Science A Controlled Assessment

Unit 1: Biology

Exemplar Material of a candidate who scored 40/50

Teachers' Notes

This ISA relates to Science A Section B1.1.2

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

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

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

Candidates should be given the hypothesis:

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

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.

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

Important: In this ISA, candidates will need to compare their results with a set of results given to them by the teacher. These may be the results of another group in the class or the teacher's own results.

Risk Assessment

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

Follow the next 5 stages to complete Science A Controlled Assessment for Microorganisms

Teachers' Notes

stage 1

Planning (Limited control)

Teachers should provide a Candidate Research Notes Form. For Science A, teachers should write the hypothesis and context written on this form. 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.

They 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 of the ISA. The Candidate Research Notes sheet is attached as an appendix.

Candidates may use technology such as the internet or CD-ROMs for their research, textbooks or any other appropriate sources of information.

Candidates 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 3 hours of work at most. 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. The candidate may use these 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.

Teachers' Notes

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. These must be checked to ensure they do not include plagiarised text, or a pre-prepared draft.

Section 1 will require them 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.

Teachers' 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.
- candidate carries out an investigation from a method provided by the teacher, or the teacher prefers that the candidates 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 must not be allowed to take their results and chart or graph away: the teacher must collect them at the end of the lesson.

Teachers' Notes

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 and 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. This may be printed on the class results table.
- 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.

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
- analyse further secondary data drawn from the same topic area as their original investigation
- relate their findings to the context set in the ISA.

An example of a Suitable Method

(Refer to Stage 3 of the Teachers' Notes)

Microorganisms (Specimen)

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 0.5cm^3 and 5cm^3

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 10cm^3 of the disinfectant into test tube '1'.
3. Remove 5cm^3 from test tube '1' into test tube '2'.
4. Add a further 5cm^3 of water to test tube '2'.
5. Remove 5cm^3 from test tube '2' into test tube '3'.
6. Add a further 5cm^3 of water to test tube '3'.
7. Repeat this process to make test tubes '4' and '5'.
8. Remove 5cm^3 of solution from test tube 5 and discard it.
9. Add 0.5cm^3 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, 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

AQA

ISA Explanation Sheet

This sheet should accompany each ISA

Centre Number	9	8	7	6	5	Date Practical Carried Out	April 2011	
ISA Code	BL1x					Name of Teacher	Sally Avalon	
ISA Title	Microorganisms (specimen)							

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.

Research Notes

AQA

Centre-assessed work
Candidate Research Notes

GCSE Science (4405) Additional Science (4408) Biology (4401) Chemistry (4402) Physics (4403)

SCYC [X] ASCC [ ] BLYC [ ] CHYC [ ] PHYC [ ]

Centre Number 98765 Centre Name The Blue School Thetford

Candidate's Name Jay S Flude Candidate's Number 1234

Investigation Title Microorganisms (specimen)

ISA number: BL1.x

The notes the candidate takes into the Controlled Assessment task are to be recorded in the spaces on 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 task.

Sally Avalon

Jay S Flude

Date: 21st April

This form can be downloaded from aqa.org.uk/candidatenotes

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Research Notes

Hypothesis

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

Research sources

1. AQA Science by Jim Breithaupt, Ann Fullick, Patrick Fullick published by Nelson Thornes
2. Internet
http://www.selah.k12.wa.us/SOAR/SciProj2003/CharleyW.html

Method(s)

1. Mix different amounts of disinfectant and water (5cm^3). Add bacteria (1cm^3). Leave for 5 minutes. Spread onto agar (heat loop). Incubator. Count colonies.

2. Mix different amounts of disinfectant and water. Dip in filter paper pieces. Put filter paper onto agar that has bacteria on it. incubator. Measure width of circle where bacteria are killed.

Equipment

Risk assessment issues

Disinfectant, water, bacteria, clock pippetes, loop, incubator, tape
sterilise loop,
tape up the dish
don't open dish

Relating the investigation to the context

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. Bottle of disinfectant under the sink in our kitchen says it kills 99% of all known germs

ISA Section 1

Centre Number	9	8	7	6	5	Candidate Number	1	2	3	4
Surname	Flude					Other Names	Jay Sue			

Notice to Candidate. 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.

Candidate Declaration. 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.

