

Appendix B: Guidance for Internally Assessed Units

AS Unit F333: *Chemistry in Practice*

Introduction

This unit is teacher assessed and externally moderated by OCR.

Candidates are assessed in **five** skill areas. Teachers assess the ability of candidates to:

- **Skill I (Competence)** – carry out practical work competently and safely using a range of techniques;
- **Skill II (Measurement)** – carry out quantitative experiments accurately and make and record reliable and valid measurements with appropriate accuracy and precision;
- **Skill III (Analysis and evaluation)** – apply chemical knowledge and processes to unfamiliar situations to analyse and evaluate their own quantitative experiments;
- **Skill IV (Observation)** – make and record valid qualitative observations with appropriate accuracy and detail;
- **Skill V (Interpretation)** – recognise, recall and show understanding of chemical knowledge to interpret and explain their own qualitative experiments, with due regard to spelling, punctuation and grammar and correct use of technical terms.

Skill I is assessed over a period of time using a minimum of **six** different practical activities.

Skills II, III, IV and V may be assessed in separate activities or they may be assessed together in **two** separate activities as follows: Skills II and III; Skills IV and V. These activities are provided by OCR. Activity sheets from the course material should **not** be used for assessment.

Award of Marks

Marks for skill I are awarded by direct observation by the teacher of the practical work carried out by candidates over a period of time. Marks are awarded in this skill area using generic descriptors provided by OCR (page 60).

Skills II, III, IV and V are assessed using activities and mark schemes provided by OCR (available via download from the OCR Interchange site) and carried out under the direct supervision of the teacher. Marks are awarded in these skill areas using activity specific mark schemes provided by OCR.

Each skill area is assessed by the teacher and given a mark between 0 and 12 to give a final mark out of 60 for this unit which is submitted to OCR.

Skill Area I (Competence)

Candidates carry out a range of practical work over time as a normal and integral part of their study of chemistry. The practical activities **must** provide opportunities for the candidate to:

- carry out a titration;
- make thermochemical measurements;
- carry out qualitative experiments using test-tubes;
- carry out an experiment involving ICT;
- prepare an organic compound;
- collaborate with other students in solving a problem.

Teachers assess the ability of candidates to carry out practical work competently and safely using

a range of techniques by direct observation and by matching achievement against the following descriptors:

Marks	Descriptors
1	<p>Works safely some of the time.</p> <p>Demonstrates competent manipulative skills only in basic practical procedures (eg heating, transferring solids and liquids) and does not resolve problems without help.</p> <p>Demonstrates a haphazard and disorganised approach to practical work, takes little care when making measurements or observations and pays little attention to detail.</p>
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3	<p>Works safely for much of the time.</p> <p>Demonstrates competent manipulative skills in some of the more demanding practical procedures (eg weighing, use of pipette or burette) and resolves some minor problems without help.</p> <p>Demonstrates a reasonable degree of organisation in approach to practical work and makes many measurements and observations carefully and pays attention to some of the detail.</p>
4	<p>Works safely most of the time.</p> <p>Demonstrates competent manipulative skills in most of the more demanding practical procedures (eg weighing, use of pipette or burette) and resolves most minor problems without help.</p> <p>Demonstrates a good degree of organisation in approach to practical work and makes most measurements and observations carefully and pays attention to much of the detail.</p>
5	
6	<p>Works safely all of the time.</p> <p>Demonstrates well developed manipulative skills in all practical procedures and resolves most problems without help.</p> <p>Demonstrates a highly organised approach to practical work and makes all measurements and observations with great care and attention to detail.</p>

The descriptors should be applied in a 'best fit' manner to choose a mark between 0 and 6 which **best** describes the work of the candidate **over the whole range of practical activities** and takes account, if appropriate, of a higher level of achievement in some of the characteristics within the descriptors and a lower level of achievement in other characteristics. A mark of 0 should be awarded if the descriptors are not met in any way.

