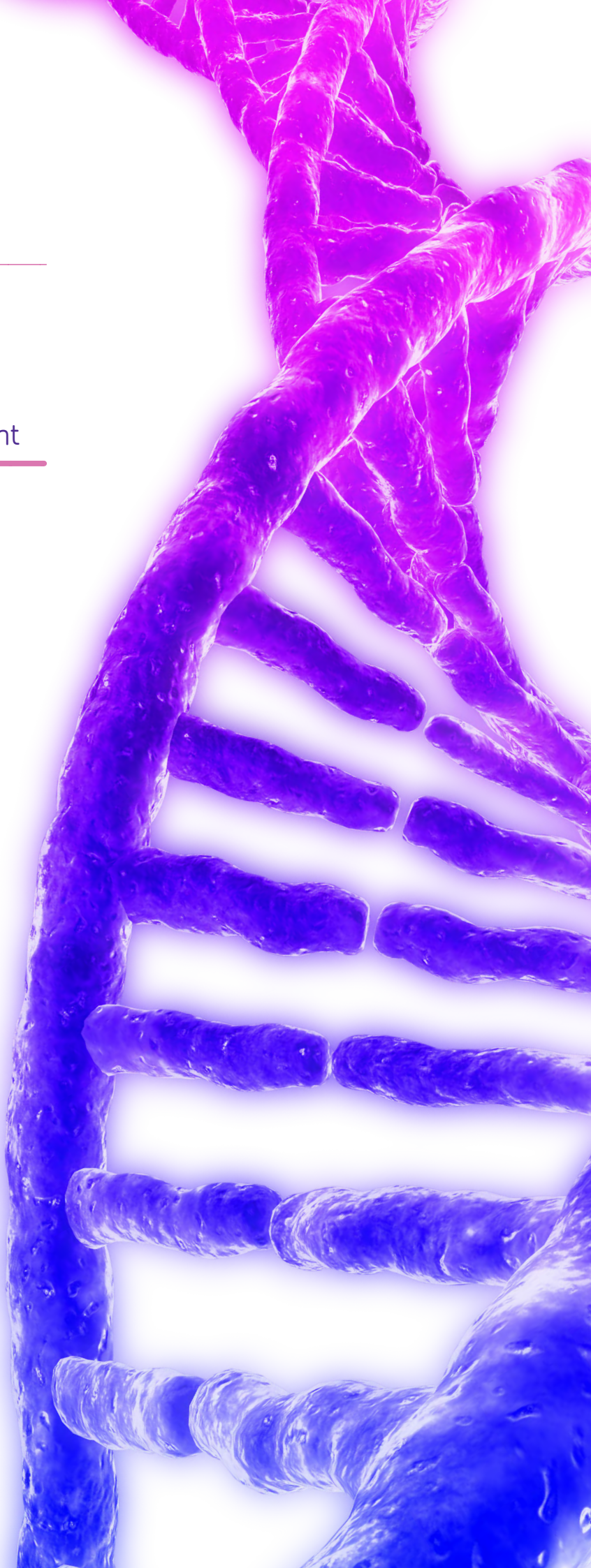

GCSE SCIENCES

Guidance on controlled assessment



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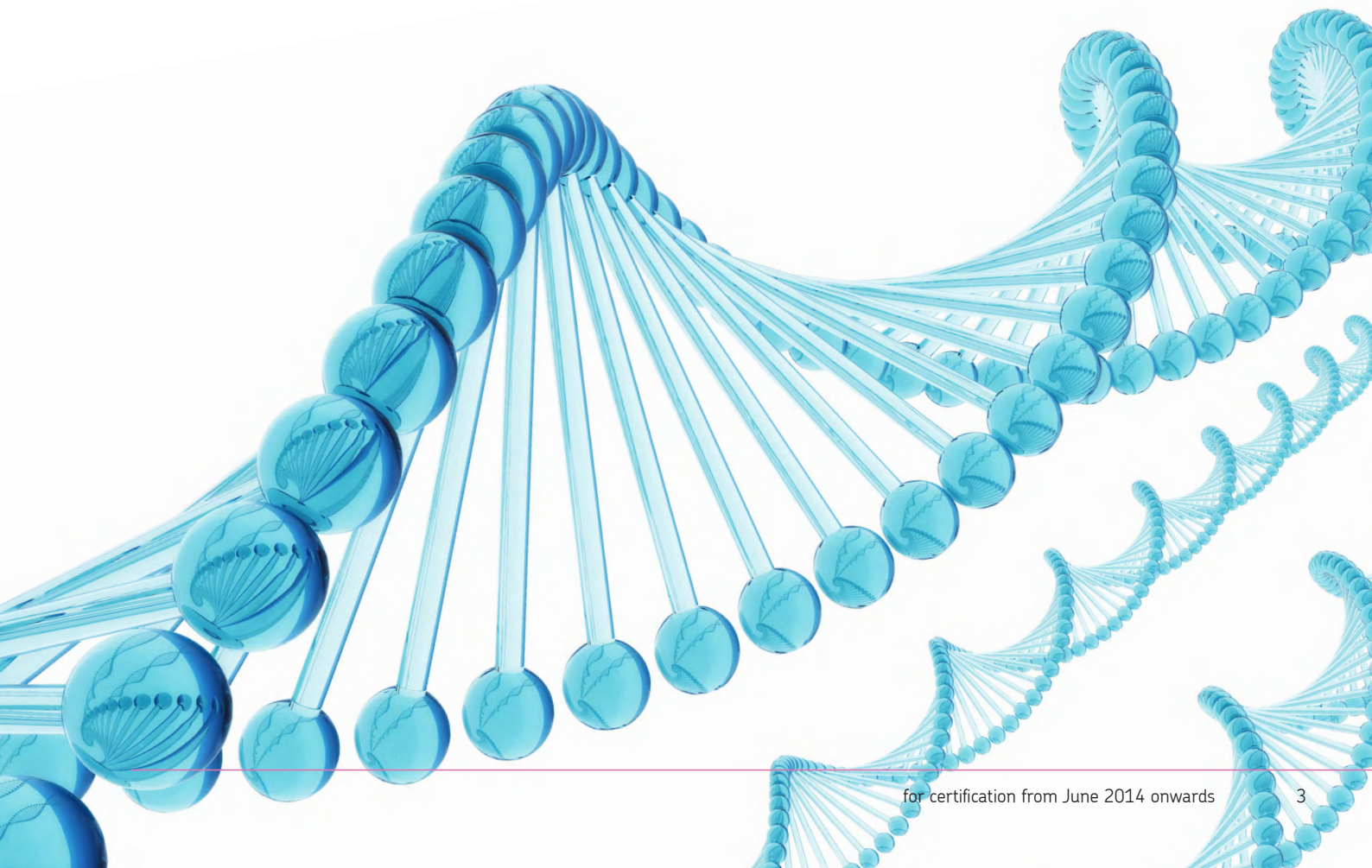
Introduction

In this guide, we're providing detailed support and advice on how to prepare, sit and assess controlled assessment for the following AQA GCSE Science specifications:

- **Science A**
- **Additional Science**
- **Biology**
- **Chemistry**
- **Physics**
- **Science B**
- **Further Additional Science**

To help you understand the changes, we've provided step-by-step instructions about the controlled assessment process and outlined what is expected of your candidates.

At each step, you will see candidate exemplar material to clearly show the new controlled assessment process.



The controlled assessment process

Controlled assessment consists of three stages.

Stage 1

Task setting – All controlled assessments are set by AQA and will be available for submission in the June examination series of each year.

Stage 2

Task taking – A description of how candidates carry out the tasks and the conditions under which assessment takes place is illustrated below:

Stages of task	Level of control	Description
Research and data collection	Limited control – limited supervision	Candidates can work unsupervised and outside of the classroom. Candidates will carry out practical work under supervision.
Writing, analysis, evaluation and review	High level of control – formal supervision	Candidates work individually to complete their reports under conditions of high control at the centre and under direct, formal supervision.

Stage 3

Task marking – Tasks are internally marked, using the mark guidance supplied by AQA and externally moderated by an AQA moderator.

Levels of control

Each of the three stages has a level of control to ensure reliability and authenticity and to make assessments more manageable for teachers and candidates.

Levels of control for GCSE Science are explained below:

Limited control – with low level limited supervision

- Candidates can complete work without direct supervision, outside of the classroom. This work will not contribute directly to assessable outcomes.
- Candidates can access resources and work in groups.
- Teachers can provide limited guidance to candidates.

High level of control – formal supervision

- Candidates must be in direct sight of the teacher at all times.
- Use of resources is tightly prescribed.
- Candidates must not communicate with each other.
- Candidates must complete all work independently.
- No assistance can be given to candidates.

Getting started

For AQA GCSE Science A, Additional Science, Biology, Chemistry, Physics and Further Additional Science, the controlled assessment takes the form of an Investigative Skills Assignment (ISA). For Science B, the controlled assessment (Using Practical and Investigative Skills) takes the form of a contextualised investigation based on a unit from the specification.

To get started, you need to:

1 – Read the teachers' notes

Each year, AQA will issue centres with a set of teachers' notes on e-AQA. These will contain details of the experiments that may be used for the controlled assessment for that year. Under the new criteria, each controlled assessment is only operational for a 12 month period. However, AQA will release the teachers' notes, and other related material one year before its operational period. This should enable more flexibility for centres, but centres should be aware of the fact that a controlled assessment cannot be submitted for moderation before its operational period.

2 – Choose a controlled assessment task from e-AQA

Controlled assessment tasks are available on e-AQA.

<https://extranet.aqa.org.uk>

Please check the front of the ISA materials to ensure that they are valid for the subject and series for which you intend to use them.

3 – Understand the new criteria and what candidates need to complete

Your science candidates will need to:

- 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.

Your Additional Science, Separate Science and Further Additional Science candidates will also need to:

- develop hypotheses.

Each year, AQA will supply:

- one ISA each for Units B1, C1 and P1. These may only be used for Science A
- one ISA each for Units B2, C2 and P2. These may only be used for either Additional Science or the Separate Sciences
- two ISAs each for Units B3, C3 and P3. These may be used for the Separate Sciences
- only one of each of the ISAs for Units B3, C3 and P3 may be used for Further Additional Science
- three controlled assessments for Science B (one for each unit).

Step-by-step guides

These step-by-step instructions are a guide for completing controlled assessment for:

- **Science A**
- **Additional Science**
- **Biology**
- **Chemistry**
- **Physics**
- **Further Additional Science**

To get started, choose an Investigative Skills Assignment (ISA) from the teachers' notes on e-AQA. Teachers should then:

- explain to the candidates the context of the investigation
- explain to the candidates the nature of the problem to be investigated
- provide the hypothesis supplied by AQA (Science A only)
- follow the six steps below on completing an ISA.

Step 1 – Planning (limited control)

- Candidates are given the opportunity to carry out an investigation.
- They need to research and identify one or two methods that could be used, depending on the ISA.