Candidate Signature	Jay S Flude	Date	April 4th 2011

For Teacher's Use	
Section	Mark
Section 1 (/20)	16
Section 2 (/30)	24
TOTAL (max 50)	40

AQA General Certificate of Secondary Education

June 20yy and January 20zz

Science A (Specimen)

Controlled Assessment ISA BU1.x Microorganisms Section 1

For moderation in May 20yy or January 20zz

Time allowed up to 45 minutes

You will need
- Your Candidate Research notes
- A pencil and a ruler

You may use a calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in **Section 1** in the spaces provided. You may use extra paper.
- 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 this paper 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.

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 ☑

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 April 2011

As part of AQA's commitment to assist students, AQA may make your CAU available on a strictly anonymous basis to teachers, examining staff and students in paper form or electronically, through the Internet or other means, for the purpose of indicating a typical mark or for other educational purposes. In the unlikely event that your CAU is made available for the purposes stated above, you may object to this at any time and we will remove the work on reasonable notice. If you have any concerns please contact cfq@aqa.org.uk

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2

Do not write outside the box

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.

Name **two** sources that you used for your research.

1. AQA Science by Jim Breithaupt, Ann Fullick, Patrick Fullick published by Nelson Thornes

2. Internet http://www.selah.k12.wa.us/SOAR/SciProj2003/CharleyW.html

Which of these sources was the more useful, and why?

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)

3/3

2 In this investigation, you will need to control some variables.

Write down one variable that you will need to control.

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

Describe **briefly** how you would carry out a preliminary investigation to find a suitable **value** to use for one of these variables.

You should also explain how the results of this preliminary investigation will help you to decide on the best value for this 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 0.1cm³ of bacteria in one, 0.2cm³ of bacteria in the next, and so on up to 1.0cm³ 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)*

2/3

Two resources both fully referenced. It is not necessary to quote full url, the name of the website is sufficient. The text quoted has title and authors which are sufficient alone and also quotes the publisher.

Comments on both sources with a clear explanation as to why one source was better than the other (had the basis of a method that could be developed).

Suitable control variable identified.

Values for control variable identified however what "0.1cm³ of bacteria" would represent is unclear. In the investigation the 'bacteria culture' will be diluted with disinfectant.

It is not clear what is meant by this phrase. A diagram may have helped.

On balance two marks is appropriate here.

3

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

Describe how you plan to do your investigation to test the hypothesis given.

You should include:

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

Equipment:

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

Plan:

1. Use a pippete to measure out 5cm3 of disinfectant into one test tube, 4cm³ into another test tube, then 3, 2, and 1. Add water to the tubes so you have 5cm3 in each tube. Put 5cm³ of water into another tube. Label all the tubes so you know what's in them
2. Get another pippete and put 1cm³ 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.
7. Put all the dishes in the incubator for 2 days.
8 Count how many colonies are growing in each dish. Each colony comes from one bacteria, so I'll know how many bacteria were alive.
9. Dont open the dishes.

Turn over ▶

The list omits a Bunsen burner, referred to in step 4.

It is not clear which 'bacteria solution' the candidate is referring to. It appears that it's the neat culture, but the candidate probably intends this to be the bacteria + disinfectant mixture that has just been made up (in steps 1 & 2).

No Bunsen burner in equipment list.

Safety issue.

No indication of temperature either here or in the equipment list.

Some control variables identified (eg volumes, time) but others omitted (eg temperature).

Identifies measurements to be made.

The method allows the collection of valid results.

The answer is coherent and uses a range of specialist terms.

Fair test:
all the tubes have the same amount of bacteria put in them and the same amount of disinfectant solution. All the petri dishes have the same sort of agar. They are all put in the incubator together for the same time.

Spelling is generally good, as is punctuation, occasional errors, eg 'pippete' and the omission of one or two capital letters. This QWC would fall into the higher mark range.

Risk assessment:
Bacteria might be harmful they can even kill you. Never open a dish with bacteria in it. Wash your hands afterwards.

Some hazards are identified. There is no reference to burning risk when using flames or to other issues when working with bacteria such as the need for sterile agar/Petri dishes.

.....

.....