It is expected that there will be a broad match between the mark awarded for skill I and the evidence available from the assessment of skills II and IV **and moderators will check for this match.**

Teachers must keep a record of the candidates' achievement over time in a working document, a specimen of which will be supplied by OCR. Teachers should use this document to help them award a mark between 0 and 6 which best describes the candidates' average level of achievement in this skill area.

This mark is then doubled to give a mark out of 12 to match those for skill areas II–V.

Skill Areas II (Measurement), III (Analysis and evaluation), IV (Observation) and V (Interpretation).

The assessment of skill areas II, III, IV and V is made using activities and specific mark schemes provided by OCR. These activities must be carried out individually under controlled conditions supervised by the teacher.

Skill areas II, III, IV and V may be assessed using separate activities.

Skill areas II and III may be assessed using a single activity in which the candidate makes, records, analyses and evaluates quantitative measurements.

Skill areas IV and V may be assessed using a single activity in which the candidate makes, records, interprets and explains qualitative observations.

Where a skill area is assessed on more than one occasion, only the best mark should be reported.

Moderation

Teachers must supply the following documentation for external moderation purposes:

- an F333 – Skill I (Competence) – Experiment Description and Mark Sheet used to describe the activities on which the mark for skill area I is based and to record marks in this skill area. This will be supplied by OCR;
 - an F333 Skill Area Mark Sheet completed to show the marks awarded in each skill area for each candidate. This will be supplied by OCR;
 - details of the activities on which the award of marks in skill areas II, III, IV and V is based;
 - candidates' work on which the award of marks in skill areas II, III, IV and V is based for those candidates in the moderation sample.
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This unit is teacher assessed and externally moderated by OCR.

Candidates carry out a single individual investigation. The topic may be taken from any aspect of chemistry. Candidates are expected to spend **about 18 hours** in the laboratory carrying out practical work as part of their investigation, and an **appropriate amount of time both before and after** this period preparing for and using the results of their investigation.

Candidates are assessed in **eight** skill areas (A–H). Teachers assess the ability of candidates to:

Skill Area A (Chemical ideas) – apply scientific knowledge and processes to unfamiliar situations (6 marks);

Skill Area B (Methods) – select and describe appropriate qualitative and quantitative methods (6 marks);

Skill Area C (Communication) – select, organise and communicate relevant information with due regard to spelling, punctuation and grammar and the accurate use of specialist vocabulary (5 marks);

Skill Area D (Observations and measurements) – make, record and communicate reliable and valid observations and measurements with appropriate precision and accuracy (6 marks);

Skill Area E (Analysis and interpretation) – analyse and interpret the results of investigative activities (6 marks);

Skill Area F (Evaluation) – explain and evaluate the methodology and results of investigative activities (6 marks);

Skill Area G (Manipulation) – demonstrate safe and skilful practical techniques and processes (5 marks);

Skill Area H (Demand) – develop and apply familiar and new chemical knowledge and processes in demanding situations (5 marks).

The marks for the eight skill areas are added together to provide a mark out of 45 for this unit which is submitted to OCR.

Authentication and marking of candidates' work.

Candidates must complete and hand in their investigation report in **three separate sections**. Teachers must verify that, to the best of their knowledge, **each section is the work of the candidate concerned**.

Section 1 of the investigation report (teacher marks skills A–C)

Candidates must complete and hand in a first draft of section 1 of their investigation report **before they begin** any practical work. **This draft should be authenticated by the teacher** and returned to the candidate so that it can be revisited and modified as the investigation proceeds. The final draft of this section should be taken in by the teacher for final marking as soon as practical work has been completed.

In this section candidates should:

- identify and describe the aims of the investigation;
- describe the chemical knowledge which they have researched in order to help them devise their investigation plan;

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- describe the equipment, materials and experimental procedures they use to achieve the investigation aims;
 - include a risk assessment;
 - include a list of references to sources they have consulted to help them devise their plan.

In all of these, candidates should be careful to use technical terms correctly and pay careful attention to spelling, punctuation and grammar.

Teachers award marks using generic criteria in three skill areas (A, B and C). In each area the marks are awarded by applying a 'best fit' approach to match the candidate's work against criteria.

