

Science A Controlled Assessment

Unit 1: Biology

Exemplar Material of a candidate who scored
30/50 marks

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 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 0.5cm³ and 5cm³
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 10cm³ of the disinfectant into test tube '1'.
3. Remove 5cm³ from test tube '1' into test tube '2'.
4. Add a further 5cm³ of water to test tube '2'.
5. Remove 5cm³ from test tube '2' into test tube '3'.
6. Add a further 5cm³ of water to test tube '3'.
7. Repeat this process to make test tubes '4' and '5'.
8. Remove 5cm³ of solution from test tube 5 and discard it.
9. Add 0.5cm³ 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



ISA Explanation Sheet

This sheet should accompany each ISA

Centre Number	0 0 0 0 7	Date Practical Carried Out	April 2011
ISA Code	B11.x	Name of Teacher	J. Johnson
ISA Title	Microorganisms		

Did the candidates use their own plans?

YES / ~~NO~~

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


Candidate carried out his own practical plan

Any other information:

Teacher Signature: *J Johnson*

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

Research Notes



Centre-assessed work
Candidate Research Notes

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

SCYC
 ASCC
 BLYC
 CHYC
 PHYC

Centre Number *00007* Centre Name *James Bond High School*
 Candidate's Name *R Dettle* Candidate's Number *1001*
 Investigation Title *Microorganisms (specimen)*
 ISA number: *B11x*

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.

J Johnson

R Dettle

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

website http://www.all-science-fair-projects.com/project1203_132_2.html
AQA science from Nelson Thornes

Method(s)

1 Mix water and disinfectant in different amounts (5ml and 15 ml)
Put in small disc of filter paper Add disc to petri dish with bacteria on it
Put in incubator for 2 days. Measure clear circles

2 mix bacteria and different amounts of disinfectant
Spread onto agar jelly Put into incubator
Count number of bacteria after 2 days

Equipment

measuring cylinder, bacteria, test tubes, bunsen burner, loop, filter paper, paper punch, tweezers, petri dish with bacteria on it

Risk assessment issues

Using bacteria can be dangerous, agar must be sterilised, use a safe bacteria like E coil, put the loop in the flame to kill other bacteria, tie hair back near the bunsen put all bags out of the way so you dont fall over

Relating the investigation to the context

You need to make sure there are no bacteria on the kitchen surfaces or you could get food poisoning and die

ISA Section 1

Centre Number	0	0	0	0	7	Candidate Number	1	0	0	1	For Teacher's Use	
Surname	Dettle					Other Names	Richard					
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.											Section	Mark
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.											Section 1 (/20)	13
Candidate Signature	R Dettle					Date	3rd April				Section 2 (/30)	17
											TOTAL (max 50)	30

AQA General Certificate of Secondary Education
June 20xx and January 20xx

Science A (Specimen)

Controlled Assessment ISA BU1.x Microorganisms Section 1

For moderation in May 20xx or January 20xx
Time allowed 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 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 J Johnson Date 3rd April

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

I used the website http://www.all-science-fair-projects.com/project1203_132_2.html and my school science text book, Science from Nelson Thornes

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

The website was the best because it gave me a method for my investigation I only had to change it a bit. My textbook was OK but it didn't give much information about disinfectants, just a lot about bacteria being resistant to antibiotics

2/3
(3 marks)

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

I need to know how long the experiment should be in the incubator for.

Describe **briefly** how you would carry out a preliminary investigation to find a suitable value to use for this variable.

You should also explain how the results of this preliminary investigation will help you to decide on the best value to use.

If I leave it too long the results will be mixed up. If its not long enough I wont see any difference. Set up some discs with disinfectant. Put them in a petri dish with agar and bacteria. Put them in the incubator. Check every day to see how much they grow. When the disinfectant kills a big enough ring of bacteria to measure, that's the best time.

2/3
(3 marks)

The first source is very well referenced, with full URL, although only the name of the website is required to gain credit. The textbook quoted has just sufficient detail for credit, although ideally candidates should give full title and author for texts

The candidate has identified the most useful source. The reason as to why it was the more useful is acceptable. On a best-fit principle, the overall answer is worth 2 out of 3

A suitable control variable is identified (time for incubation). There is some attempt to explain why the variable is important to the investigation and should be controlled. However, details as to how the best value to use for the variable should be chosen are unclear

3

Do not write
outside the
box

- 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

Get all your equipment together. This is Petri dishes with agar in them (sterilised), test tubes, E. coli culture, filter paper, hole puncher, tweezers, Bunsen burner, measuring cylinder, marker pen, disinfectant, loop.