Helpful hints:

- candidates may use technology such as the internet or CD-ROMs for their research, textbooks or any other appropriate sources of information
 - candidates should research the context of the investigation
 - candidates should research a method or methods for the experiment. This should include a risk assessment
 - candidates can create one A4 side of their own research notes to use in step 2 and step 5. This should be done on the candidate research notes sheet provided by AQA.
-

Step 2 – Reporting on the planning research (high control)

- Candidates will need to produce a blank table ready for the results of the investigation. This may be produced at the same time as the candidates are answering section 1 of the ISA, or at any other convenient time prior to the practical work being carried out.
- Candidates will be given section 1 of the ISA to answer.
- They will need to work on their own and under controlled conditions to answer it.
- Candidates can use their own candidate research notes.
- Section 1 is a 45 minute written test with 20 marks available.

Helpful hints: before undertaking section 1, make sure your candidates know:

- the context of the investigation and how it might be applied in real life
- key words such as ‘hypothesis’
- what ‘variables’ in an investigation they need to consider and manage
- different ways to test a hypothesis
- how to write a detailed plan of a chosen method
- possible hazards and risks and how to minimise them
- different tables that are used to record results.

Step 3 – Practical work (limited control)

- Candidates perform the practical experiment either individually or in groups.
- Candidates may, depending on circumstances, use the method that they have planned or a method provided either by the teacher or by AQA.

Helpful hints:

- if a teacher decides that the method produced by the candidate(s) is unworkable, unsafe or unmanageable, then a method may be provided
- AQA will supply a method that may be used in such circumstances or the teacher may provide one
- after a candidate has submitted his or her own blank table, teachers may supply a blank table in which candidates can record their results.

Step 4 – Processing primary data (high control)

- Candidates will be required to draw a graph or bar chart of their results.

Helpful hints:

- candidates may use a computer to create their graph but this must be done under the direct supervision of the teacher and must be printed straight away
- for this part of the investigation candidates must work individually under direct supervision.

Step 5 – Analysing results (high control)

- Candidates will be given section 2 of the ISA, which will include questions concerning conclusions and evaluation.
- Section 2 is a 50 minute written test with 30 marks available.

Helpful hints: – before undertaking section 2, make sure your candidates know:

- how to analyse results and draw conclusions
- how to match results to a hypothesis
- how to evaluate the method of collecting data and the quality of the results
- how to analyse secondary data.

Step 6 – Marking the ISA

- Section 1 and section 2 of the ISA are marked internally using the marking guidelines supplied by AQA.
- Marking should be done in red ink, and annotations made where necessary to show the moderator the reasons for the decisions.

Helpful hints:

- candidates may improve their marks by carrying out another controlled assessment appropriate to that subject, but not the same one that has already been completed
- if more than one controlled assessment has been completed, submit the one with the highest mark.

Key points

- To view the teachers' notes make sure you have access to e-AQA.
- If not, register at <https://extranet.aqa.org.uk>
- You will be provided with your own controlled assessment adviser. Contact details for your adviser can be found in teacher online standardisation, on e-AQA.
- For units 2 and 3, the candidates must supply their own hypothesis.
- If you have any questions about the ISA, call the GCSE Science subject team on **01483 477 756** or email science-gcse@aca.org.uk.

Administration: teachers' notes

Controlled Assessment – Science A ISA BU1.x Microorganisms (Specimen)

For moderation in May 20xx

Teachers' Notes

This ISA relates to Science A Section B1.1.2 Keeping Healthy

Topic of investigation

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

Overview

Candidates should:

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

Candidates should be given the hypothesis:

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

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

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

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

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

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

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

Risk Assessment

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

Administration: teachers' notes

Stage 1 – Planning (Limited control)

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

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

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

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

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

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

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

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

For this stage, candidates must work individually under direct supervision

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

Section 1 will require candidates to:

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

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

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

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

Administration: 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.
- if the candidate carries out an investigation from a method provided by the teacher, or the teacher prefers that the candidate use a particular format - in which case the candidate would be able to score full marks for producing their own table.

Stage 4 – Processing primary data (High control)

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

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

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

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

Stage 5 – Analysing results (High control)

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

AQA will provide a Secondary Data Sheet

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

Candidates should be given Section 2 of the ISA.

They should also be given:

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

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

Any candidate who does not take part in the practical; work cannot score any marks for Section 2 of the ISA.

Administration: teachers' notes

Section 2 will require candidates to:

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

Controlled assessment in detail

Step 1 – Planning

The discussion session

- After the teacher has chosen the controlled assessment task, the teacher should then explain to candidates the nature of the problem to be investigated.
- In unit 1 ISAs for Science A, the teacher will give the candidates a hypothesis which has been supplied by AQA.
- In unit 2 and 3 ISAs, candidates must supply their own hypothesis.

Research (limited control)

- After the discussion session, candidates should be told to research one or two possible methods of carrying out the investigation. Whether it is one or two will depend on the particular ISA. This could be done as a homework session.
- They will also need to research the context that has been set and any health and safety issues with the method(s).
- They will be allowed to make notes on one side of A4, which they will take into section 1 and 2 of the ISA. AQA will provide a candidate research notes sheet on e-AQA which must be signed by both the candidate and the teacher.
- The use of web sites for research by students is permitted. However, there have been occasions when a third party has posted on the internet a copy or close version of the AQA suggested method from the Teachers' Notes. If you or your students come across such a web site, then you should:
 - notify AQA so that we may ask that the website be taken down
 - not permit your students to use the website for their research.

Key points

- Collectively candidates could produce a huge variety of methods to perform their practical work. If the teacher decides that the method produced by the candidate(s) is unworkable, unsafe or unmanageable, then the teacher may provide a method.
- AQA will supply a method that may be used in such circumstances which teachers can adapt to their own programme of study. Alternatively, teachers may provide their own method.
- If the teacher provides the candidate with a different method, the worksheet for this method may be given to the candidate for use with section 2 of the ISA.
- Teachers should always complete an ISA explanation sheet.
- The candidate's research notes sheet, of which an example can be found on the following page, will be used by the candidate for both of the written sections of the ISA.

Step 1 – Planning



Controlled Assessment Candidate Research Notes

For use with: GCSE Science A Route 1 (4405) GCSE Science A Route 2 (4406)
Additional Science Route 1 (4408) Additional Science Route 2 (4409)
Further Additional Science (4410)
Biology (4401) Chemistry (4402) Physics (4403)

SCA4P ☒ AS4P ☐ BL4P ☐ CH4P ☐ PH4P ☐ FAS4P ☐

Centre number 98765 Centre name The Blue School Thetford

Candidate's full name Jay S Flude Candidate number 1234

Investigation Title
Microorganisms (specimen)

ISA number
BU1.X

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

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

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

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

Declaration

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

Sally Avalon
Teacher signature

Jay S Flude
Candidate signature

Date 21st April

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Step 1 – Planning

Hypothesis <i>The survival and growth of microorganisms depends upon the concentration of disinfectant.</i>
Research sources <i>1. AQA Science by Jim Breithaupt, Ann Fullick, Patrick Fullick published by Nelson Thornes</i> <i>2. Internet http://www.selah.k12.wa.us/SOAR/SciProj2003/CharleyW.html</i>
Method(s) <i>1. Mix different amounts of disinfectant and water(5cm³). Add bacteria(1cm³). Leave for 5 minutes. Spread onto agar (heat loop). Incubator. Count colonies.</i> <i>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.</i>
Equipment <i>Disinfectant, water, bacteria, clock pipettes, loop, incubator, tape</i>
Risk assessment issues <i>sterilise loop,</i> <i>tape up the dish</i> <i>don't open dish</i>
Context: Cleaning kitchen surfaces. Relating the investigation to the context <i>Cleaning kitchen surfaces is important or you can pass bacteria from food like meat to bread when your making sandwiches. Chicken has salmonella and you can get bad food poisoning. So you have to use disinfectant strong enough to kill the bacteria or you might die.</i> <i>Bottle of disinfectant under the sink in our kitchen says it kills 99% of all known germs.</i>

Step 2 – Reporting on the planning and research

Blank table for the results (high control)

- Just as in the previous specification, candidates will be required to independently produce a blank table for their results. The table should be able to accommodate everything that the candidate is going to measure and record during the investigation. The table should include appropriate headings and units.
- After the candidate has produced a table, the teacher will mark the blank table. When the table has been marked, the teacher may return it to the candidate to use in the investigation. Alternatively teachers may supply a blank table in which candidates can record their results.

Section 1 of the ISA (high control)

- Candidates take section 1 of the ISA written test. Up to 45 minutes is allowed for this. The test may be taken in the normal teaching room, provided that candidates can be accommodated in such a way as to prevent any copying or unauthorised collaboration.
- Any access arrangements that apply to individual candidates for written papers, eg extra time for statemented candidates, or the use of a scribe or a reader will also apply to the ISA. Section 1 of the ISA will contain questions about the methods that candidates have researched and is worth 20 marks of the overall 50 allocated to the controlled assessment.
- Each candidate may use their candidate research notes sheet made during their research.

Risk assessment

- Section 1 will also contain questions about the hazards and risks associated with the researched methods.

Key points

- Candidates will need to carry out a risk assessment in order to be able to answer some of the questions in section 1.
- Make sure your candidates know key words such as 'hypothesis' and 'variables'.

Step 2 – Reporting on the planning and research

Centre Number	9	8	7	6	5	Candidate Number	1	2	3	4	For Teacher's Use	
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 4 th 2011					
											Section	Mark
											Section 1 (/20)	
											Section 2 (/30)	
											TOTAL (max 50)	



General Certificate of Secondary Education
June 20yy

Science A

(Specimen)

SCA4P/BU1.X

Controlled Assessment ISA BU1.x Microorganisms

Section 1

For moderation in May 20yy

You will need

- Your Candidate Research notes
 - A pencil and a ruler
- You may use a calculator.

Time allowed

- 45 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer all questions in the spaces provided
- Do not write outside the box around each page or on blank pages.
- Do all rough work in this book.
- Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for Section 1 is 20.
- The maximum mark for the Controlled Assessment Unit is 50
- You are reminded of the need for good English and clear presentation in your answers.

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 teacherSally Avalon..... DateApril 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 cfg@aqa.org.uk

To see how AQA complies with the Data Protection Act 1988 please see our Privacy Statement at aqa.org.uk

Step 2 – Reporting on the planning and research

2

Do not write
outside the
box

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

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

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>

Compare the usefulness of the two sources.

[3 marks]

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.

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

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

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

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

[3 marks]

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.....

Comments - Q1

- A website has been quoted, and the reference to the book is sufficiently detailed with title and author.
- The comparison of the two sources is just sufficient to enable the award of 3 marks.

3 marks

Comments - Q2

- A suitable control variable has been identified.
- Values for the control variable are given. However what "0.1 cm³ of bacteria" would represent is unclear.
- It is not clear what is meant by the last sentence. A diagram may have helped.
- On balance 2 marks is appropriate here.

2 marks

Step 2 – Reporting on the planning and research

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.

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

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

[9 marks]

Equipment:

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

Plan:

1. Use a pipette to measure out 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 pipette 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.