7/9

(9 marks)

The answer just falls within the higher category as a whole, there are some omissions in several of the descriptors but the method could be followed by another student and would give valid results. The candidate also indicates replication (to improve the quality of results) though does not refer to repeatability.

5

Do not write outside the box

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

Briefly outline **one other** method you could have used.

Explain why you chose **not** to do 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) 2/3

An alternative method is outlined briefly. There is no specific detail (although full procedures are not required) and it would be difficult for anyone to follow this.

Two suggestions as to why the method would not be as good as the chosen one.

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)

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

The 'average' column is unnecessary as this is a derived value.

Concentration is referred to as 'strength', the unit (%) is given.

Reference to number of bacteria is sufficient to imply numbers of colonies, in this case 'bacteria that grew' is the parameter and 'number' is the unit.

2/2

END OF SECTION 1

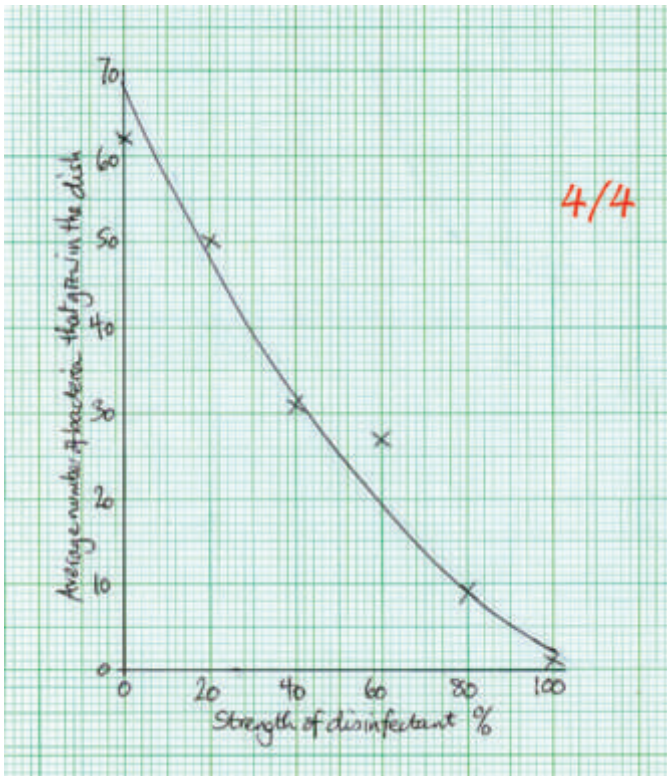
16/20

Table and graph for Section 2 of the ISA

Results Table – Jay S Flude Teacher Miss Avalon

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

Jay S Flude Form 10P
Science teacher Miss Avalon



Both X and Y axes are fully labelled, with units.

Points are plotted correctly (to within a tolerance of 1mm).

An appropriate curve is drawn. A suitable straight line would also have been acceptable from these plots

ISA Section 2

Centre Number	9	8	7	6	5	Candidate Number	1	2	3	4
Surname	Flude					Other Names	Jay Sue			

Notice to Candidate. 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.

Candidate Declaration. 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.

Candidate Signature	Jay S Flude	Date	7th April

For Teacher's Use	
Section	Mark
Section 1 (/20)	16
Section 2 (/30)	24
TOTAL (max 50)	40

AQA General Certificate of Secondary Education

June 20yy and January 20zz

Science A (Specimen)

Controlled Assessment ISA BU1.x Microorganisms Section 2

For moderation in May 2012 or January 2013

Time allowed 50 minutes

For this paper you must have:
- Results tables and charts or graphs from your investigation
- A copy of the pooled class results
- The Secondary Data Sheet
- Your Candidate Research notes
- A pencil and ruler

You may use a calculator

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in **Section 2** in the spaces provided. You may use extra paper.
- 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 this paper 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 ☑

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 10th April

As part of AQA's commitment to assist students, AQA may make your CAU available on a strictly anonymous basis to teachers, examining staff and students in paper form or electronically, through the Internet or other means, for the purpose of indicating a typical mark or for other educational purposes. In the unlikely event that your CAU is made available for the purposes stated above, you may object to this at any time and we will remove the work on reasonable notice. If you have any concerns please contact cfg@aqa.org.uk

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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 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)

3/3

Reference to bacteria, rather than 'bacterial colonies' would be acceptable here.

