



Higher
Coursework
Assessment Task



Higher Chemistry

Assignment

Assessment task

This document provides information for teachers and lecturers about the coursework component of this course in terms of the skills, knowledge and understanding that are assessed. It **must** be read in conjunction with the course specification.

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Introduction

This document contains instructions for teachers and lecturers, marking instructions, and instructions for candidates for the Higher Chemistry assignment. You must read it in conjunction with the course specification.

This assignment is worth 20 marks (scaled to 30). This is 20% of the overall marks for the course assessment.

This is one of three course assessment components. The other components are question papers.

Instructions for teachers and lecturers

General information

This information applies to the assignment for Higher Chemistry.

The assignment assesses the application of skills of scientific inquiry and related chemistry knowledge and understanding.

The assignment allows candidates to demonstrate the following skills, knowledge and understanding:

- ♦ applying knowledge of chemistry to new situations, interpreting information and solving problems
- ♦ planning, designing and safely carrying out experiments/practical investigations to test given hypotheses or to illustrate particular effects
- ♦ collecting and recording data from experiments/practical investigations
- ♦ selecting information from a variety of sources
- ♦ presenting information appropriately in a variety of forms
- ♦ processing the information (using calculations and units, where appropriate)
- ♦ making predictions and generalisations based on evidence/information
- ♦ drawing valid conclusions and giving explanations supported by evidence/justification
- ♦ evaluating experiments/practical investigations and suggesting improvements
- ♦ communicating findings/information effectively

The assignment offers challenge by requiring candidates to apply skills, knowledge and understanding in a context that is one or more of the following:

- ♦ unfamiliar
- ♦ familiar but investigated in greater depth
- ♦ integrating a number of familiar contexts

Candidates research and report on a topic that allows them to apply skills and knowledge in chemistry at a level appropriate to Higher.

The topic must be chosen with guidance from teachers and/or lecturers and must involve experimental work.

The assignment has two stages:

- ♦ research
- ♦ report

The research stage must involve experimental work which allows measurements to be made. Candidates must also gather data/information from the internet, books or journals.

Candidates must produce a report on their research.

Conditions of assessment

Setting, conducting and marking the assignment

Setting

The assignment is:

- ◆ set by centres within SQA guidelines
- ◆ set at a time appropriate to the candidate's needs
- ◆ set within teaching and learning and includes experimental work at a level appropriate to Higher

Conducting

The assignment is:

- ◆ an individually produced piece of work from each candidate
- ◆ started at an appropriate point in the course
- ◆ conducted under controlled conditions

Marking

The report is submitted to SQA for external marking.

All marking is quality assured by SQA.

Assessment conditions

Controlled assessment is designed to:

- ◆ ensure that all candidates spend approximately the same amount of time on their assignments
- ◆ prevent third parties from providing inappropriate levels of guidance and input
- ◆ mitigate concerns about plagiarism and improve the reliability and validity of SQA awards
- ◆ allow centres a reasonable degree of freedom and control
- ◆ allow candidates to produce an original piece of work

There are two levels of control.

Under a high degree of supervision and control	Under some supervision and control
<ul style="list-style-type: none"> ◆ the use of resources is tightly prescribed ◆ all candidates are within direct sight of the supervisor throughout the session(s) ◆ display materials which might provide assistance are removed or covered ◆ there is no access to e-mail, the internet or mobile phones ◆ candidates complete their work independently ◆ interaction with other candidates does not occur ◆ no assistance of any description is provided 	<ul style="list-style-type: none"> ◆ candidates do not need to be directly supervised at all times ◆ the use of resources, including the internet, is not tightly prescribed ◆ the work an individual candidate submits for assessment is their own ◆ teachers and/or lecturers can provide reasonable assistance

The assignment has two stages.

Stage	Level of control
◆ research	conducted under some supervision and control
◆ report	conducted under a high degree of supervision and control

Instructions

Teachers and/or lecturers must exercise their professional responsibility to ensure that the report submitted is the candidate's own work.

It is recommended that no more than 8 hours is spent on the **whole** assignment.

A maximum of 2 hours is allowed for the report stage.