Continue your answer on the next page

Turn over ►

Step 2 – Reporting on the planning and research

4

Do not write
outside the
box

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.*

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.

Risk assessment:

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

Comments - Q3

- The equipment list omits step 4.
- On step 3 of the method, 'solution' the candidate is neat culture, but the candidate bacteria + disinfectant mixture (steps 1 & 2).
- Taping the lid of the dish.
- In step 7, there is no indication in the equipment list. Some volumes, time) but others.
- Step 8 identifies measure.
- The method allows the candidate

Comments - Q3

- The equipment list omits a Bunsen burner, referred to in step 4.
- On step 3 of the method, 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).
- Taping the lid of the dish is an appropriate safety measure.
- In step 7, there is no indication of temperature either here or in the equipment list. Some control variables identified (eg volumes, time) but others omitted (eg temperature).
- Step 8 identifies measurements to be made.
- The method allows the collection of valid results.
- The answer is coherent and uses a range of specialist terms.
- 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.
- 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.
- 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 candidate and would give valid results. The candidate also indicates replication (to improve the quality of results) though does not refer to repeatability.

7 marks

Step 2 – Reporting on the planning and research

5

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

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

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

[3 marks]

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.

.....

.....

.....

- 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]

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			

END OF QUESTIONS

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Comments – Q4

- An alternative method is outlined briefly. There is no specific detail (although full procedures are not required). It would be difficult for anyone to follow this.
- Two suggestions are given as to why the method would not be as good as the chosen one.

2 marks

Comments – Q5

- 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 marks

20

Total for Section 1: 16

Step 3 – Practical work

The practical work (limited control)

- Candidates may use the method that they have chosen and planned.
- If the teacher decides that the method produced by the candidate(s) is unworkable, unsafe or unmanageable, then the teacher may provide a method.
- AQA will supply a method that may be used in such circumstances.
- The marking guidelines supplied by AQA will provide teachers with indicators as to how marks will be awarded based on the methods candidates choose.
- There is no specified time limit for the practical work, although it is anticipated that most experiments should be capable of being completed within a one hour lesson. If necessary however, the experiment may be continued over a number of lessons. Any paperwork, eg result tables, should/must be collected in at the end of the first lesson, and returned to the candidate at the start of the next lesson.
- In some ISAs it will be necessary for the teacher to pool the results of the class. This is so that each candidate may be allowed to see the results of others in order to better evaluate them and form a conclusion. In cases where there is only a single candidate, then the teacher's own results may be used for comparison.

Key points

- As before, it is possible that candidates, based on their research, will be carrying out a variety of different methods. Where this occurs, or where candidates' methods are deemed to be unworkable, unsafe or unmanageable, teachers can provide their own material or the method given by AQA.
- Where the methods generated are unworkable, unsafe or unmanageable then the AQA marking guidelines will dictate how marks are apportioned and will take into account experiments which are scientifically accurate but not possible due to circumstances such as lack of equipment.
- Even if a candidate does not go on to carry out his or her plan for the experiment, that candidate may still be awarded up to maximum marks for the written plan in section 1 of the ISA.
- In a unit 2 or unit 3 ISA, it may be necessary to give the candidate a different hypothesis. This is because the new method may not be capable of testing the candidate's original hypothesis.

ISA explanation sheet



ISA Explanation Sheet

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

Centre Number	9	8	7	6	5	Date Practical Carried Out
---------------	---	---	---	---	---	----------------------------

ISA Code	PUI.x	ISA Title
----------	-------	-----------

Name of Teacher	G. Fisky
-----------------	----------

Independent variable	Dependent variable
----------------------	--------------------

Did you make any changes to the suggested method?

YES / NO

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

30 candidates in the group produced about a dozen different methods. Which I considered unmanageable. So we used the AQA method.

PUI.x
Domestic hot water tanks

Any other Information:

Teacher Signature: G. Fisky

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

Step 3 – Practical work



Controlled Assessment Method Sheet

Science A - BU1.x

Microorganisms (Specimen)

This method could be used to investigate the following hypothesis:

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

You will need to prepare a table for the results.

Equipment:

Nutrient broth pre-inoculated with safe bacteria (labelled "safe bacteria")

5 test tubes

Syringes or other means of measuring volumes of 0.5cm^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, and then place them in the incubator at 25°C for 2 – 3 days.
12. After 2 – 3 days count and record the number of colonies of bacteria on each agar plate.

Step 4 – Processing primary data

Drawing the graph or bar chart (high control)

- Candidates will be required to draw a graph or bar chart of their results.
- Examples of marking guidelines for the graph/bar chart can be found towards the end of this document. Candidates may be awarded up to 4 marks for an appropriate bar chart or line graph.

Key points

Computers and information technology can be used to generate the line graph or bar chart but this must be done under direct supervision of the teacher.

Step 4 – Processing primary data

6

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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

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

Turn over ►

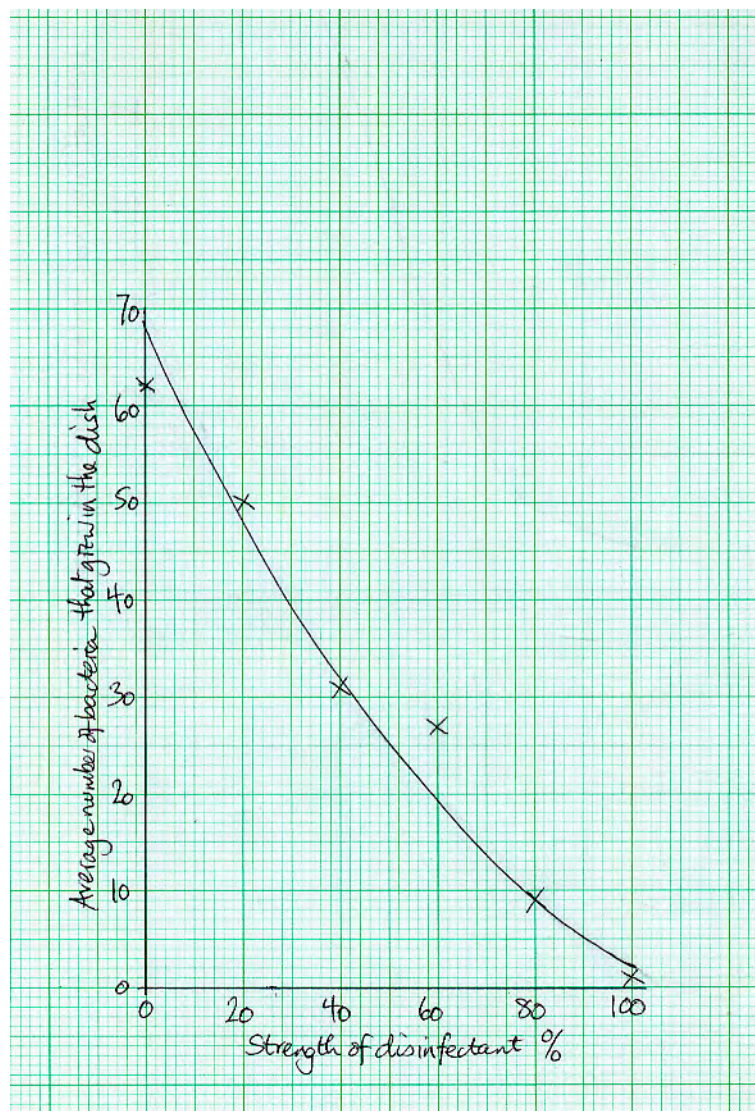
Step 4 – Processing primary data

7

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Jay S Flude Form 10P
Microorganisms ISA

Science teacher Miss Avalon



Turn over ►

Step 5 – Analysing results

Section 2 of the ISA (high control)

- Section 2 will include questions concerning conclusions and evaluation. 50 minutes are allowed for this section, but again the usual access arrangement rules will apply.
- AQA will supply a data sheet containing a number of case studies for candidates to use in section 2 of the ISA.
- Section 2 will also include a question asking candidates to relate the findings from the investigation to the context they were given.
- Candidates may again use their candidate research notes that they made during their research.
- Candidates who have been given a method sheet for a new method may be allowed to use this when answering section 2.

Key points

Secondary data is given in section 2 to which candidates will need to refer. Therefore candidates should be familiar with using this type of stimulus material and have the necessary experience in order to evaluate the data given.

Step 5 – Analysing results

Centre Number	9	8	7	6	5	Candidate Number	1	2	3	4	For Teacher's Use	
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	7 th April				Section	Mark
											Section 1 (/20)	
											Section 2 (/30)	
											TOTAL (max 50)	



General Certificate of Secondary Education
June 20yy

Science A

(Specimen)

SCA4P/BU1.X

Controlled Assessment ISA BU1.x Microorganisms

Section 2

For moderation in May 20yy

For this paper you must have:

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

Time allowed

- 50 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for Section 2 is 30.
- The maximum mark for the Controlled Assessment Unit is 50
- You are reminded of the need for good English and clear presentation in your answers.

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

Yes ☐ No ☒

Did the candidate take an active part in the practical?

Yes ☒ No ☐

Teacher Declaration:

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

Signature of teacher **Sally Avalon** Date **10th April**

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Step 5 – Analysing results

2

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

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

[3 marks]

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*

1 (b) Did you repeat any of the measurements in your investigation?

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

Your explanation should include examples from your results.

[3 marks]

I didn't need to repeat any of my measurements. 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.

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

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

What was the range of this variable?

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

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

Give a reason for your answer.

[3 marks]

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.

.....

Comments – Q1 (a)

- Reference to bacteria, rather than 'bacterial colonies' is acceptable here.
- All three variables have been correctly identified.

3 marks

Comments – Q1 (b)

- There is a clear statement that repeats were not carried out. There is no reference as to specific values from the results.

2 marks

Comments – Q1 (c)

- The correct range is quoted. The values may be given in either order.
- A suitable value within the range has been given and the reason is acceptable.

3 marks

Step 5 – Analysing results

3

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

[3 marks]

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.

.....

.....

.....

.....

Comments - Q1 (d)

- 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.

2 marks

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

[3 marks]

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

.....

.....

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.....

Comments - Q1 (e)

- The response indicates the other results support the hypothesis. There is no reference to trends, patterns or specific values.

1 mark**Turn over ►**

Step 5 – Analysing results

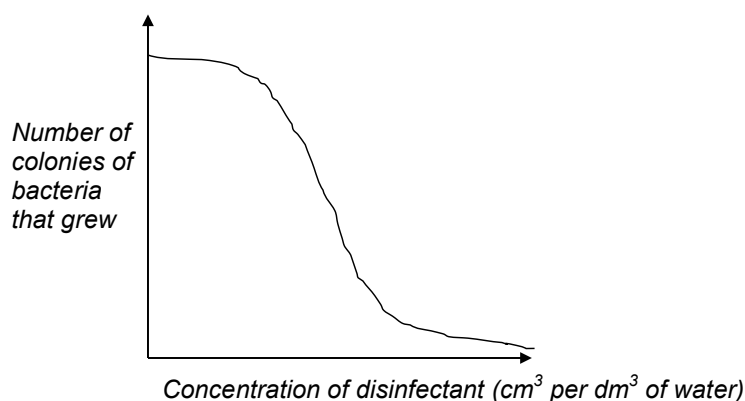
4

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

2 (a) 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 marks]



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

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

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

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

[3 marks]

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.