All three variables correctly identified.

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)

2/3

There is a clear statement that repeats were not carried out, although the candidate did in fact test each different concentration twice, and states that the results of each of the two trials were similar. There is no reference to specific values from the results.

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

What was the range of this variable? Give the units.

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

Correct range quoted. The values may be given in either order.

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.

Suitable value within the range.

The reason is acceptable.

(3 marks)

3/3

3

1(d) The hypothesis that you were given before you started your investigation was:

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

Do **your** results support this hypothesis?

Explain your answer.

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.

2/3

(3 marks)

The candidate does not quote values from the results, only correctly describing the overall trend within the results. There is no reference to the reducing effect (of increasing disinfectant concentration) at higher concentrations.

1 (e) You researched the results obtained by other people in your class or by your teacher.

Do the results **of others** support the hypothesis?

Explain your answer.

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

1/3

(3 marks)

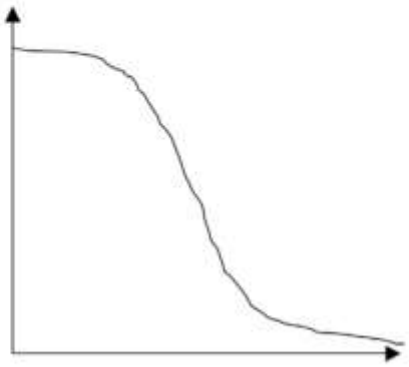
The response indicates the other results support the hypothesis, and the phrase' All the class got the same sort of results' is just sufficient by way of an explanation to allow one mark to be awarded. There is no reference to trends, patterns or specific values.

Turn over ▶

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

2(a) Label the axes and draw a sketch graph of the results in Case study 1.

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



2/2
(2 marks)

The axes are correctly labelled. The units on the x axis are correct, and since the value plotted on the y axis is purely a number, no units are required here. The curve is an appropriate reflection of the data.

2 (b) Explain whether or not the results on the Secondary Data sheet 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.

2/3
(3 marks)

A clear indication that Case studies 1 & 2 support the hypothesis, and a reference to the general trend in both. However there is no reference to the anomaly in Case study 2.

Recognition that Case study 3 is inappropriate along with an explanation as to why it is not.

2 (c) Use Case study **4** to answer this question.

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 Ecoli. Hospitals need to kill MRSA and the new disinfectant hasn't been tried on MRSA

3/3

(3 marks)

Identifies that the advice is not supported

Explains why advice is not supported

Advantage of 'Ger-off'

Identifies further trials that should be done with 'Ger-off'

3 How could the results from your investigation be useful in making sure that food preparation surfaces at home are free of bacteria?

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.

2/3

(3 marks)

Idea from investigation linked to context.

Relates findings from investigation to context. However little detail in explanation.

Further information from research

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.

4/4

(4 marks)

24/30

END OF QUESTIONS

Class results

Group 1 results

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

Group 3 results

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

ISA Data Sheet

Secondary Data Sheet – Controlled Assessment 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 cm^3 per 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.

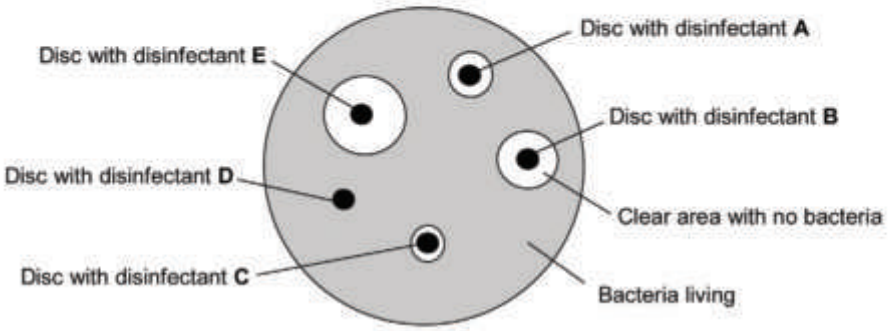
Percentage concentration of hand-wash	Number of bacterial colonies that grew			
	Test 1	Test 2	Test 3	Mean
0	147	151	146	148
25	62	88	63	71
50	36	32	33	34
75	14	18	15	16
100	0	0	0	0

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 manufacturers' 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.