Teachers and/or lecturers must ensure candidates understand the requirements of the task. The instructions for candidates outline the requirements for the assignment and teachers and/or lecturers must give these to candidates at the outset. These must not be altered or supplemented by centre-devised material.

Teachers and/or lecturers must not, **at any stage**, provide candidates with a template or model answers.

Research stage

The research stage is conducted under some supervision and control. See 'Conditions of assessment' section.

Choosing the topic

At the start of the research stage, the teacher and/or lecturer must agree the choice of topic with the candidate to ensure that it:

- ◆ is appropriate for Higher Chemistry
- ◆ has associated experimental work that can generate numerical data
- ◆ allows the candidate the opportunity to access all of the available marks

The teacher and/or lecturer must ensure that a **range** of topics is available for candidates to choose from. A range of topics means that it is acceptable for the same general topic to be investigated in a class and across classes, providing that a variety of independent variables are being investigated, or a variety of experiments are being carried out, or both. This is to ensure that centres do not use a whole-class experiment.

Teachers and/or lecturers must minimise the number of candidates within a class:

- ◆ investigating the same topic
- ◆ investigating the same independent variable
- ◆ carrying out the same experiment

A range of topics chosen for investigation will create the climate in which candidates can produce original work within the conditions of assessment.

Once candidates have agreed the topic with their teacher and/or lecturer, the candidate must formulate an aim.

Formulating the aim

The teacher or lecturer must provide advice on the suitability of the candidate's aim, taking into account the factors below:

- ◆ health and safety considerations
- ◆ availability of resources
- ◆ availability of internet/literature data

Teachers and/or lecturers must not provide candidates with an aim.

After the candidate has formulated an aim, they can progress through the research stage.

The candidate's research consists of gathering data relevant to the aim from an experiment and comparative data/information from an internet/literature source. The candidate's research may also involve gathering extracts from internet/literature source(s) to support their description of the underlying chemistry.

Candidates can carry out their research in any order. They do not have to follow the order outlined below.

Experimental research

Teachers and/or lecturers can supply instructions for the experimental procedure. This must **only** be a basic list of instructions. These instructions must not include the range, number or interval of values or measurements nor should there be any reference to repeats. Candidates must decide these for themselves. Where there is a safety issue, a maximum value for the range may be provided.

Teachers and/or lecturers are responsible for ensuring that appropriate risk assessment has been carried out and that candidates have guidance on the safe and correct use of chemicals and equipment.

Teachers and/or lecturers must not provide candidates with experimental data.

Teachers and/or lecturers must not provide candidates with a blank or pre-populated table for experimental results.

Candidates must carry out the experimental work individually or as part of a small group. (A small group is defined as having two, three or four candidates.)

Group work may be an appropriate approach in a number of circumstances, for example:

- ◆ to encourage diversity of research topic
- ◆ where experiments are labour- or time-intensive
- ◆ where resources are limited

Where candidates work in a group, teachers and/or lecturers must ensure every candidate participates in the experimental work. Within the small group, it is acceptable for

candidates to share experimental data. However, they must not share experimental data between groups. Where candidates in a small group have the same raw data, any calculations and analysis must be done individually.

Teachers and/or lecturers must not provide feedback to candidates on their results. However, where **candidates** identify a problem with their results and indicate that they wish to repeat the experiment, candidates may do so.

Internet/literature research

The internet/literature research must be the work of the individual candidate; candidates cannot work in a group to carry out this research.

Candidates may carry out research to find comparative data/information and underlying chemistry outwith the direct supervision of teachers and/or lecturers.

Candidates must undertake internet/literature research using only websites, journals and/or books, to find secondary data/information.

Candidates must not have access to lists of potential sources of comparative data or lists of sources of extracts to support their description of the underlying chemistry. Candidates must not be directed to specific websites, journals or textbooks. Candidates must not be provided with whole articles or extracts from websites, journals or textbooks, selected by a third party.

Candidates must find internet/literature data/information that they can compare to their experimental data and record the reference to the source.

This can be data/information that:

- ◆ matches the sample range used
- ◆ is not an exact match for the sample range used
- ◆ is generic and illustrates a trend or pattern expected in the experimental data

Teachers and lecturers must not provide candidates with a set of experimental data to compare with the candidates' own data.