.....

Comments – 2 (a)

- The axes are correctly labelled (units are not essential here) and the curve is an appropriate reflection of the data.

2 marks

Comments – 2 (b)

- A clear indication that case studies 1 & 2 support the hypothesis, and there is a reference to the general trend in both. However there is no reference to the anomaly in case study 2.
- There is recognition that case study 3 is inappropriate along with an explanation as to why it is not appropriate.

2 marks

Step 5 – Analysing results

5

2 (c) Look at Case Study 4.

A hospital worker who saw the results advised:

"The hospital can use 'Ger-off' at 90% concentration to make sure most bacteria are killed."

Do you agree with this advice?

Explain your answer.

[3 marks]

I don't think it would be a good idea because even at 100% Ger-off doesn't kill many staphylococcus and staphylococcus is a common bacteria that you get in hospitals. But it would be good at killing Listeria bacteria and nearly all the E.coli.

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

.....

.....

.....

.....

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

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

[3 marks]

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.

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 four marks for your chart or graph.

[4 marks]

END OF QUESTIONS

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Comments – 2 (c)

- The candidate states that the advice is not supported, and explains the reason for this.
- The candidate states an advantage of 'Ger-off' and identifies further trials that should be done with 'Ger-off'.

3 marks

Comments – Q3

- An idea from the investigation has been linked to context, and findings from the investigation have been related to the context. However there is little detail in the explanation.
- Further information from research has been quoted.

2 marks

Comments – Q4

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

2 marks

**Total for both sections
38/50**

30

Step 6 – Marking the ISA

Marking

- Sections 1 and 2 of the ISA are marked internally, using the mark guidance supplied by AQA.
- Marking should be done in red ink. Where necessary, annotations should be used to show the reasons for mark decisions.
- Full marking guidelines will be available on e-AQA. To access e-AQA, register at <https://extranet.aqa.org.uk>

Security of ISA papers and marking guidelines

When marking Section 1 and 2 of the ISA, centres should treat them, and the marking guidelines, as secure assessment documents. Therefore due care and regard needs to be taken if marking is done off site.

Key points

- Teacher online standardisation (TOLS) is available on e-AQA. Find out more about at aqa.org.uk/about-us/what-we-do/products-and-services/teacher-online-standardisation.
- Each centre is assigned a Controlled Assessment Adviser who will be able to give direct support on all aspects of the controlled assessments. Contact details for your adviser can be found on TOLS or by contacting the GCSE Science subject team at science-gcse@aqa.org.uk.

Marking guidelines

Science ISA – BU1.x Microorganisms (Specimen).
For moderation in May 20yy.

Please mark in red ink. Each part of each question must show some red ink to indicate that it has been seen. Subtotals for each part of each question should be written in the right-hand margin.

Enter the marks for section 1 and section 2 and the total mark on the front cover of the answer booklet for section 1. Fasten both sections together with the results table(s) and the graphical work and the candidate's research notes.

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

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

These marking guidelines are necessarily generic. Additional guidance on how to relate these generic marking guidelines to particular investigations is given below the generic section. Read through the whole of the candidate's answer and use the marking guidelines below to arrive at a 'best-fit' mark.

Section 1				
	0 marks	1 mark	2 marks	3 marks
Q. No.1	No creditworthy response.	Two relevant sources are clearly identified. or one relevant sources is identified and the usefulness of the source commented on.	Two relevant sources are clearly identified. and the usefulness of one of the sources is commented on.	Two relevant sources are clearly identified. and the usefulness of both sources is explained and a comparison made.
Additional guidance	An identified source is referred to by title and author or for websites at least the name of the web page should be quoted. Any identified source should be capable of being accessed by the moderator. A clear comment on only one of the sources may be sufficient to gain 3 marks if the answer implies a comment on the other source. If candidates have taken part in peer discussion as part of their research, simply stating this is not sufficient to qualify for quoting a source. Similarly reference to their own notes or exercise book alone is insufficient.			

Section 1

	0 marks	1 mark	2 marks	3 marks
Q. No.2	No creditworthy response.	A suitable control variable is stated.	A suitable control variable is stated. Only one value to be investigated in the preliminary experiment is suggested. The dependent variable is stated, but details concerning its measurement are incomplete.	A suitable control variable is stated. The limits of the range to be investigated in the preliminary experiment are appropriate. A statement concerning how the dependent variable values obtained could be used to determine the best value for the control variable 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 preliminary investigation may involve testing two ends of a range to see if there is sufficient variation, or to establish a suitable value. A suitable control variable might be the length of time for which the colonies of bacteria are allowed to grow. A statement concerning how the results could be used might be eg “if the bacteria colonies haven’t grown much I would have to extend the time before measuring them”. An example of a detail for the dependant variable might be measuring the diameter of the ring of growth of bacteria. Do not give full credit to a candidate who describes how to do the entire investigation at this stage.			

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 terms where appropriate.

In order to attain a mark within a certain level, **both** the science **and** the QWC must be considered.

Read through the whole of the candidate's answer and use the marking guidelines below to arrive at a 'best-fit' mark, as candidates may meet some criteria but not others in a mark range.

	0 marks	1, 2 or 3 marks	4, 5 or 6 marks	7, 8 or 9 marks
Q. No.3	No creditworthy response.	Some 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 answer shows very weak spelling, punctuation and grammar.	Most of the necessary equipment is stated. The method described will enable valid results to be collected. The measurements to be made are stated. 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 answer shows reasonable spelling, punctuation and grammar although there may still be some errors.	Most of the necessary equipment is stated. The method described will enable valid results to be collected. The measurements to be made are stated. 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				
	0 marks	1 mark	2 marks	3 marks
Q. No.4	No creditworthy response.	An alternative method is outlined briefly although some of the necessary steps may not be clear.	An alternative method is outlined briefly. A simple suggestion is given as to why this alternative method would not have been as good as the one chosen.	An alternative method is outlined briefly. An explanation is given as to why this alternative method would not have been as good as the one chosen.
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			
	0 marks	1 mark	2 marks
Q. No.5	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 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				
	0 marks	1 mark	2 marks	3 marks
Q. No.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. Examples of dependent variables are: the number of colonies of bacteria that grow, or the cloudiness of nutrient broth. Examples of control variables are: the volume of disinfectant used, the temperature of incubation, or the time of incubation.			

Section 2				
	0 marks	1 mark	2 marks	3 marks
Q. No.1 (b)	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 or minor variations.	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 errors with reference to their own 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 errors with reference to their own results, and the effects that these would cause.
Additional guidance	If the candidate answers “Yes”, they may refer to clearly anomalous results that need repeating, or to the fact that not all the points lie comfortably on a line of best fit (random errors) or to a systematic error, therefore needing more results to calculate a mean. If the candidate answers “No”, they may refer to eg all points on the graph lying close to the best fit line. Reference to lack of time may be allowed for 1 mark at the teacher’s discretion, but should be annotated. Credit should be given to candidates who either plan to do repeats before doing the practical work, or who realise the need for repeats after collecting the results.			

Section 2

	0 marks	1 mark	2 marks	3 marks
Q. No.1 (c)	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	The range may be given from highest to lowest or from lowest to highest, or as a single figure indicating the differences between the highest and lowest values. Units should appear at least once. The values given should be checked against the results table. 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				
	0 marks	1 mark	2 marks	3 marks
Q. No.1 (d)	No creditworthy response.	A valid statement is made about whether or not the results support the hypothesis.	A valid statement is made about whether or not the results support the hypothesis. The answer includes either a reference to a pattern or some examples from the results.	A valid statement is made about whether or not the results support the hypothesis. The answer includes a reference to a pattern and some examples from the results.
Additional guidance	The candidate's statement(s) must match the candidate's own results. An example of a pattern might be "the stronger the concentration of disinfectant, the more bacteria were killed". An example of results quoted in support might be "At 20% concentration the bacteria count was 50, but at 100% concentration all bacteria were killed".			

Section 2				
	0 marks	1 mark	2 marks	3 marks
Q. No.1 (e)	No creditworthy response.	A simple correct statement is made as to whether or not the results are reproducible.	A simple correct statement is made as to whether or not the results are reproducible. A simple explanation is given, supported by an example from the results (this may be a qualitative example referring to a pattern on the results).	A simple correct statement is made as to whether or not the results are reproducible. A detailed explanation is given, supported by at least two examples from the results.
Additional guidance	Note that the answer should refer to the class or teacher's results, and not simply to the expected result. A statement as to whether or not the results are reproducible might be "other people have got the same results". A simple explanation of this might be "they have got the same graph". A more detailed explanation might be "when we used 50% concentration, we got no growth of bacteria, but others did".			

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

Section 2				
	0 marks	1 mark	2 marks	3 marks
Q. No.2 (b)	No creditworthy response.	A simple correct statement is made about at least two of the case studies 1, 2 and 3 , as to whether or not they support the hypothesis.	Simple correct statements are made about case studies 1, 2 and 3 , supported by a more detailed explanation of one of them.	Simple correct statements are made about case studies 1, 2 and 3 , supported by a more detailed explanation of both case studies 2 and 3 .
Additional guidance	An example of a clear statement for case 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 results are based on type of disinfectant rather than concentration.			

Section 2				
	0 marks	1 mark	2 marks	3 marks
Q. No.2 (c)	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%)”. 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				
	0 marks	1 mark	2 marks	3 marks
Q. No.3	No creditworthy response.	Results from the investigation or an idea from the research has been related to the context.	Results from the investigation or an idea from the research has been related to the context. There is a simple explanation of how the results or idea can be applied and used in the context.	Results from the investigation or an idea from the research has been related to the context. There is a detailed explanation of how the results or idea can be applied in the context.
Additional guidance	The candidate could 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			
	Answer	Additional guidance	Mark
Q. No.4	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.	1
	Y axis: suitable scales chosen and labelled with quantity and units.	Accept axes reversed. 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: • categoric, a bar chart should be drawn • continuous, a best fit line should be drawn. NB If no line is possible because there is no correlation, candidates should state this on the graph to gain the mark.	1

Step-by-step guide: Science B controlled assessment

These step-by-step instructions are a guide for completing controlled assessment for:

Science B

To get started, choose a controlled assessment from the options on e-AQA. Teachers should then:

- put the task into a context that will be suitable for their candidates to understand the reason for the investigation
- provide a hypothesis within the context for the candidates to investigate
- lead a discussion with the candidates to outline the technique that is to be used. This might include demonstrating the technique and illustrating the variety of equipment available. Candidates may need to practice the technique
- follow the steps below on completing a controlled assessment.

Step 1 – Planning and research (limited control)

- Candidates need to research the context of the investigation, to give an application for it.
- They need to identify the method they are going to use.
- They need to identify the hazards and risks associated with their investigation.

