Study 1. No values need to be shown on either axis, and the line may intercept either axis.</i>		

**BU1.x Microorganisms (Specimen) ISA - Marking Guidelines**

<b>SECTION 2</b>				
	<b>0 marks</b>	<b>1 mark</b>	<b>2 marks</b>	<b>3 marks</b>
<b>Q. No. 2 (b)</b>	No creditworthy response	A simple correct statement is made about <b>at least two</b> of the Case Studies <b>1, 2 and 3</b> , as to whether or not they support the hypothesis.	Correct statements are made about Case Studies <b>1, 2 and 3</b> , supported by a more detailed explanation of <b>one</b> of them.	Correct statements are made about Case Studies <b>1, 2 and 3</b> , supported by a more detailed explanation of <b>both</b> Case Studies <b>2 and 3</b> .
<b>Additional Guidance</b>	<p><i>An example of a clear statement for Case Study 1 is “The greater the concentration, the fewer colonies/bacteria grow”.</i></p> <p><i>Further explanation for Case Study 2 could include reference to the variation in results between the two tests.</i></p> <p><i>Further explanation for Case Study 3 will be that that results are based on type of disinfectant rather than concentration.</i></p>			
<b>SECTION 2</b>				
	<b>0 marks</b>	<b>1 mark</b>	<b>2 marks</b>	<b>3 marks</b>
<b>Q. No. 2 (c)</b>	No creditworthy response	<p>A comment is made as to whether the advice is supported or not.</p> <p>There is a simple statement that uses information from the graph to support the comment.</p>	<p>A comment is made as to whether the advice is supported or not.</p> <p>There is a statement that uses information from the graph to support the comment.</p> <p>A clear advantage of using “Ger-off” <b>or</b> a clear disadvantage of using “Ger-off” is stated.</p>	<p>A comment is made as to whether the advice is supported or not.</p> <p>There is a statement that uses information from the graph to support the comment.</p> <p>A clear advantage of using “Ger-off” <b>and</b> a clear disadvantage of using “Ger-off” is stated.</p>
<b>Additional Guidance</b>	<p><i>Examples of advantages include: “All Listeria will be killed (at 90% concentration)” or “All E. coli (probably) killed (at 90%)”</i></p> <p><i>Examples of disadvantages include: “Staphylococcus will not all be killed” or “Has not been tested on other bacteria” “Need to consider cost (effectiveness)”, “Need to compare effectiveness with currently used disinfectants” or “Use depends on nature of infection being treated”.</i></p>			

## BU1.x Microorganisms (Specimen) ISA - Marking Guidelines

SECTION 2				
	0 marks	1 mark	2 marks	3 marks
<b>Q. No. 3</b>	No creditworthy response	Results from the investigation or an idea from the research has been related to the context.	Results from the investigation or an idea from the research has been related to the context.  There is a <b>simple</b> explanation of how the results or idea can be applied and used in the given context.	Results from the investigation or an idea from the research has been related to the context.  There is a <b>detailed</b> explanation of how the results or idea can be applied in the given context.
<b>Additional Guidance</b>	<i>The candidate should attempt to explain, e.g. how manufacturers of disinfectants (or homeowners) could work out the optimum concentration of disinfectant to use at home.</i>			
Graph or chart				
	Answer	Additional Guidance		Mark
<b>Q. No. 4</b>	X axis: suitable scales chosen and labelled with quantity and units.	Scale should be such that the plots occupy at least one third of each axis.		<b>1</b>
	Y axis: suitable scales chosen and labelled with quantity and units.	Accept axes reversed.  It may not always be necessary to show the origin.		<b>1</b>
	Points or bars plotted correctly to within $\pm 1$ mm.	Allow one plotting error out of each 5 points/bars plotted.		<b>1</b>
	Suitable line drawn on graph or bars correctly labelled on bar chart.	Allow error carried forward from incorrect points. If wrong type of graph / chart, maximum <b>3</b> marks. If the independent variable is: <ul style="list-style-type: none"> <li>• categoric, a bar chart should be drawn</li> <li>• continuous, a best fit line should be drawn.</li> </ul> <b>N.B.</b> If no line is possible because there is no correlation, candidates should state this on the graph to gain the mark.		<b>1</b>