Teachers and/or lecturers must not provide feedback to candidates on their research.

Report stage

The report stage is conducted under a high degree of supervision and control. See 'Conditions of assessment' section.

Candidates must be given a maximum of 2 hours to produce the report.

- ◆ This can be a continuous period of time or split over a number of successive subject lessons.

- ◆ Centres are responsible for ensuring that candidates are given no more than the maximum time.
- ◆ If the report is produced over a number of successive lessons, then the teacher or lecturer must retain candidates' work and store it securely between lessons to ensure that candidates do not add any additional materials to those they had at the start of the report stage. Teachers and lecturers must not provide any additional teaching or coaching in relation to the assignments between reporting sessions.

Candidates may word-process their report and use appropriate software to produce graphs – providing that the assessment conditions are met.

Teachers and/or lecturers must check that all materials (in any format) that each and every candidate will use in the report stage are:

- ◆ the instructions for candidates, which must not have been altered
- ◆ the candidate's raw experimental data which may be tabulated, however must not have additional blank or pre-populated columns for mean and derived values
- ◆ data/information taken from the internet or literature or the SQA data booklet, which must not include sample calculations
- ◆ a record of the source(s) of internet or literature data/information
- ◆ the instructions used for the experimental procedure
- ◆ extract(s) from internet/literature source(s) or the SQA data booklet to support the underlying chemistry, which must not include sample calculations

An extract must be:

- ◆ chosen by the candidate – they must select what information to extract
- ◆ verbatim – it must be a direct copy, which can be a printout, photocopy or handwritten (and word for word)
- ◆ from an internet/literature source – not from centre-devised course material or class notes. Candidate notes of any description are not permitted.
- ◆ checked by the teacher or lecturer to ensure that it is an extract (unannotated), and not notes or a draft

There is no size limit on an extract; however, it must be an extract and not the full document.

Candidates **must not** have access to a previously prepared draft of a report or any part of a report.

In addition, candidates **must not** have access to the assignment marking instructions during the report stage.

Candidates must not have access to the internet during the report stage.

Teachers and/or lecturers must not provide any form of feedback to a candidate on their report.

Following completion of the report stage, candidates must not be given an opportunity to redraft their report.

Teachers and lecturers **must not** read the reports before they are submitted to SQA.

Evidence to be gathered

The following candidate evidence is required for this assessment:

- ◆ a report

The report is submitted to SQA, within a given time frame, for marking.

The same report cannot be submitted for more than one subject.

Marking instructions

In line with SQA's normal practice, the following marking instructions for the Higher Chemistry assignment are addressed to the marker. They will also be helpful for those preparing candidates for course assessment.

Candidates' evidence is submitted to SQA for external marking.

General marking principles

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.

Detailed marking instructions

Read the whole report before assigning any marks.

Section	Max mark	Expected response and marking instructions
1 Aim (1 mark)		
	1	<p>An aim that describes clearly the purpose of the investigation.</p> <p>The word ‘aim’ is not required, but the statement of the aim should be separate from the title.</p> <p>Acceptable versions of an aim could be:</p> <ul style="list-style-type: none">♦ ‘To determine the effect of cooking time on the concentration of vitamin C.’♦ ‘To measure the sulfur dioxide content of white wines.’ <p>Note: ‘to investigate antioxidants’ or ‘to investigate alcohols’ would not be acceptable.</p>

Section	Max mark	Expected response and marking instructions
2 Underlying chemistry (3 marks)		
	3	<p>An account of chemistry relevant to the aim of the investigation.</p> <p>Mark this section holistically. Award marks for the ‘quality’ of the underlying chemistry at a depth appropriate to at least Higher level. Underlying chemistry may be found anywhere in the assignment report but award the marks in this section.</p> <p>The candidate must demonstrate an understanding of relevant chemistry and use their own words wherever possible. They can, however, include complex diagrams and complicated structural formulae from an internet and/or literature source.</p> <ul style="list-style-type: none"> ◆ Award 3 marks for a good understanding of relevant chemistry. The account does not need to be what might be termed ‘excellent’ or ‘complete’. ◆ Award 2 marks for a reasonable understanding of relevant chemistry. ◆ Award 1 mark for a limited understanding of relevant chemistry. ◆ Award 0 marks for demonstrating no understanding of relevant chemistry. <p>Only award marks for underlying chemistry. Do not award marks for general information, for example historical or socio-economic information.</p>