Helpful hints:

- candidates may use technology such as the internet or CD-ROMs for their research, textbooks, journals or any other appropriate sources of information
- candidates should decide for themselves factors such as the independent variable, the range, interval and number of repeat readings they should take
- candidates may bring the information they collect at this stage into the supervised sessions to use in preparing their final report
- the planning stage should take one to two lessons, including the high control session used for the write-up.

Step 2 – Reporting on the planning and research (high control)

- Candidates work on their own to write their introduction to the investigation, prepare their plan and compile the risk assessment.
- Candidates may use the information collected in their research to do this.
- Writing up the plan should take no more than one or two lessons. If it takes more than one lesson, candidates' work must be taken in and kept securely between lessons.
- The completed plans should be kept securely and attached to the final report for marking.

Helpful hints: before writing up the plan and risk assessment, make sure your candidates know:

- ways of presenting sources of research
- what variables in an investigation should be considered and managed
- different ways to test a hypothesis
- how to write a detailed plan of a chosen method
- possible hazards, the associated risks, how to manage them and how to complete a risk assessment.

Step 3 – Practical work (limited control)

- Candidates perform the practical experiment, either individually or in groups.
- Candidates may use the method they have planned or the method provided by the teacher.
- Candidates may use ICT to collect their results where appropriate.

Helpful hints:

- if the candidate's own plan is unworkable, unsafe or unmanageable in the laboratory, the teacher may provide them with a method to use for collection of data.

Step 4 – Data processing, analysis and evaluation (high control)

- Candidates work on their own to process and analyse their own data, the secondary data given in the candidates' notes and the class or teacher-obtained secondary data, and to write their evaluation of their investigation.
- If candidates did the practical work in groups, they must clearly identify the data that has been collected under their own direction.
- This part of the controlled assessment should be completed in two to three normal lessons (about 4 hours).

Helpful hints:

- if the candidate's own plan is unworkable, unsafe or unmanageable in the laboratory, the teacher may provide them with a method to use for collection of data
- it is at this stage candidates should be given pooled classroom data and/or teacher-derived data from the same investigation to use in their analysis and evaluation
- candidates may use ICT in their analyses, where appropriate
- candidates' work must be taken in at the end of one session and kept securely until the next session. Candidates must not be allowed to work on their report between sessions
- before they start their analysis and evaluation, make sure your candidates know how to:
 - analyse results and draw conclusions
 - match results to a hypothesis
 - evaluate their method of collecting data
 - analyse secondary data, both collected and provided
 - use secondary data to validate their own work.

Step 5 – Marking the controlled assessment

- The candidates' reports are marked internally using the mark guidance supplied by AQA.
- Marking should be done in red ink, and annotations made where necessary to show the moderator reasons for the decisions.

Helpful hints:

- candidates may improve their marks by carrying out another controlled assessment for the specification.
- if more than one controlled assessment is completed, submit the one with the highest mark.

Administration: teachers' notes

GCSE Science B Controlled Assessment

The effectiveness of antacid remedies

This task relates to Unit 2 context 3.4.1.2 – Chemistry in action in the body.

Method

Methods and techniques in the Controlled Assessment are not necessarily restricted to those mentioned in the specification. Candidates should be encouraged to use appropriate technology when completing the task.

Candidates should be given the opportunity to carry out an investigation concerning the effectiveness of an antacid on stomach acid, and must write a report on their findings.

Candidates should be given the opportunity to practice the techniques of titration before completing this investigation. They should, however, plan and make decisions on equipment and readings to be taken, for themselves.

Candidates should carry out some preliminary research concerning an application for their investigation. They will need to decide on their research method, which could include the use of books, internet sources and surveys. Candidates should bring the information they collect into the supervised sessions to use as part of their final report.

In the practical stage, candidates may work singly or in groups to obtain their data. However, each candidate must record and process the data individually, and must identify the data collected under their own direction.

In addition to the secondary data given in the Notes for Candidates, candidates should be given group or teacher data to analyse and compare with their own in order to comment on the validity of their own work.

Area of Investigation

This work should be carried out during the teaching of the section relating to Unit 2, section 3.4.1.2 – Chemistry in action in the body.

- Our stomach contains hydrochloric acid. Sometimes excess acid can make us feel very uncomfortable and may cause heartburn and nausea.
- Pharmacologists use their knowledge of neutralisation reactions to monitor and control stomach acid using antacids. They test the effectiveness of antacids in terms of how effectively they neutralise excess stomach acids before they are sold to the consumer.
- Name some hazards of acids and bases and some control measures that can be put in place to minimise risks from them.
- Understand that the stomach works most effectively in acid conditions by helping to break down food.
- Explain how an antacid neutralises excess stomach acid to help to treat heartburn and nausea.

Contextualisation of task

The task should be put into a context, so that candidates understand the reason for the investigation that they are carrying out. An example context is given below.

Biochemists working for pharmaceutical companies test a variety of medicines in order to find fast, effective relief from heartburn or acid reflux. Doctors may need to prescribe drugs to help patients with indigestion. These medicines work by neutralising the excess acid within the stomach which helps break down food. When developing new antacid remedies it is important, for both scientific and commercial reasons, to know

Administration: teachers' notes

what amount of antacid is best in neutralising particular acid conditions. You are researching the effectiveness of an antacid preparation in neutralising an acid, to compare the results with known antacids.

Suggested approaches

Candidates could test either a known amount of an antacid compound or an appropriate commercial preparation.

1. Candidates could add a known amount of hydrochloric acid (volume and concentration) to an antacid, calcium carbonate. Alternatively, a commercial antacid preparation could be used. If a commercial preparation is used, it is recommended that one based on calcium carbonate is chosen.
2. The excess acid can be found by titration against a standard sodium hydroxide solution. By difference, the amount of hydrochloric acid that reacted with the antacid can be calculated.

Working safely in the laboratory

It is the responsibility of the centre to be aware of any health and safety implications of the investigation and ensure that a risk assessment for the practical is carried out. Teachers should remind candidates about safe working when carrying out laboratory procedures.

Analysing secondary data

As part of the task, candidates are required to verify their data by comparing it with secondary data. This data could be the results obtained by other groups within the class, and/or results for the investigation that have been obtained by the teacher or technician before the candidates do the practical themselves.

Candidates should also use the data given in the Notes for Candidates.

Stage 1 – Planning and research

The teacher should lead a discussion with the candidates to outline the technique that is to be used. This might include demonstrating the technique and illustrating the variety of equipment available.

Candidates should be shown the technique to be used, and should be given the opportunity to have hands-on experience of the technique. Candidates should then be left to themselves to decide factors such as the independent variable to be investigated, the range, interval and number of repeat readings they should take.

At the end of the planning session, candidates must work on their own, under direct supervision, to write their plan and risk assessment for the practical. Teachers must collect all work at the end of the session and keep it securely for marking and submission with the final report for moderation.

Candidates also need to carry out research into an application of the investigation they are carrying out. This research could take different forms such as internet searches, book and journal searches, or questionnaires and surveys. Candidates should decide for themselves an appropriate method of research for their investigation.

Administration: teachers' notes

Stage 2 – Practical work

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

The teacher may provide a method, after the candidate has produced their own plan, if the candidate's plan is unworkable, unsafe or unmanageable in the laboratory. For plans that are otherwise good, but unworkable for a good reason (ie logistical) candidates should not lose any marks. However, where the plan is dangerous or unworkable (from a scientific perspective) this will be reflected in the marking.

The method suggested above could be used, but this should not preclude centres from adapting the method to suit their own needs.

Candidates may be given instructions of a general nature, but these should not be so prescriptive as to preclude candidates from making their own decisions.

Each candidate must contribute to the collection of data.

Once the candidates have completed their investigation, their results should be made available to others in their group for data analysis and evaluation. Candidates should use the results of others (possibly other groups in their class or teacher-obtained results), and the secondary data given in the Notes for Candidates, to analyse the validity of their own results.

Stage 3 – Data processing, analysis and evaluation

For this part of the investigation candidates must work on their own, under direct supervision to write up their findings, analyse their own and the secondary data and present their evaluations and conclusions.

The data given in the Notes for Candidates are based on taking 0.125g of calcium carbonate, adding 50 cm³ of 0.1 M HCl, and titrating the excess with 0.1 M NaOH.

Controlled assessment in detail

Science B

Step 1 – Planning and research

The discussion session

- Methods and techniques in the controlled assessment are not necessarily restricted to those mentioned in the specification.
- The teacher should lead a discussion with the candidates to outline the technique that is to be used. This might include demonstrating the technique and illustrating the variety of equipment available.
- Candidates should be shown the technique to be used, and should be given the opportunity to have hands-on experience of the technique.
- Candidates should then be left to themselves to decide factors such as the independent variable to be investigated, the range, interval and number of repeat readings they should take.

Research

- Candidates need to carry out research into an application of the investigation they are carrying out. This research could take different forms such as internet searches, book and journal searches, or questionnaires and surveys. Candidates should decide for themselves an appropriate method of research for their investigation.
- The research could be done as a homework session and written notes made.

Key points

- Collectively, candidates could produce a huge variety of methods to perform their practical work. If the teacher decides that the method produced by the candidate(s) is unworkable, unsafe or unmanageable then the teacher may provide a method for candidates to use in the practical session.
- AQA will supply suggestions for contextualisation of the task and suggestions for approaches to the task. Teachers are free to choose to use or adapt these suggestions to suit their candidates, or to use their own ideas.

Step 2 – Reporting on the planning and research

- Candidates must work on their own, under direct supervision, to write their introduction, plan and risk assessment for their investigation. They may use the notes they have made during their research in writing their plan.
- This stage should take one or two normal lessons to complete.
- Teachers must collect all work in at the end of the session and keep it securely for marking and submission with the final moderation. The teacher should not return work to the candidate.
- The teacher may provide a method, after the candidate has produced their own plan, if the candidate's plan is unworkable, unsafe or unmanageable in the laboratory. For plans that are otherwise good, but unworkable for a good reason (ie logistical), candidates should not lose any marks. However, where the plan is dangerous or unworkable (from a scientific perspective) this will be reflected in the marking.

Key points

Where methods generated are unmanageable or unsafe, the AQA mark guidance will dictate how marks are apportioned and will take into account experiments that are scientifically accurate but not possible due to circumstances such as lack of equipment.

Step 3 – Practical work

- Candidates perform the practical investigation.
- Candidates may use the method that they have planned.
- If the teacher decides that the method produced by the candidate(s) is unworkable, unsafe or unmanageable, then the teacher may provide a method.
- There is no specified time limit for the practical work, although it is anticipated that most experiments can be completed within a 1 hour lesson. If necessary, however, the experiment may be continued over a number of lessons.
- It may be necessary for the teacher to pool the results of the class. This is so that each candidate may be allowed to see the results of others in order to evaluate their own work and form a conclusion. Teachers may also choose to carry out the investigation themselves to provide another set of data for the candidates to analyse and evaluate.