Measure out 5ml of disinfectant in a test tube, put 15ml of water with it.

Measure out 10ml of disinfectant and put 10ml of water with it.

Measure out 15ml of disinfectant and add 5ml of water. Put 20ml of disinfectant into another test tube, then 20ml of water in another. Label all the tubes.

Put the loop in the flame until its red, then take it out to cool. Dip it in the bacteria tube and spread it over the agar jelly. Keep the lid on all the time.

Punch some holes out of the filter paper then dip one into the first test tube. Put it on the jelly in the dish. Do this for four more pieces of filter paper. Put one hole in each tube, then add it to the dish spread out.

Put sellertape on the lid of the dish and put your name on it.

Put it in the incubator for two or three days.

A reasonable attempt to describe soaking the discs in disinfectant solution and putting onto the agar jelly

The list of apparatus is fairly comprehensive, although lacks details of sizes of eg the measuring cylinder

Control variable... volume of mixture

An acceptable interval of concentrations has been suggested. The range is the highest possible. It is not clear how the tubes should be labelled (name or contents)

Inoculating the plate with the safe bacteria is described, but it would be difficult for someone else to follow, 'Spred (sic)' is not clear and keeping the lid on all the time would be impossible. Candidates may give their steps in numbered order if it helps organisation, however sentence construction and punctuation remain important

Safety precaution identified, but no explanation as to why it is important

Turn over ►

Look to see which bit of filterpaper has the biggest space round it where the bacteria aren't growing. You could measure how wide the spaces are for each piece of fliter paper.

Not a clear description. A diagram may have helped
Identification of what measurements to take, but not really clear

This is a fair test because all the filter papers are the same size, I've used the same bacteria and they've been in the same dish so they get the same conditions.

Details of how it will be fair, though specific conditions could have been given

You have to be careful with bacteria because you can catch diseases. Don't touch them with your fingers. Keep the lid of the dish shut. Tape it up and dont open it again. Get rid of the dish afterwards by burning it.

Safety issues

A number of technical terms are used appropriately. There are some errors in spelling 'fliter paper', 'testubes', 'spred', 'sellertape', missing apostophes. Punctuation and sentence construction is generally good.

6/9

(9 marks)

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 added different amounts of disinfectant to bacteria in test tubes, then put samples onto agar jelly. I would of put this in the incubator and seen how many bacteria grew.

I didn't do this because I found the method I did on the internet and it seemed OK.

1/3

(3 marks)

Brief description of an alternative method but lacking clarity or detail, this might for example have been a method the candidate experienced in class or found outlined in texts or on the internet

No attempt to explain why the chosen method was better than the alternative

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 two marks for your table.

(2 marks)

<i>Amount of disinfectant in ml</i>	<i>Amount of water in ml</i>	<i>Width of space round the filter paper (cm)</i>

2/2

'Amount' is just about acceptable for 'volume'. 'Width of space' is not really clear in terms of what will be measured, but it is reasonable to believe the candidate is referring to diameter of inhibition circle. The table gives no indication of the concentration of disinfectant but with both columns for 'amount' there is just sufficient to accept. Appropriate units are given.