Section	Max mark	Expected response and marking instructions
3 Data collection and handling (6 marks)		
3 a	1	<p>A brief summary of the approach used to collect experimental data.</p> <p>This mark is awarded for demonstrating the ability to summarise the method.</p> <p>Where the candidate has not demonstrated the ability to summarise the method, do not award the mark.</p> <p>The summary need only be in sufficient detail that the nature of the experiment can be visualised. The candidate does not need to include details such as the concentrations and volumes of solutions used.</p> <p>The candidate should not include excessive details in the summary.</p> <p>It is taken for granted that the candidate will follow general safety rules, such as wearing safety glasses and/or goggles. The summary must identify any additional safety measures that should be taken to minimise risk, for example carrying out a procedure such as spraying a chromatogram in a fume cupboard, or removing a delivery tube from a liquid before stopping heating a test tube or flask.</p> <p>Where an experiment does not require any specific safety measures, the candidate must make a statement indicating this.</p> <p>A diagram on its own is insufficient to gain this mark.</p> <p>Acceptable summaries of an experimental approach could be:</p> <ul style="list-style-type: none"> ♦ ‘Tea samples were titrated with iodine solution using starch as the indicator. We wore gloves when handling iodine solution.’ ♦ ‘The alcohol concentration of different drinks was measured by distilling the drink and measuring the density of the distillate. A hot plate was used and there were no flames nearby.’

Section	Max mark	Expected response and marking instructions
3 b	1	<p>Sufficient raw data from the candidate's experiment.</p> <p>Where appropriate, repeated measurements must be included.</p> <p>The number and range of values must be appropriate to the aim. A minimum of three values will be appropriate in some investigations; however, the number will depend upon the aim of the assignment.</p> <p>For example:</p> <ul style="list-style-type: none"> ◆ Where the aim is to investigate the effect of chain length on the heat energy released when alcohols are burned, a minimum of three alcohols are required to show a trend. ◆ Where the aim is to investigate the hardness of water samples from different locations, it would be acceptable for the candidate to test water samples from three locations. <p>In this section, do not penalise errors in the presentation of data, such as missing headings or missing units from tables.</p> <p>Award this mark for raw, unprocessed data and not mean or derived values calculated from raw data.</p>

Section	Max mark	Expected response and marking instructions
3 c	1	<p>Data, including any mean and/or derived values, presented in correctly produced table(s) and correct units shown for calculated values.</p> <p>Experimental data must be tabulated.</p> <ul style="list-style-type: none"> ♦ Every column must have a clear heading. ♦ Units must be indicated in column headings or given after every data entry. <p>Appropriate units must be stated for values calculated by the candidate from experimental data.</p> <p>In this section, do not penalise errors in the calculation of values.</p>

Section	Max mark	Expected response and marking instructions
3 d	1	<p>Values calculated correctly using a chemical relationship.</p> <p>The candidate must correctly complete a chemical calculation based on experimental data.</p> <p>Chemical calculations include:</p> <ul style="list-style-type: none"> ♦ calculations involving the relationship between moles, concentration and solution volumes ♦ calculations involving the relationship between moles and gram formula masses ♦ calculations of reacting masses or gas volumes based on balanced equations ♦ calculation of percentage yields ♦ enthalpy calculations ♦ calculations of relative or average rates for a chemical reaction <p>Where measurements have been repeated, all mean and/or average values must be calculated correctly.</p> <p>In this section, do not award marks for the calculation of averages and/or titre values from burette readings on their own.</p>
3 e	1	Data relevant to the experiment from an internet/literature source.