Step 4 – Data processing, analysis and evaluation

- Candidates must work on their own (under direct supervision) to process and analyse their own data.
- Candidates should be given pooled classroom data, and/or data obtained by the teacher, to help them in their analysis and to compare with in order to validate their own data.
- Candidates should use and refer to the secondary data provided in the notes for candidates in their analysis. They should consider any questions included in the notes for candidates in their write-up.

Key points

Candidates should be familiar with using secondary data and have the necessary experience in order to evaluate the data given.

Step 5 – Marking the controlled assessment

- The candidates' plans, risk assessments, data analyses and evaluations are all marked internally, using the marking guidance supplied by AQA. This guidance is available in the specification and at the back of each set of teachers' notes.
- Marking should be done in red ink.
- Annotation should be used to show the reasons for mark decisions.
- The next few pages show a sample controlled assessment. Following this is a commentary explaining the marking of each strand in the assessment grid. The assessment grid can be found in the Science B specification, and a more detailed version, with individual mark allocations, can be found in Secure Key Materials in e-AQA <https://extranet.aqa.org.uk>

Key points

- Teacher online standardisation (TOLS) is available on e-AQA. Find out more about at [aqa.org.uk/about-us/what-we-do/products-and-services/teacher-online-standardisation](https://www.aqa.org.uk/about-us/what-we-do/products-and-services/teacher-online-standardisation).
- Each centre is assigned a Controlled Assessment Adviser who will be able to give direct support on all aspects of the controlled assessments. Contact details for your adviser can be found on TOLS or by contacting the GCSE Science subject team at science-gcse@aca.org.uk.

Step 1 – The effectiveness of antacid remedies

1. RESEARCH.

I'm going to investigate how effective antacids are on stomach acid. Sometimes people take antacids if they get indigestion or heartburn. On www.bbc.co.uk/health it says that if you get indigestion you might feel pain in your stomach or think you're having a heart attack. You might feel bloated or get wind or nausea. Sometimes excess acid is linked with ulcers and drugs like aspirin can make it worse. Antacids are alkalis so neutralise the acid. When chemists make new antacids they have to be tested to check they work and that they are safe to use. A chemist might do an investigation like mine when testing new antacid remedies. They would use alkalis to neutralise the acids. Research and development sections of pharmaceutical companies have the role of producing and testing new remedies.

I researched the ingredients of some remedies on <http://heartburn/about.com> and found that Tums contain famotidine 10mg, calcium carbonate 800mg and magnesium hydroxide 165mg. Maalox contains just calcium carbonate. I know we have this in school so I want to use calcium carbonate in my experiment.

On www.ehow.com it said that stomach acid is 0.16M hydrochloric acid so I think I'll use the same in my experiment so it's similar to real stomach acid.

I found a method for investigating ant acids on www.practicalchemistry.org which said that burettes allow you to measure the acid accurately, so I want to try to use one in my experiment. I could use some maths to work out how strong the alkali and remaining acid are.

$$\frac{4}{4}$$

Step 2 – The effectiveness of antacid remedies

2. PLANNING.

Aim.

The purpose of my experiment is to investigate how effective calcium carbonate is as an antacid treatment by using different amounts to neutralise a known amount of hydrochloric acid and then titrating this against sodium hydroxide.

EQUIPMENT

Equipment	Why used ?
Goggles	To protect our eyes.
50ml measuring cylinders	To measure out the acid and alkali.
0.1M hydrochloric acid	To react with the alkali.
Calcium carbonate powder	To neutralise the acid (Antacid).
0.1M sodium hydroxide	To titrate with the acid.
Electronic balance	To weigh the calcium carbonate.
Clamp and stand	To hold the burette.
White tile	To see the change in colour easily.
Burette	To titrate the alkali with acid.
Filter funnel	To fill the burette.
Conical flask	To mix the acid and alkali.
Universal indicator	To show when it's neutral.
Spatula	To measure out the calcium carbonate.

FAIR TESTING

What I'll keep the same	What I'll change
The volume and concentration of hydrochloric acid and sodium hydroxide used.	The mass of calcium carbonate added to the hydrochloric acid each time.
The same equipment throughout.	

Step 2 – The effectiveness of antacid remedies

Method.
1. Fill the burette with 50ml of 0.1M sodium hydroxide.
2. Use a measuring cylinder to measure out 50ml of 0.1M hydrochloric acid and put it in a conical flask.
3. Add a pipette of universal indicator and it should turn red.
4. Place a white tile and the conical flask under the burette.
5. Add the alkali to the acid using the tap to control the flow. Stop when the universal indicator turns green and record the volume of sodium hydroxide added to the acid. This is the rough titration which will give me an idea of when the colour change occurs so I can do the rest of the results very carefully.
6. Repeat 3 times but adding the alkali slowly to get an accurate reading of the volume added.
7. Now measure out 0.02g of calcium carbonate and add to 50ml of hydrochloric acid in the conical flask. Mix well and wait for all fizzing to stop.
8. Titrate the remaining acid to see what volume of sodium hydroxide is needed to neutralise it. Record the result and repeat 3 times to check reliability.
9. Repeat this for 0.05, 0.07 and 0.10g of calcium carbonate and repeat each one three times.
10. Calculate mean volumes of sodium hydroxide needed to neutralise the remaining stomach acid by adding the three results together and dividing it by three.

Step 2 – The effectiveness of antacid remedies

Variables

Independent	Dependent
Mass of calcium carbonate added to the acid (g)	Amount of sodium hydroxide (0.1M) added to neutralise the acid (ml)

I think that when more calcium carbonate is added we will use less sodium hydroxide to neutralise the acid because the calcium carbonate reacts with the hydrochloric acid to give carbon dioxide, calcium chloride and water. The water will dilute the remaining acid so less alkali is needed to neutralise it.

$\frac{4}{6}$

Step 3 – The effectiveness of antacid remedies

3. ASSESSING AND MANAGING RISK.

Equipment/ procedure/ chemical used	Hazard	Risk	Control measure	Source of information
Glassware.	You could cut yourself.	Medium risk to anyone using them. They are very easy to break.	Visually check for cracks or chips before picking up. Keep away from edge of bench. Know the 1st aid for cuts.	Own knowledge. Use British Red Cross website for 1st aid for cuts.
Electronic balance.	Electric shock.	Low as they are designed to be safe to use in labs and use a low voltage.	Visually check wires and plug have intact insulation before plugging in. Ensure that bench is dry and no taps are used nearby. Know the 1st aid for electric shock.	Own knowledge. Use British Red Cross website for 1st aid for electric shock.
Universal indicator.	Flammable and could cause skin allergy. Slips or falls if spilt.	Medium risk. Could be spilt on your skin very easily.	No Bunsen flames on in room. Use pipette to measure out solution so it doesn't come into skin contact. Wash hands carefully if you get it on you. Clear up all spillages with paper towels.	Cleapss hazcards.

Step 3 – The effectiveness of antacid remedies

Equipment/ procedure/ chemical used	Hazard	Risk	Control measure	Source of information
hydrochloric acid (0.1M).	Irritant can damage the skin and eyes. Slips or falls if spilt.	Medium as it can be spilt very easily and looks like water so you might forget to wash it off.	Clear up any spillages immediately using paper towels. Wash hands well after the practical just in case. Wear goggles at all times. Know the first aid for chemicals in the eyes or on the skin. Make sure there's no metals left lying around as acid reacts with them.	Cleapss hazcards. Use British Red Cross website for information on 1st aid for chemical burns.
Sodium hydroxide (0.1M).	Irritant can damage eyes and skin. Slips or falls if spilt.	Medium as it can be spilt very easily and looks like water so you might forget to wash it off.	Clear up any spillages immediately using paper towels. Wash hands well after the practical just in case. Wear goggles at all times. Know the first aid for chemicals in the eyes or on the skin. If your hands feel soapy wash with lots of water.	Cleapss hazcards. Use British Red Cross website for information on 1st aid for chemical burns.

Step 3 – The effectiveness of antacid remedies

Equipment/ procedure/ chemical used	Hazard	Risk	Control measure	Source of information
Calcium carbonate.	Low hazard could cause coughing if breathed in.	Low – it's used in lots of everyday things like toothpaste.	Keep the lid on and don't shake container to keep the dust down. Any asthmatics should have their inhaler on them at all times.	Cleapss hazcards.
Carrying out the experiment.	Chemicals in the eyes or skin could be irritants.	Medium unless you fill and use the burette very carefully.	Put the clamp and stand down on the floor to fill up the burette so it is well below eye level. Keep goggles on at all times. Know the 1st aid for chemicals in eyes or on skin.	Own knowledge and practical chemistry website. Use British Red Cross website for 1st aid for chemicals in eyes or on skin.
Carbon dioxide.	Suffocation.	Very low as only small amounts will be produced by the reaction.	Keep the lab well ventilated by opening up the windows.	Own knowledge and Cleapss hazcards.

Equipment/ procedure/ chemical used	Hazard	Risk	Control measure	Source of information
hydrochloric acid (0.1M).	Irritant can damage the skin and eyes. Slips or falls if spilt.	Medium as it can be spilt very easily and looks like water so you might forget to wash it off.	Clear up any spillages immediately using paper towels. Wash hands well after the practical just in case. Wear goggles at all times. Know the first aid for chemicals in the eyes or on the skin. Make sure there's no metals left lying around as acid reacts with them.	Cleapss hazcards. Use British Red Cross website for information on 1st aid for chemical burns.
Sodium hydroxide (0.1M).	Irritant can damage eyes and skin. Slips or falls if spilt.	Medium as it can be spilt very easily and looks like water so you might forget to wash it off.	Clear up any spillages immediately using paper towels. Wash hands well after the practical just in case. Wear goggles at all times. Know the first aid for chemicals in the eyes or on the skin. If your hands feel soapy wash with lots of water.	Cleapss hazcards. Use British Red Cross website for information on 1st aid for chemical burns.
				<u>8</u> 8

Step 4 – The effectiveness of antacid remedies

4. COLLECTING DATA.

Mass of calcium carbonate added to 50ml of 0.1M hydrochloric acid (g)	Volume of 0.1M sodium hydroxide added to neutralise the remaining acid (ml)				
	Rough titration	1st attempt	2nd attempt	3rd attempt	mean
0	50	50.0	49.8	50.0	49.9
0.02	43	42.6	43.1	42.8	42.8
0.05	31	31.0	29.5	31.0	30.5
0.07	21	24.3	20.9	20.7	20.8
0.10	10.5	10.2	10.3	10.4	10.3

The 1st attempt using 0.07g gave a high result so wasn't used in my mean. If I had more time I would have repeated this one again.