END OF SECTION 1

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13
20

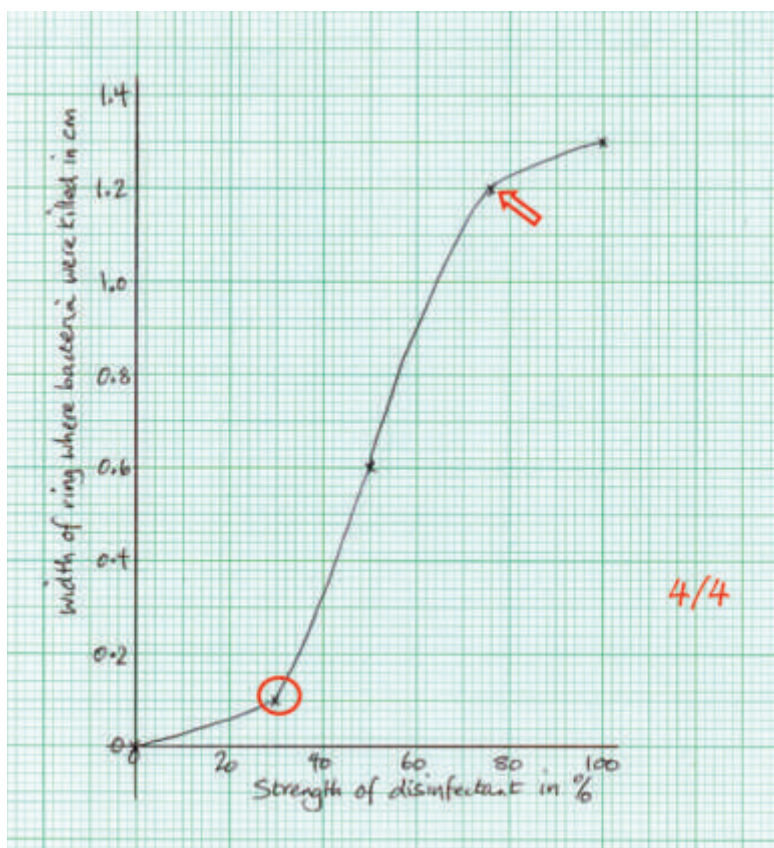
Table and graph for Section 2 of the ISA

Results table for disinfectant investigation:

Name *Richard Dettle* *11Z*

% concentration of disinfectant	Width of circle where bacteria were killed in cm
<i>0</i>	<i>0.0</i>
<i>25</i>	<i>0.1</i>
<i>50</i>	<i>0.6</i>
<i>75</i>	<i>1.2</i>
<i>100</i>	<i>1.3</i>

Richard Dettle Form 11Z Disinfectant graph



One of the plots (25,0.1) is incorrect. However the mark guidance indicates that one error out of every five plots is acceptable.

The minor plot error at (75,1.2) is within tolerance (1mm) and should not be treated as a plotting error

ISA Section 2

Centre Number	0 0 0 0 7	Candidate Number	1 0 0 1	For Teacher's Use	
Surname	Dettle		Other Names	Richard	
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.				Section	Mark
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.				Section 1 (/20)	13
Candidate Signature	R Dettle		Date	8th April	
				Section 2 (/30)	17
				TOTAL (max 50)	30

AQA General Certificate of Secondary Education
June 20xx and January 20xx

Science A (Specimen)

Controlled Assessment ISA BU1.x Microorganisms Section 2

For moderation in May 20xx or January 20xx

Time allowed 50 minutes

For this paper you must have:

- results tables and charts or graphs from your investigation
- a copy of the results of others
- 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 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

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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 *J Johnson* Date *16th April*

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2

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 the disinfectant*

The dependent variable was *how wide a space there was round the filterpaper with disinfectant*

One control variable was *how long it was left in the incubator*

3/3
(3 marks)

All three variables suitably identified. 'How wide a space' is acceptable here as indicating the diameter of the zone of inhibition.

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 didnt do any of my results again. The results are what I expected they show a nice pattern and a good graph. I didnt have time to do them again anyway because it takes three days in the incubator

1/3
(3 marks)

There is a clear statement regarding repetition. This is not enough to indicate that there are no anomalous results. the reference to lack of time is not appropriate here.

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

What was the range of this variable?

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

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 would have done 60% strength. Because this is where the difference gets interesting because theres a lot of change

2/3
(3 marks)

The correct range and units are given. The values could have been quoted in the opposite order.

An appropriate value is suggested, however the reason for its choice is not clear.

3

Do not write outside the box

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. The graph I drew shows that if the strength of the disinfectant is stronger it means that more bacteria are killed

2/3

(3 marks)

The response correctly indicates that the hypothesis is supported. A simple directional pattern is stated, thus developing the hypothesis.

1 (e) You have been given a set of results obtained by other people
 Do these other results support the hypothesis?
 Explain your answer.