Section	Max mark	Expected response and marking instructions										
3 f	1	<p>A citation and reference for a source of the internet/literature data/information.</p> <p>The candidate must cite the literature source within the body of the report and give the reference later in the report.</p> <table><tr><th>Source</th><th>Reference</th></tr><tr><td>Website</td><td>Full URL for the page(s) with date accessed The URL ‘www.bbc.co.uk (Dec 2017)’ is not acceptable, but http://www.bbc.co.uk/education/topics/z2snb9q (Dec 2017) is an acceptable reference.</td></tr><tr><td>Journal</td><td>Title, author, journal title, volume and page number</td></tr><tr><td>Book</td><td>Title, author, page number and either edition or ISBN</td></tr><tr><td>Data booklets</td><td>Title, page number and either year of publication or ISBN or full URL</td></tr></table>	Source	Reference	Website	Full URL for the page(s) with date accessed The URL ‘www.bbc.co.uk (Dec 2017)’ is not acceptable, but http://www.bbc.co.uk/education/topics/z2snb9q (Dec 2017) is an acceptable reference.	Journal	Title, author, journal title, volume and page number	Book	Title, author, page number and either edition or ISBN	Data booklets	Title, page number and either year of publication or ISBN or full URL
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Book	Title, author, page number and either edition or ISBN											
Data booklets	Title, page number and either year of publication or ISBN or full URL											

Section	Max mark	Expected response and marking instructions
4 Graphical presentation (4 marks)		
		<p>The candidate's graph must be based on their own experimental data.</p> <p>Mark computer-generated graphs in the same way as hand-drawn graphs.</p> <p>Graphs should be of a size that allows the scaling and labelling of the axes and the accuracy of the plotting of the data points to be readily checked.</p> <p>It may not be possible to check the accuracy of plotting if data points are excessively large, minor gridlines are omitted, or the candidate has not used graph paper.</p>
4 a	1	An appropriate format from the options of scatter graph, line graph or bar graph.
4 b	1	The axis/axes of the graph has/have suitable scale(s).
4 c	1	<p>The axes of the graph have suitable labels and units.</p> <p>Do not penalise spelling mistakes or the use of abbreviations if the meaning of an axis label can be clearly understood within the context of the investigation.</p> <p>Appropriate abbreviations may be used for units.</p>

Section	Max mark	Expected response and marking instructions
4 d	1	<p>Accurately plotted data points and, where appropriate, a line of best fit.</p> <p>Do not award this mark if it is not possible to check the accuracy of plotting.</p>
5 Analysis (1 mark)		
	1	<p>A valid comparison of the experimental data with data from the internet/literature source.</p> <p>A correct and valid relationship is identified between the results of the experiment and the data/information from the internet/literature source. The data values in the experiment should also be discussed in comparison with each other and in comparison with the data/information in the internet/literature source.</p>
6 Conclusion (1 mark)		
	1	<p>A valid conclusion that relates to the aim and is supported by all the data in the report.</p> <p>Where no aim has been stated, do not award this mark.</p>

Section	Max mark	Expected response and marking instructions
7 Evaluation (3 marks)		
	3	<p>Evaluation of the investigation</p> <p>Award 1 mark for each valid evaluative statement relating to the candidate's data, supported by appropriate justification.</p> <p>Any evaluative statement that describes a change to the procedure carried out should identify the impact of that change on the candidate's data.</p> <p>The evaluative statements should relate to the quality of the data/information obtained from:</p> <ul style="list-style-type: none"> ♦ experimental procedures ♦ internet/literature source <p>A maximum of one of these marks is available for evaluation of the internet/literature source.</p>
8 Structure (1 mark)		
	1	<p>A clear and concise report with an informative title.</p> <p>The structure of the report does not need to follow the structure suggested in the marking instructions or instructions for candidates, but should flow in a logical manner.</p> <p>Note: 'Higher Chemistry assignment' alone is not acceptable.</p>
Total	20	

Instructions for candidates

This assessment applies to the assignment for Higher Chemistry.

This assignment is worth 20 marks. This is 20% of the overall marks for the course assessment.