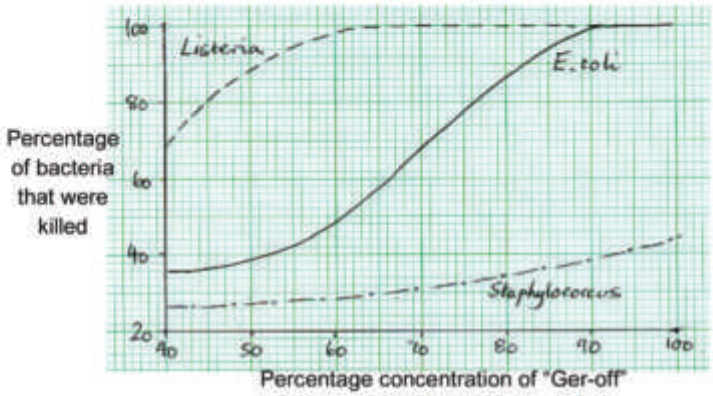


Case study 4

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 Exemplar Mark Guidance

Science ISA – BU1.x Microorganisms (Specimen) for moderation in May 20yy or January 20zz

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 and fasten them together with the results table(s), the graphical work and the candidate's research work from Section 1 of the ISA.

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.

These marking guidelines are necessarily generic. Teachers will be given additional guidance on how to relate these marking guidelines to particular investigations.

Read through the whole of the candidate's answer and use the marking guidelines below to arrive at a 'best-fit' mark. The layout on the ISA has been designed to help the candidate to structure an answer, but it does not matter if the candidate has written part of the answer in what you consider to be the wrong section of a question.

SECTION 1				
Question 1	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response	Two relevant sources are identified	Two relevant sources are clearly identified The usefulness of one of the sources is commented on	Two relevant sources are clearly identified The usefulness of both sources is explained and a comparison made
Additional Guidance	*A clearly identified source is referred to by title and author or for websites at least the name of the web site should be quoted.* *A clear comment on only one of the sources may be sufficient to gain 2 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.*			

SECTION 1				
	0 marks	**1 mark**	**2 marks**	**3 marks**
Question 2	No creditworthy response	A control variable is stated	A control variable is stated Only one value to be investigated in the preliminary investigation is suggested	A control variable is stated The limits of the range to be investigated in the preliminary experiment are appropriate A statement concerning how the results could be used to determine the best value has been made
Additional Guidance	*A suitable method may involve measuring the extent of growth of colonies of bacteria after different time intervals, and then comparing the results.* *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.* *Do* **not** *give full credit to a candidate who describes how to do the entire investigation at this stage.*			

SECTION 1

Question 3

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.

Candidates will be required to use good English, organise information clearly and use specialist vocabulary where appropriate.

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 within a mark band.

0 marks	1, 2 or 3 marks	4, 5 or 6 marks	7, 8 or 9 marks
No creditworthy response	Most of the necessary equipment is stated The method described is weak but shows some understanding of the sequence of an investigation The measurements to be made are stated An appropriate hazard is identified, but the corresponding risk assessment and control measure is weak or absent The answer is poorly organised, with almost no specialist terms and little or no detail given The spelling, punctuation and grammar is very weak	All of the major items of equipment are listed The method described will enable valid results to be collected The measurements to be made are stated and at least one control variable is given Any significant hazards are identified, together with a corresponding control measure but the risk assessment is weak or absent The answer has some structure and organisation, use of specialist terms has been attempted but not always correctly, and some detail is given The spelling, punctuation and grammar is reasonable although there may still be some errors	All of the major items of equipment are listed The method described will enable valid results to be collected The measurements to be made are stated and control variables are clearly identified, with details of how they will be monitored or controlled Any significant hazards are identified, together with an assessment of the associated risks and corresponding control measures The answer is coherent and written in an organised, logical sequence, containing a range of relevant specialist terms used correctly The answer shows almost faultless spelling, punctuation and grammar

Additional Guidance

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.

It may be possible to credit a clearly labelled diagram for some of the marks.