Yes. Because in both results tables, the results show the same pattern as mine

1/3

(3 marks)

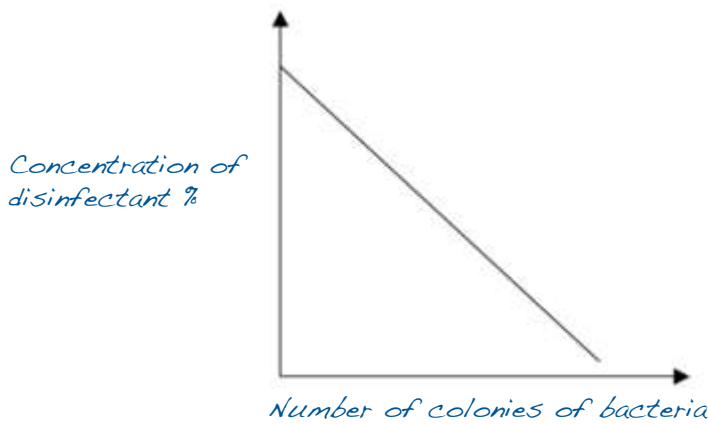
Correctly identifies that the additional results support the hypothesis. However there is no further amplification.

Turn over ►

4

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.



1/2

(2 marks)

The axes are correctly labelled (the orientation of the axes is not important) however the trend line does not match the data in Case study 1.

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

Do the results in Case studies 1, 2 and 3 support or not 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 on the sheet do support the hypothesis. You can see this because when the strength of the disinfectant is stronger in case Study 1 there is less bacteria. This is the same in case study 2.

I'm not sure about Case Study 3 because it has different disinfectants, but you can still see that the bacteria grow more for some disinfectants. Perhaps they had different concentrations because the results look like my experiment.

1/3

(3 marks)

There is little detail to this response. A simple statement is made about Case study 1, and repeated for Case study 2. However no reference is made to the anomaly; the loose reference to Case study 3 being inappropriate is insufficiently clear and shows a lack of understanding.

5

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.

Geroff is a new disinfectant. It kills different sorts of bacteria differently. It is really good at killing listeria. Perhaps hospitals have a lot of listeria. It kill Ecoil as well but not so good. Its not very good at killing stapyllococcus.

1/3

(3 marks)

The candidate has clearly used the graph however has not come to any conclusions and has not indicated whether he is in agreement with the advice.

3 Think about the context that you were given for this investigation

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.

You have to make sure you have your disinfectant strong enough. If you don't you might get ill. There are lots of germs around the kitchen. The makers put insturctions on the bottle. Always follow the insturctions.

1/3

(3 marks)

The candidate recognises that the concentration of disinfectant is important and explains why it is important to remove bacteria from work surfaces. The reference to following the 'insturctions'(sic) is insufficient for additional credit

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)

END OF QUESTIONS

17
-
30

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Class results

Group 1 results

% concentration of disinfectant	Width of circle where bacteria were killed in cm
0	0.1
20	0.3
40	0.7
60	1.4
80	1.6
100	2.0

Group 3 results

% concentration of disinfectant	Width of circle where bacteria were killed in cm
0	0.0
10	0.0
20	0.2
30	0.3
40	0.5
50	1.1
60	1.4
70	1.4
80	1.6
90	1.8
100	1.8

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.

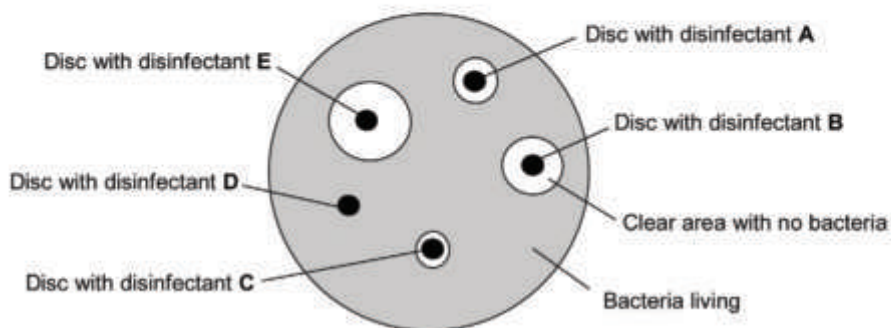
Percentage concentration of hand-wash	Number of bacterial colonies that grew			
	Test 1	Test 2	Test 3	Mean
0	147	151	146	148
25	62	88	63	71
50	36	32	33	34
75	14	18	15	16
100	0	0	0	0

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.