It assesses the following skills, knowledge and understanding:

- ◆ applying knowledge of chemistry to new situations, interpreting information and solving problems
- ◆ planning, designing and safely carrying out experiments/practical investigations to test given hypotheses or to illustrate particular effects
- ◆ collecting and recording data from experiments/practical investigations
- ◆ selecting information from a variety of sources
- ◆ presenting information appropriately in a variety of forms
- ◆ processing the information (using calculations and units, where appropriate)
- ◆ making predictions and generalisations based on evidence/information
- ◆ drawing valid conclusions and giving explanations supported by evidence/justification
- ◆ evaluating experiments/practical investigations and suggesting improvements
- ◆ communicating findings/information effectively

Your assignment has two stages:

- ◆ research
- ◆ report

Your teacher or lecturer will let you know if there are any specific conditions for doing this assessment and tell you how the assignment will be carried out.

In this assignment, you have to investigate a topic in chemistry by doing research.

Your research involves gathering data/information from an experiment and from internet/literature sources.

You then produce a report on your investigation.

Your teacher or lecturer will not mark your report at any point. It is sent to SQA for marking.

Research stage

Choosing your topic

- ◆ You need to choose a relevant topic in chemistry to investigate.
- ◆ You must agree your topic with your teacher or lecturer.

Deciding your aim

- ◆ Once you have chosen your topic you need to decide on the aim of your investigation. Remember that you need to do an experiment and find data/information to compare with your experimental results.
- ◆ Your teacher or lecturer will provide advice on the suitability of your aim, in terms of safety and availability of resources. They will not assess your aim.

Experimental research

- ◆ When choosing your experiment, remember it must allow measurements to be taken.
- ◆ When carrying out your experiment, you must work either on your own or as part of a small group. If you are working as part of a small group, you must take an active part.
- ◆ Make sure you use a sufficient number of values over a wide enough range to meet the aim of your investigation.
- ◆ You must repeat your experiment, if possible.
- ◆ Your raw experimental data may be tabulated, however tables must not have additional blank or pre-populated columns for mean and derived values.
- ◆ You will use your raw experimental data during the report stage.

Internet/literature research

You must carry out your own internet/literature research.

- ◆ You need to find data/information from the internet, books and/or journals that you can compare to your experimental data. This could be a table or a graph, or information from diagrams or text. This data/information does not need to exactly match your experiment but could illustrate the trend or pattern expected in your experimental data.
- ◆ It is important that you record where you get your data/information from in enough detail that another person could find it. This is known as a reference.
- ◆ In your report you will need to describe the chemistry relevant to your aim. You can gather extracts from the internet, books and/or journals to help you write your description of the underlying chemistry. Extracts must be from an internet/literature source – not from centre-devised course material or class notes. An extract must be a direct copy, which can be a printout, photocopy or handwritten (word for word) and must not be annotated. There is no size limit on an extract; however, it must be an extract and not the full document. During the report stage you will need to show your understanding by writing this description using your own words.
- ◆ Your extracts can include any formulae or relationships you may need but must not include sample calculations.

- ◆ During the report stage you will need to show your understanding by writing your description of the chemistry relevant to your aim using your own words.

Report stage

Producing the report

- ◆ The report must be all your own work.
- ◆ When producing your report, you will be supervised at all times.
- ◆ You have 2 hours to complete your report.

Resources

During the report stage you are only allowed to have certain materials.

You can have:	You cannot have a previously prepared:
<ul style="list-style-type: none"> ◆ these instructions for candidates ◆ extracts you have gathered from the internet, books and/or journals to help you describe the chemistry relevant to your aim ◆ the instructions used in the experimental procedure ◆ your raw experimental data, which may be tabulated ◆ your internet or literature data/information, including the reference to the source of the data/information 	<ul style="list-style-type: none"> ◆ draft of your report ◆ draft of any part of your report ◆ sample calculations from any source ◆ a table containing additional blank or pre-populated columns for mean and derived values

Your teacher or lecturer cannot provide you with feedback or tell you how to improve your report.

Guidance on producing your report

Your report must be easy to follow.

You may find that using headings will help to make your report clear.

Title

- ◆ Your title must tell the reader what your report is about.

Aim

- ◆ Your aim must describe clearly the purpose of your investigation.