$\frac{7}{8}$

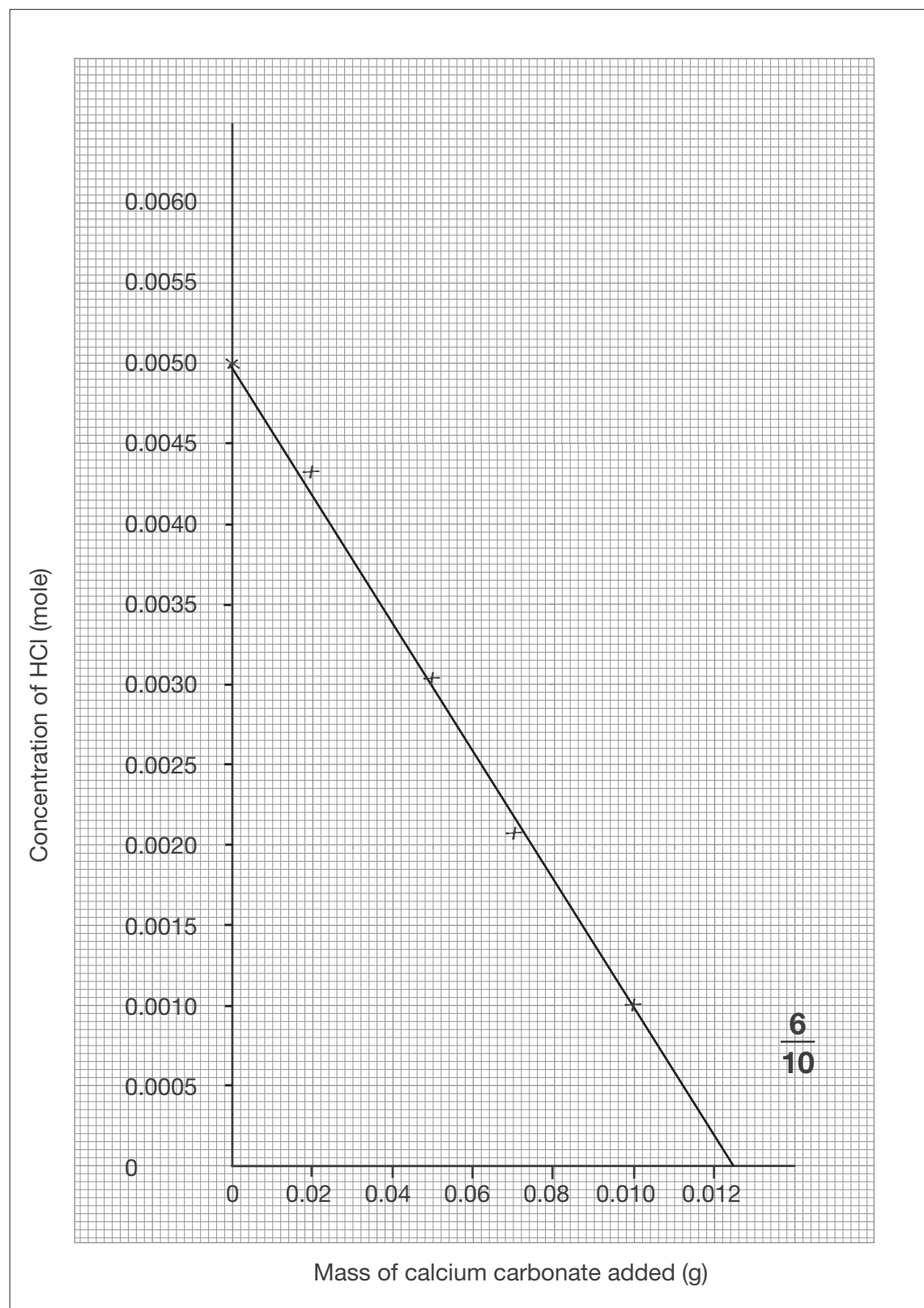
Step 5 – The effectiveness of antacid remedies

5. PROCESSING DATA.

My graph is negatively proportional as it's a straight line. It shows a negative correlation as it goes down. It shows that as I used more calcium carbonate the remaining hydrochloric acid was reduced so the volume of sodium hydroxide needed to neutralise it was also reduced. I calculated the moles of hydrochloric acid remaining by taking each mean titration and dividing it by 1000 and multiplying it by 0.1. My graph shows that if I added 0.126g of calcium carbonate to the acid it would be completely neutralised.

I plotted these figures onto the graph and it clearly shows that the amount of acid is greatly reduced by the calcium carbonate being added. My teacher suggested that I should do a line graph but told me to do my own scales. I didn't use the 1st attempt for 0.07g in my mean as this was an anomalous result compared to the other two. The other two results were quite close so I think my work will still be reliable.

Step 5 – The effectiveness of antacid remedies



Step 6 – The effectiveness of antacid remedies

6. ANALYSING DATA.

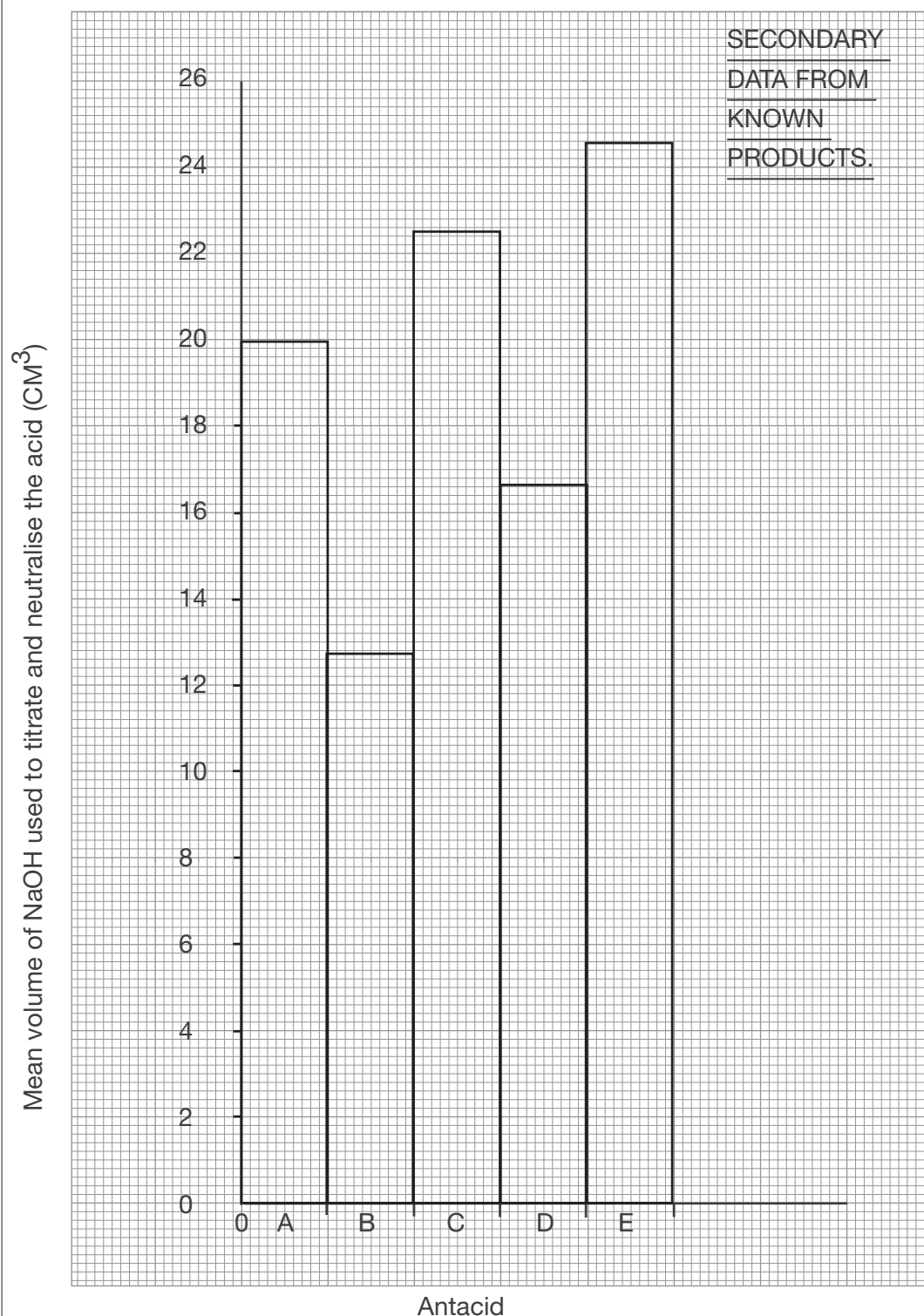
I found out that calcium carbonate is a good chemical to use as an antacid as the number of moles of hydrochloric acid remaining after the reaction, was greatly reduced. For example when 0.02g was added the HCl was 0.0043M but when 0.10g was added it was only 0.00103M. If you double the amount of calcium carbonate you halve the amount of acid left.

I used the secondary data provided to work out the mean volume of sodium hydroxide needed to neutralise dilute hydrochloric acid for antacids A-E. My means are in the table below. I didn't include the third result for sample D in the mean as it looks like an anomalous result.

Antacid	Volume of sodium hydroxide (ml) needed to neutralise dilute hydrochloric acid	Mean volume of sodium hydroxide (ml) needed to neutralise dilute hydrochloric acid
A	21	20
	19	
	20	
B	12.5	12.65
	13.15	
	12.5	
C	22.65	22.5
	22.45	
	22.5	
D	16.5	16.62
	16.70	
	26.7	
E	24.60	24.6
	24.6	
	24.6	

Step 6 – The effectiveness of antacid remedies

I used the means to draw this graph.



Step 6 – The effectiveness of antacid remedies

Looking at the secondary data provided, I think that the antacid E must have between 0.05 and 0.07g of calcium carbonate in it as the titration value was 24.6ml. My results were between 30.5 and 20.8ml for the same amounts. Antacids A, B, C and D must have between 0.07 and 0.1g of calcium carbonate in them as the titration values were 20, 12.65, 22.5 and 16.62ml. My results were between 20.8 and 10.3ml for these amounts. To make my results even more reliable I should have repeated the anomalous result for the 1st attempt at 0.07g and not just left it out of my mean. I could have kept on repeating each experiment until I got 3 repeats all within 0.5ml of each other. To make my data more valid I should have found out more about antacids A-E and tried to use the same amount of chemicals in my experiment so I could compare my results with those more, or I could have borrowed some results from someone else in the class to check them. The most effective antacid in the table was also antacid B as only 12.65ml of sodium hydroxide was used to neutralise the dilute acid whereas antacid E needed 24.6ml.

$\frac{3}{6}$

Step 7 – The effectiveness of antacid remedies

7. EVALUATING THE PRACTICAL ACTIVITY.

Most of my results were good apart from the 1st attempt with 0.07g which was too high – I should have repeated this one again. I think the rest of my results are good as all of the points on the graph are close to the line that I did.