Skill Area A (Chemical ideas) – apply scientific knowledge and processes to unfamiliar situations (6 marks).

Skill Area B (Methods) – select and describe appropriate qualitative and quantitative methods (6 marks).

Skill Area C (Communication) – select, organise and communicate relevant information with due regard to spelling, punctuation and grammar and the accurate use of specialist vocabulary (5 marks).

Section 2 of the investigation report (teacher marks skill D)

Candidates must complete and hand in section 2 of their investigation report as soon as they have completed their practical work. This section should be authenticated by the teacher. Candidates are expected to retain a copy of this section to allow them to interpret and evaluate the results of their investigation.

In this section candidates should:

- Record the observations and measurements made during the investigation, taking care that there are a sufficient number of good quality measurements and/or observations that are presented clearly.

Teachers award marks using generic criteria in one skill area (D). In this area the marks are awarded by applying a 'best fit' approach to match the candidates' work against criteria.

Skill Area D (Observations and measurements) – make, record and communicate reliable and valid observations and measurements with appropriate precision and accuracy (6 marks).

Section 3 of the investigation report (teacher marks skills E and F)

Candidates must complete and hand in section 3 of their investigation report after they have been given time to analyse, interpret and evaluate their investigation. **This section should be authenticated by the teacher.**

In this section candidates should:

- describe the outcomes of their investigation;
 - draw together observations and/or manipulate raw data using calculations and graphs;
 - interpret observations and measurements;
 - draw conclusions from raw and/or manipulated data and observations using underlying chemical knowledge;
 - comment on the limitations of practical procedures;
 - calculate, where appropriate, the experimental uncertainty associated with measurements;
 - evaluate the choices of equipment, materials and practical procedures used in the
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investigation;

Teachers award marks using generic criteria in two skill areas (E and F). In each skill area the marks are awarded by applying a 'best fit' approach to match the candidates' work against the criteria.

Additional skill areas (G and H)

In addition to the six skill areas described above, teachers award marks in two further areas (G and H) using generic criteria. In both skill areas, marks are awarded by applying a 'best fit' approach to match the candidates' work against the criteria.

Marks for these two skill areas must be awarded soon after the completion of practical work.

The practical work undertaken by the candidate must be supervised by the teacher who will assess skill area G. In addition, teachers must keep a record as a working document of their observation of the candidates' ability to carry out practical work safely and skilfully.

The teacher will assess the ability of the candidate to:

- work safely;
- manipulate equipment and materials;
- make observations and take measurements.

In skill area H teachers assess the demand of the investigation undertaken by the candidate.

Teachers take account of the demand arising from the candidate:

- using unfamiliar equipment and chemical ideas;
- using experimental procedures in unfamiliar situations;
- using chemical ideas in unfamiliar situations;
- devising innovative experimental procedures;
- solving emerging problems.

Detailed Mark Schemes

For each skill shown in the tables that follow, the descriptors below should be applied in a 'best fit' manner to choose a mark between 1 and 5 or 6 which **best** describes the work of the candidate and takes account, if appropriate, of a higher level of achievement in some of the characteristics within the descriptors and a lower level of achievement in other characteristics. This should be achieved by selecting the descriptors at each level which provide the best match with different aspects of the candidates' work. A mark of 0 should be awarded if the descriptors are not met in any way.

Moderation of Candidates' Work

Where candidates are assessed by different teachers in a centre, a system of internal moderation must be devised and used to ensure that exactly the same standards are used in the award of marks for all candidates. A recommended method would involve all teachers in the centre marking the work of a selection of candidates at the start of the moderation process to establish the standards to be applied to the work of all candidates.

The work of candidates will also be subject to external moderation by OCR.

Teachers must supply the following documentation for external moderation purposes:

- a completed mark record form showing the marks awarded in each skill area for each

candidate. This will be supplied by OCR;

- the working document used by teachers to help award an appropriate mark in skill area G.

Sections 1, 2 and 3 of the candidates' final investigation report on which the award of marks is based for those candidates in the moderation sample.