Underlying chemistry

- ◆ You must describe the chemistry relevant to your aim.
- ◆ You must use your own words as much as possible.
- ◆ You may choose to include:
 - formulae or balanced equations
 - an explanation of properties
 - explanations of relationships or trends
 - an explanation of the meaning of any chemical terms used
 - copies of diagrams which you would find difficult to draw, for example, complicated structural formulae
- ◆ You can quote from extracts as long as you give a description or explanation, in your own words, showing that you understand the chemistry.
- ◆ Other than quoting from your extracts, you must not copy directly from them. Copying directly from your extracts would not show that you understand the chemistry.

Description of experiment

- ◆ You must give only a **brief** description that shows you can summarise your experimental procedure. You must not give a full description. Details such as the range, number or interval of values or measurements, or information about repeats are not required.
- ◆ When you carried out your experiment, you followed general safety rules, for example wearing safety glasses or goggles. Your description of the experiment must identify any additional safety measures you took to minimise risk. If your experiment did not require any additional safety measures, you must state this.

Experimental data

- ◆ You must include a table showing **all** of the raw data measurements (for example, start and end values) you recorded during your experiment.
- ◆ Make sure you include column headings and units (where appropriate).
- ◆ Using your experimental data, you must carry out a chemical calculation.
- ◆ Chemical calculations include:
 - calculations involving the relationship between moles, concentration and solution volumes
 - calculations involving the relationship between moles and gram formula masses
 - calculations of reacting masses or gas volumes based on balanced equations
 - calculation of percentage yields
 - enthalpy calculations
 - calculations of relative or average rates for a chemical reaction
- ◆ You should show at least one sample calculation.
- ◆ Make sure you include units in your calculated values.
- ◆ If you have carried out repeat experiments, you must calculate average values.

Graphical presentation

- ◆ You must produce a graph of your experimental results.
- ◆ The graph must:
 - be a scatter graph, line graph or a bar graph, whichever is appropriate for your data
 - be large enough to allow points to be read accurately
 - have suitable scales, labels and units on the axes
- ◆ You must use graph paper or graphing software.
If you are using graphing software, you must include both major and minor gridlines.
You must use plotting symbols that are clear but not too large.
- ◆ If you are plotting a scatter graph, a line or curve of best fit should usually be drawn.
However, if there is no obvious pattern to your plotted data points, you should not try to draw a line or curve of best fit.

Data from an internet/literature source

- ◆ You must include data from an internet/literature source that you can compare with the data from your experiment.
- ◆ You must cite your internet/literature source within the body of the report near to the relevant data/information.
- ◆ You can cite a source in many ways. One example is to put a number, for example (1), next to the data/information and the same number beside the reference given later in the report. A citation cannot be a URL.
- ◆ You must include a reference later in the report.
- ◆ You must include the following information in a reference:

Source	Reference
Website	full URL for the page or pages, with the date accessed
Journal	title, author, journal title, volume and page number
Book	title, author, page number and either edition or ISBN
Data booklets	title, page number and either year of publication or ISBN or full URL

Analysis

You **must** compare your experimental data with the data from your internet/literature source. You must state a relationship between your experimental results and the data/information from your internet/literature source. The data values that you have obtained in your experiment should be also be discussed in comparison with each other and in comparison with the data/information in your internet/literature source.

For example:

- ◆ in a determination of vitamin C in different fruit juices, the values obtained for each juice should be compared in relation to the other juices you tested and the values for each juice should be compared with the values obtained from the internet.

OR

- ◆ in the investigation of enthalpies of combustion of different alcohols, the enthalpy values that you determine should be compared for each alcohol in your data set and the value obtained for each alcohol compared with the values obtained from the internet/literature source.

Conclusion

You must state a conclusion that relates to your aim **and** is supported by **all** the data included in your report. This must not be a restatement of results.

Evaluation

You should make three evaluative statements, with appropriate justification, referring to the data/information provided in your report.

Your evaluative statements can relate to:

- ◆ your experimental procedure
- ◆ your internet/literature source.

Evaluative statements made about your experimental procedure must be made with direct reference to the data that you have obtained. **These statements should include comments on the quality of your data and reasons why your experiment worked well or suggestions for improvements/changes to the experiment.** If changes to your experimental procedure are given, you should state the impact that these changes make on your data.