Strengths	Weaknesses
Working safely and in an organised way	I used powdered marble instead of pure calcium carbonate
Didn't have to ask for lots of help in the experiment	I put the sodium hydroxide in the burette which blocked up the tap a bit
I did lots of repeats	It was hard to tell when the acid was neutralised because the colour change was hard to see
I tidied up my working area after the experiment	It was hard to mix the conical flask at the same time as adding the alkali from the burette

Step 7 – The effectiveness of antacid remedies

Improvements to be made	Reasons
Use pure calcium carbonate instead of powdered marble	There was some marble left at the end which could have been impurities which might have affected the reliability of my results.
Change the experiment so that the acid was in the burette and not the sodium hydroxide	Sodium hydroxide can form crystals in it if left around too long. This could block up the tap on the burette affecting the results.
Use a pH meter instead of the universal indicator	It was difficult to get the exact colour change as it sometimes looked yellow/green and sometimes looked blue/green. With a pH meter I would only have to look for a number 7 for neutral on the screen.
Use a magnetic stirrer instead of mixing the conical flask by hand	It was hard to swirl the conical flask and open the tap on the burette at the same time. By using a magnetic stirrer it would be much easier.
Use a glass pipette and filler to measure out the hydrochloric acid	I think I might have not measured the acid correctly in the measuring cylinder. I think a pipette would give a more accurate result.
Make sure there are three repeats all within 0.5ml of each other	This way my results will be very reliable.
Check my results with three other people in the class	This way my results will be more valid.
	6
	6

Marking the sample controlled assessment

Science B

Step 1 – Research

0 marks	Level 1	Level 2	Level 3
	Sources are mentioned: www.bbc.com heartburn/about.com , www.ehow.com and www.practicalchemistry.org An application is given (1 mark).	The application is described. The research has been used as a basis for the investigation (1 mark).	A scientific explanation has been given discussing acid and alkali neutralisation (1 mark). Three research sources have been given and the research has been used as a basis for the investigation into the effect of antacids (1 mark).
			Total 4/4 marks

Step 2 – Planning

0 marks	Level 1	Level 2	Level 3
	The purpose of the investigation is given as an investigation into how effective an antacid is (1 mark). The variables are given in the fair testing table on page 2 and in the variables table on page 3 (1 mark).	The plan is organised and could be followed by another person (1 mark). The variables are given and a possible relationship between the variables is shown (1 mark). The candidate has recognised that the investigation is a back titration. However, the candidate has shown a lack of understanding when stating that the water produced will dilute the acid causing less alkali to be needed to neutralise it.	There are some steps that are unclear in the plan. Step 6 could be improved by stating that the alkali should be added dropwise while swirling the conical flask. The candidate has also not explained that titrations should be repeated until there is concordance in the results. If this was all present then the Level 3 planning mark could be awarded. Although the relationship between the variables is given, it is not presented as a quantitative relationship. The candidate should suggest, for example, what might happen when the amount of calcium carbonate is doubled. Also the understanding of why the amount of alkali needed decreases when the amount of calcium carbonate is added increases is confusing and so the Level 3 mark cannot be awarded here.
			Total 4/6 marks

Step 3 – Assessing and managing risk

0 marks	Level 1	Level 2	Level 3
	A risk assessment has been completed (1 mark) with references to health and safety practices (1 mark).	The hazards (1 mark) and associated risks (1 mark) have been identified. Control measures have been suggested (1 mark).	All the hazards (1 mark) and risks (1 mark) have been identified. Most control measures are based on scientific reasoning and even though some control measures are based on common sense this is only where appropriate. The risk assessment is thorough (1 mark).
			Total 8/8 marks

Step 4 – Collecting data

0 marks	Level 1	Level 2	Level 3
	Titration have been carried out and the results recorded in a table, so observations have been made (1 mark) and data has been recorded (1 mark).	The observations are accurate (1 mark). The data has been recorded with no errors (1 mark) and the candidate has recognised that one of the results for mass 0.07g should be repeated (1 mark).	The candidate has only recorded the final result and so is not awarded the observation mark here. The candidate needs to record all the measurements or observations made in order to gain this mark. This could be done with a table showing initial and final volumes for the titres. Even though the rough titration have not been recorded to 1 decimal place the rest of the data is recorded with consistent significant figures and with correct headings and units. This is acceptable for (1 mark). The anomalous result for 0.07g has been identified and the candidate would have repeated this if possible (1 mark).
			Total 7/8 marks

Step 5 – Processing data

0 marks	Level 1	Level 2	Level 3
	Patterns have been identified (1 mark). The average mass for each titre has been calculated (1 mark). A line graph has been drawn (1 mark).	The quantitative relationship between the variables has not been identified. The candidate should describe, for example, what has happened when the amount of calcium carbonate is doubled. The means have been calculated using appropriate significant figures for the data obtained (1 mark). The candidate chose their own scales for the graph but was given guidance on drawing the data as a line graph (1 mark). The candidate recognised they should not use the anomalous result for the 0.07g mass (1 mark).	The candidate has recognised that the line is negatively proportional. However, this doesn't clearly explain the relationship between the amount of calcium carbonate and the volume of alkali used to neutralise the acid, so the Level 3 patterns mark is not awarded. To be awarded the Level 3 calculation mark the candidate must show the mathematical formula they have used and give at least one worked example. This is not present in this piece. The candidate was given guidance on what sort of graph to draw so no marks are awarded here.
			Total 6/10 marks

Step 6 – Analysing data

0 marks	Level 1	Level 2	Level 3
	A conclusion has been given (1 mark).	The candidate has tried to relate the conclusion to the data but has got confused in their use of data. The example they have given using data does not support their conclusion even though their conclusion is correct. They have compared their results with the secondary data (1 mark) and have suggested repeating the anomalous result to improve reliability and have given simple suggestions to improve validity (1 mark).	The conclusions do not relate directly to their primary data as they are confused on how to use the data. There are some correct conclusions concerning the secondary data but no further secondary data (eg group data) has been used. There is no evidence of a comprehensive scientific understanding. The candidate should discuss that the acid is neutralised by the calcium carbonate and this is why less alkali is needed when more calcium carbonate is used. This should then relate to the initial question of how effective antacids are on stomach acid.
			Total 3/6 marks

Step 7 – Evaluating the practical activity

0 marks	Level 1	Level 2	Level 3
	An evaluation has been carried out (1 mark) and improvements have been suggested (1 mark).	The effectiveness of the methods has been evaluated (1 mark). The improvements are sensible and justified (1 mark).	Strengths and weaknesses have been described (1 mark) and justified improvements are given (1 mark).
			Total 6/6 marks
			Overall total 38/48 marks

Administration

Introduction

1. The controlled assessment papers will be available in May. The Exams Officer may print out one copy of the ISA papers for the science department to use in preparation. However these papers should be treated in the same way as for any other external exam paper and kept under strictly secure conditions.
2. The ISA papers should **not** be downloaded on to the centre's intranet. Neither should any electronic copies be made.
3. Teachers' notes are published on Secure Key Materials on e-AQA so that teachers can incorporate the controlled assessment into their schemes of work.
4. The new specification controlled assessment can be used by the candidates as soon as they arrive in centres but they have only one opportunity for moderation.
5. Out of date ISAs will **not** be accepted for earlier or later moderation dates.
6. The candidates' work must be held under secure conditions for the entire period.
7. Do not use the 'live' controlled assessment tasks for practice purposes. The use of past papers or parts of past papers is permitted, but these should not be used in the context of a 'live' ISA.
8. Candidates should be entered in February for moderation in the following June. Teachers should attach the ISA to a specific subject when making entries but amendments can be made later. A mark is not needed at the time of entry but must be submitted to AQA and the moderator by 7 May. Marks must be submitted on the Centre Mark Form (CMF). The centre should also circle the highest and lowest non-zero mark for each subject on the CMFs.
9. The table overleaf shows the codes needed for controlled assessment entry and the ISAs that may be used with the candidates:

Subject and certification code	Entry code for controlled assessment unit
Science A (route 1) 4405 Science A (route 2) 4406	SCA4P
Additional Science (route 1) 4408 Additional Science (route 2) 4409	AS4P
Biology 4401	BL4P
Chemistry 4402	CH4P
Physics 4403	PH4P
Further Additional Science 4410	FAS4P
Science B 4502	SCB4P

10. Centres should be careful to ensure they submit ISAs appropriate for the subject that candidates are entering and for the appropriate moderation date, as marks from inappropriate subjects and out of date ISAs will not be accepted.
11. A separate entry is needed for each of the required units and for the overall subject before certification. Entry for centre assessed unit is not automatic. For example, for GCSE Biology (foundation level) you need to enter BL1F, BL2F, BL3F and BL4P. Centres should also enter the certification code of 4401.
12. Please refer to the specification for further explanation of the choices that can be made about when to certificate for each subject.
13. A candidate is only allowed to have one attempt at each ISA, and this may only be submitted for moderation on one occasion.
14. **Risk assessment**
It is the responsibility of the centre to ensure that a risk assessment is carried out for each investigation.
15. **The practical work**
For this part of the investigation candidates may work individually or in groups. It is advisable for teachers or technicians to carry out trial experiments.
16. Examples of teachers' notes for the ISAs and for Science B are given in this guide. The examples of marked work given in the 'Controlled assessment in detail' sections are based on these teachers' notes.

Frequently asked questions

Question: What does an ISA written test look like?

Answer: Please refer to the documents supplied in the guide. They are specimen papers accredited by Ofqual and are a representation of what the live controlled assessments will look like.

Question: Do the new ISAs have different criteria for units 1, 2 and 3?

Answer: Yes, they do, although the criteria are only slightly different in one respect. As shown on page 6, AQA will supply a hypothesis for unit 1 ISAs, whereas for units 2 and 3 candidates will be required to supply their own hypothesis.

Question: Are there definitions of unworkable, unsafe or unmanageable, or is this left to a teacher's discretion?

Answer: This is left to the discretion of the teacher. In terms of how this will affect the marks awarded to a candidate's method, as a general rule, if a plan is unmanageable in that it requires equipment that is not available, then no marks will be lost (as per the marking guidance). If, however, a plan is unsafe because it would mean a breach of health and safety procedures, then this may be subject to a loss of marks (again, as per the marking guidance).

Question: What is quality of written communication?

Answer: Quality of written communication (QWC) is a form of requirements where a candidate needs to structure their answer in a logical fashion, using correct spelling, punctuation and grammar, as well as supplying specialist terms where appropriate. Please refer to the guidance on quality of written communication document supplied by AQA for further details.

Question: What amount of teaching time is likely to be required to conduct the new controlled assessments?

Answer: Approximately 5 to 6 hours, dependent on circumstances.

Question: What is the difference between an ISA and the Science B controlled assessment?

Answer: In Science B there are no structured written papers. Although timings are suggested in Science B for various stages of the controlled assessment, exact timings are not prescribed as in the ISA.

Helpful websites and contact information

Free services

e-AQA

e-AQA gives teachers access to useful resources such as Exampro Extra Online and enhanced results analysis (ERA). To find out more about Exampro Extra Online, register for ERA at <https://extranet.aqa.org.uk>

Teacher Support meetings

Details of the full range of our teacher support meetings are available on our website at aqa.org.uk/professional-development

Speak to your subject team

You can talk directly to the GCSE sciences subject team about all our GCSE sciences specifications on **01483 477 756** or email science-gcse@aq.aqa.org.uk

For the latest information

Find out more, including the latest news, support and downloadable resources, at aqa.org.uk