Marks	Descriptors for Skill A (Chemical ideas) (6 marks)	Descriptors for Skill B (Methods) (6 marks)
	Apply chemical knowledge and processes to unfamiliar situations. (range, depth, accuracy)	Select and describe appropriate qualitative and quantitative methods. (aims, choices, descriptions)
1	Describes a small range of basic chemical knowledge in support of the investigation. Describes chemical knowledge superficially and includes few details. Makes errors in using chemical knowledge and describes chemical knowledge which is not relevant to the actual investigation undertaken.	Identifies and defines the aims of the investigation in a vague or unclear manner. Selects equipment and materials and devises experimental procedures that are sometimes inappropriate to achieve the aims of the investigation. Describes in limited detail the experimental procedures used.
3	Describes a wide range of chemical knowledge in support of the investigation. Describes chemical knowledge in some depth and includes many details. Makes a few errors when describing chemical knowledge and describes chemical knowledge which is generally relevant to the actual investigation undertaken.	Identifies and defines the aims of the investigation in a generally precise and clear manner. Selects equipment and materials and devises experimental procedures that are generally appropriate to achieve the aims of the investigation. Describes, including most appropriate detail, experimental procedures used.

Marks	Descriptors for Skill A (Chemical ideas) (6 marks)	Descriptors for Skill B (Methods) (6 marks)
	Apply chemical knowledge and processes to unfamiliar situations. (range, depth, accuracy)	Select and describe appropriate qualitative and quantitative methods. (aims, choices, descriptions)
6	Describes a comprehensive range of chemical knowledge in support of the investigation. Describes chemical knowledge in great depth and includes all appropriate details. Describes chemical knowledge without errors and describes chemical knowledge which is fully relevant to the actual investigation undertaken.	Identifies and defines the aims of the investigation in a very precise and clear manner. Selects equipment and materials and devises experimental procedures that are fully appropriate to achieve the aims of the investigation. Describes in fine detail the experimental procedures used.

Intermediate marks should be awarded to provide the best match between a candidate's performance and the descriptors.

Marks	Descriptors for Skill D (Observation and measurements) (6 marks)	Descriptors for Skill E (Analysis and interpretation) (6 marks)	Descriptors for Skill F (Evaluation) (6 marks)
	<p>Make, record and communicate reliable and valid observations and measurements with appropriate precision and accuracy. (results: number, range, quality, clarity)</p>	<p>Analyse and interpret the results of investigative activities. (outcomes, calculations, graphs, interpretation of observations, conclusions)</p>	<p>Explain and evaluate the methodology and results of investigative activities. (limitations of procedures, reliability and validity of observations, uncertainty associated with measurements, equipment and procedure choice)</p>
1	<p>Records significantly fewer observations and/or measurements than are appropriate for the particular investigation undertaken and records a limited range of observations and/or measurements.</p> <p>Records observations that are vague, lack detail or are inappropriate and/or measurements that are imprecise, of poor quality or lack appropriate units.</p> <p>Records observations and/or measurements in a haphazard, unclear or disorganised format which make it difficult to understand them.</p>	<p>Describes the outcomes of the investigation in basic terms only.</p> <p>Makes little effective use of observations to support conclusions and/or makes little progress in calculations or draws poor quality or inappropriate graphs from measurements.</p> <p>Makes little use of underlying chemical knowledge to interpret observations and/or measurements and draws basic or superficial conclusions from recorded observations and/or measurements.</p>	<p>Comments briefly and in simple terms on the limitations of practical procedures.</p> <p>Comments briefly and in simple terms on the reliability and validity of observations and/or includes calculations of the uncertainty associated with measurements that are of limited range or inaccurate.</p> <p>Comments briefly in descriptive rather than evaluative terms on the choices made of materials, equipment and practical procedures used in the investigation.</p>
3	<p>Records most appropriate observations and/or measurements for the particular investigation undertaken, and records a wider range of observations and/or measurements.</p> <p>Records observations that are often precise, detailed and appropriate and/or measurements that are generally precise, of good quality and include appropriate units.</p> <p>Records observations and/or measurements in a generally clear and organised format which make it possible to understand them with little difficulty.</p>	<p>Describes the outcomes of the investigation in reasonable detail.</p> <p>Makes reasonably effective use of observations to support conclusions and/or generally uses calculations effectively and draws graphs from measurements which are generally of good quality and appropriate.</p> <p>Makes quite good use of underlying chemical knowledge to interpret observations and/or measurements and draws conclusions from recorded observations and/or measurements which are in some detail and depth.</p>	<p>Comments on some of the key limitations of practical procedures.</p> <p>Comments in reasonable detail on the reliability and validity of observations and/or includes calculations of the uncertainty associated with measurements that include a range of different types and are generally accurate.</p> <p>Evaluates in reasonable detail the choices made of materials, equipment and practical procedures used in the investigation.</p>