SECTION 1				
Question 4	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response	An alternative method is outlined briefly although some of the necessary steps may not be clear **OR** A 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 although some of the necessary steps may not be clear A suggestion is given as to why this alternative method would not have been as good as the one chosen	An alternative method is outlined in sufficient detail so that the necessary steps are clear A sensible explanation is given as to why this alternative method would not have been as good as the chosen one
Additional Guidance	*Full detailed plans are not required for the alternative method* *Suggestions regarding lack of specific, named equipment are sufficient as a sensible explanation*			

Table for the results			
Question 5	**0 marks**	**1 marks**	**2 marks**
	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
Additional Guidance	*The table should be able to accommodate all of the variables that the candidate is going to measure or record during the investigation. There is no need for the candidate to include columns for repeats, means or derived values.*		

SECTION 2

Question	0 marks	1 mark	2 marks	3 marks
1 (a)	No creditworthy response	Any **one** variable correctly identified	Any **two** variables correctly identified	All **three** variables correctly identified
Additional Guidance	*The independent is the concentration of disinfectant used* *An example of a dependent variable is: the number of colonies of bacteria that grow* *An example of a control variables is: the temperature of incubation*			
Question 1 (b)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response	There is a correct statement regarding whether or not any measurements were repeated There is mention of the presence or absence of anomalous results	There is a correct statement regarding whether or not any measurements were repeated There is reference to either anomalous results or to systematic or random uncertainties	There is a correct statement regarding whether or not any measurements were repeated and a clear indication of which results were repeated There is reference to either anomalous results or to systematic or random uncertainties, and the effects that these would cause
Additional Guidance	*In order to gain maximum marks, the candidate should quote some examples from their results.* *The candidate may refer to a clearly anomalous result that needs repeating, or to the fact that not all the points lie comfortably on a line of best fit (random uncertainties) or to a systematic uncertainty, such as that caused by the background lighting.*			
Question 1 (c)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	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
Additional Guidance	*An appropriate extra reading will usually be one of the following:* • *an intermediate reading to fill in a gap, perhaps where the trend line becomes unclear* • *a reading outside the range already investigated, perhaps to see if the trend continues*			

SECTION 2				
Question 1 (d)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response	A simple statement is made as to whether or not the results support the hypothesis	A simple statement is made as to whether or not the results support the hypothesis and an explanation that includes a simple description of a correctly identified pattern or lack of pattern	A simple statement is made as to whether or not the results support the hypothesis an explanation that includes a detailed description of a correctly identified pattern or lack of pattern
Additional Guidance	*Note that the answer should refer to the candidate's own results, and not simply to the expected result.*			
Question 1 (e)	**0 marks**	**1 mark**	**2 marks**	**3 marks**
	No creditworthy response	A simple statement is made as to whether or not the results of others support the hypothesis	A simple statement is made as to whether or not the results of others support the hypothesis and an explanation is provided using either an example from the other results or a correctly identified pattern	A simple statement is made as to whether or not the results of others support the hypothesis and a detailed explanation is provided using either **two** examples from the other results or correctly identified patterns in the results
Additional Guidance	*Note that the answer should refer to the other results provided, and not simply to the expected result.*			
Question 2 (a)	**0 marks**	**1 marks**	**2 marks**	
	No creditworthy response	Both axes labelled with the variables and units	Both axes labelled with the variables and units **and** an appropriate line drawn	
Additional Guidance	*Accept axes drawn either way round (i.e. it doesn't 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.*			

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

SECTION 2

Question 3	0 marks	1 mark	2 marks	3 marks
	No creditworthy response	An idea from the research has been related to the context	An idea from the research has been related to the context There is a simple explanation of how this idea can be applied and used in the given context	An idea from the research has been related to the context There is a detailed explanation of how this idea can be applied in the given context
Additional Guidance	*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.*			

Graph or chart

Question 4	Answer	Additional Guidance	Mark
	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. Accept axes reversed. It may not always be necessary to show the origin.	**1**
	Y axis: suitable scales chosen and labelled with quantity and units.		**1**
	Points or bars plotted correctly to within ± 1 mm.	Allow one plotting error out of each 5 points/bars plotted.	**1**
	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 3 marks. If the independent variable is: • categoric, a bar chart should be drawn • continuous, a best fit line should be drawn **N.B.** If no line is possible because there is no correlation, candidates should state this on the graph to gain the mark	**1**