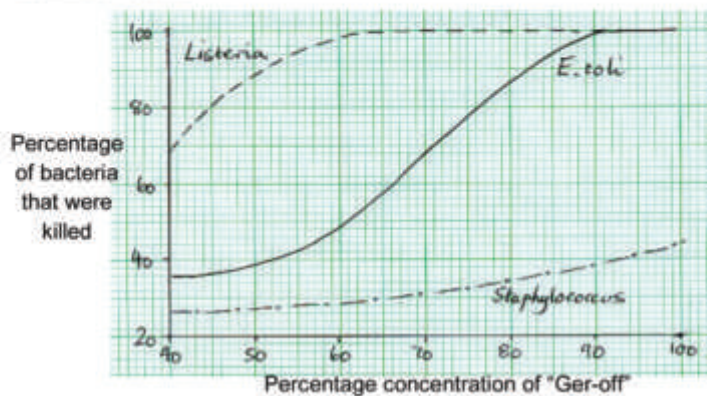


Case study 4

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 largely 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	0 marks	1 mark	2 marks	3 marks
1	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	<p><i>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.</i></p> <p><i>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.</i></p> <p><i>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.</i></p>			

SECTION 1				
	0 marks	1 mark	2 marks	3 marks
<p>Question</p> <p>2</p>	<p>No creditworthy response</p>	<p>A control variable is stated</p>	<p>A control variable is stated</p> <p>Only one value to be investigated in the preliminary investigation is suggested</p>	<p>A 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 results could be used to determine the best value has been made</p>
<p>Additional Guidance</p>	<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> <p><i>Do not give full credit to a candidate who describes how to do the entire investigation at this stage.</i></p>			

SECTION 1

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.

Question

3

0 marks	1, 2 or 3 marks	4, 5 or 6 marks	7, 8 or 9 marks
No creditworthy response	<p>Most 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 spelling, punctuation and grammar is very weak</p>	<p>All of the major items of equipment are listed</p> <p>The method described will enable valid results to be collected</p> <p>The measurements to be made are stated and 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 spelling, punctuation and grammar is reasonable although there may still be some errors</p>	<p>All of the major items of equipment are listed</p> <p>The method described will enable valid results to be collected</p> <p>The measurements to be made are stated 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>

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	<i>Full detailed plans are not required for the alternative method Suggestions regarding lack of specific, named equipment are sufficient as a sensible explanation</i>			
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	<i>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.</i>			

SECTION 2				
Question 1 (a)	0 marks	1 mark	2 marks	3 marks
	No creditworthy response	Any one variable correctly identified	Any two variables correctly identified	All three variables correctly identified
Additional Guidance	<p>The independent is the concentration of disinfectant used</p> <p>An example of a dependent variable is: the number of colonies of bacteria that grow</p> <p>An example of a control variables is: the temperature of incubation</p>			
Question 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</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 uncertainties</p>	<p>There is a correct statement regarding whether or not any measurements were repeated and a clear indication of which results were repeated</p> <p>There is reference to either anomalous results or to systematic or random uncertainties, and the effects that these would cause</p>
Additional Guidance	<p>In order to gain maximum marks, the candidate should quote some examples from their results.</p> <p>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.</p>			
Question 1 (c)	0 marks	1 mark	2 marks	3 marks
	No creditworthy response	<p>At least one end of the range is correctly stated</p> <p>Another value of the independent variable is suggested, although it may not be appropriate</p>	<p>The range is correctly stated, according to the candidate's own results</p> <p>Another appropriate value of the independent variable is suggested</p> <p>The reason for the additional value is unclear or inappropriate</p>	<p>The range is correctly stated, according to the candidate's own results</p> <p>Another appropriate value of the independent variable is suggested</p> <p>The reason for the additional value is clear and appropriate</p>
Additional Guidance	<p>An appropriate extra reading will usually be one of the following:</p> <ul style="list-style-type: none"> • 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	<i>Note that the answer should refer to the candidate's own results, and not simply to the expected result.</i>			
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	<i>Note that the answer should refer to the other results provided, and not simply to the expected result.</i>			
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	<i>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.</i>			

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	<p>An example of a clear statement for Case study 1 is "the greater the concentration, the fewer colonies/bacteria grow".</p> <p>Further explanation for Case study 2 could include reference to the variation in results between the two tests</p> <p>Further explanation for Case study 3 will be that that results are based on type of disinfectant rather than concentration</p>			
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	<p>Examples of advantages include: "all <i>Listeria</i> will be killed (at 90% concentration)" or "All <i>E.coli</i> (probably) killed (at 90% concentration)"</p> <p>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"</p>			

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	<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			
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.	1
	Y axis: suitable scales chosen and labelled with quantity and units.	It may not always be necessary to show the origin.	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: <ul style="list-style-type: none"> • 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