No more than one of the statements can evaluate your internet/literature source(s).

Summary

You can use this table to check you have covered all the sections in your report.

Section	Description	Marks
Title and structure	An informative title and a structure that can be easily followed.	1
Aim	A description of the purpose of your investigation.	1
Underlying chemistry	A description of the chemistry relevant to your aim, which shows your understanding.	3
Data collection and handling	A brief description of your experiment, including safety measures.	1
	Sufficient data from your experiment.	1
	Data from your experiment presented in a table(s) with headings and units.	1
	Units shown after any values you have calculated.	
	Values correctly calculated from your experimental data using a chemical relationship.	1
	Data/information from an internet/literature source.	1
	A citation for an internet/literature source and the reference later in the report.	1
Graphical presentation	Appropriate type of graph used to present your experimental data.	1
	Suitable scales.	1
	Suitable labels and units on axes.	1
	All data plotted accurately, with line or curve of best fit if appropriate.	1
Analysis	Experimental data compared to data from internet/literature source.	1
Conclusion	A conclusion relating to your aim, based on all the data in your report.	1
Evaluation	Three evaluative statements supported by justifications and identifying impact.	3
Total		20

Once complete, give your report to your teacher or lecturer to submit to SQA.

Administrative information

Published: June 2020 (version 3.0)

History of changes

Version	Description of change	Date
2.0	<p>‘Instructions for teachers and lecturers’ section:</p> <ul style="list-style-type: none">◆ ‘Instructions’ sub-section:<ul style="list-style-type: none">— clarification that instructions for candidates must not be altered or supplemented by centre-devised materials◆ ‘Choosing the topic’ sub-section:<ul style="list-style-type: none">— information added that there must be a range of topics available for candidates to choose from and that teachers/lecturers must minimise the numbers investigating the same topic within a class◆ ‘Experimental research’ sub-section:<ul style="list-style-type: none">— candidates can be given only a basic list of instructions for the experimental procedure and must decide on range, interval and number of repeats for themselves◆ ‘Internet/literature research’ sub-section:<ul style="list-style-type: none">— this must be the work of the individual candidate— candidates must undertake research using only websites, journals and/or books— provision of a wide list of URLs or a wide list of journals and/or books should be the exception— provision of the full content of a wide list of sources should be the exception◆ ‘Report stage’ sub-section:<ul style="list-style-type: none">— teachers/lecturers must check the materials of each and every candidate— information added to the bullet points about raw experimental data, internet/literature data and extracts— information added on extracts— list of items that candidates cannot have access to in the report stage replaced with ‘Candidates must not have access to a previously prepared draft of a report or any part of a report.’◆ Marking instruction for ‘evaluation’ updated for clarification.	September 2019

	<p>♦ 'Instructions for candidates' section updated to reflect the changes made in the 'instructions for teachers and lecturers' section.</p>	
3.0	<p>Addition of 'collecting and recording data from experiments/practical investigations' to the list of skills, knowledge and understanding on page 2.</p> <p>Clarification of a 'range of topics' on page 5.</p> <p>Additional details on 'Formulating the aim' and 'Experimental Research' on page 6.</p> <p>Removal of the provision of lists of potential sources on page 7.</p> <p>Additional information on conducting the 'Report stage' over successive lessons and the inclusion of the SQA H/AH Chemistry data booklet on page 8.</p> <p>Clarification of the 'Analysis' in the Marking Instructions on page 19.</p> <p>Clarification of the 'Evaluation' in the Marking Instructions on page 20.</p> <p>Additional information added to 'Description of experiment' in the instructions for candidates on page 24.</p> <p>Additional information included in the 'Data from an internet/literature source' in the instructions for candidates on page 26.</p> <p>Clarification of the 'Analysis' and 'Evaluation' in the instructions for candidates on pages 26 and 27.</p>	June 2020

Note: you are advised to check SQA's website to ensure you are using the most up-to-date version of this document.

Security and confidentiality

This document can be used by SQA approved centres for the assessment of National Courses and not for any other purpose.

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