Marks	Descriptors for Skill D (Observation and measurements) (6 marks)	Descriptors for Skill E (Analysis and interpretation) (6 marks)	Descriptors for Skill F (Evaluation) (6 marks)
	<p>Make, record and communicate reliable and valid observations and measurements with appropriate precision and accuracy. (results: number, range, quality, clarity)</p>	<p>Analyse and interpret the results of investigative activities. (outcomes, calculations, graphs, interpretation of observations, conclusions)</p>	<p>Explain and evaluate the methodology and results of investigative activities. (limitations of procedures, reliability and validity of observations, uncertainty associated with measurements, equipment and procedure choice)</p>
6	<p>Records all appropriate observations and/or measurements for the particular investigation undertaken and records a wide range of observations and/or measurements to investigate the chosen topic effectively.</p> <p>Records observations that are precise, detailed and appropriate and/or measurements that are precise, of good quality and include appropriate units.</p> <p>Records observations and/or measurements in a clear and organised format which make it easy to understand them.</p>	<p>Describes the outcomes of the investigation in full detail.</p> <p>Makes very effective use of observations to support conclusions and/or uses calculations effectively and draws graphs from measurements which are all of good quality and appropriate.</p> <p>Makes comprehensive and effective use of underlying chemical knowledge to interpret observations and/or measurements and draws conclusions from recorded observations and/or measurements which are in considerable detail and depth.</p>	<p>Comments on all of the expected limitations of practical procedures.</p> <p>Comments in full detail on the reliability and validity of observations and/or includes accurate calculations of the uncertainty associated with all types of measurements recorded.</p> <p>Fully evaluates the choices made of materials, equipment and practical procedures used in the investigation.</p>

Intermediate marks should be awarded to provide the best match between a candidate's performance and the descriptors.

Marks	Descriptors for Skill C (Communication) (5 marks)	Descriptors for Skill G (Manipulation) (5 marks)	Descriptors for Skill H (Demand) (5 marks)
	Select, organise and communicate relevant information. (risk assessment, references, clarity, vocabulary, QWC)	Demonstrates safe and skilful techniques and processes. (safety, manipulative skills, organisation)	Develop and apply familiar and new chemical knowledge and processes in demanding situations. (procedures, chemical ideas, innovation/creativity)
1	<p>Includes a risk assessment which covers only some of the hazards, contains much material which is not relevant to the investigation undertaken, is superficial and is inaccurate.</p> <p>Includes a list of references which is linked to a narrow range of sources and which lacks detail about the sources.</p> <p>Produces an account which is unclear and is difficult to understand, in which specialist vocabulary is used inappropriately and in which spelling of technical terms is frequently inaccurate.</p>	<p>Works safely some of the time.</p> <p>Demonstrates competent manipulative skills in basic practical procedures and resolves problems with help.</p> <p>Some aspects of the approach to practical work are organised, takes some care when making observations and/or measurements and pays some attention to detail.</p>	<p>The level of demand in the investigation is low because:</p> <p>Experimental procedures cover activities undertaken as a normal part of the chemistry course;</p> <p>Chemical ideas which have been met before are used in familiar situations;</p> <p>There is some limited evidence of innovation or creativity in devising experimental procedures and/or, if appropriate, in solving emerging problems.</p>
3	<p>Includes a risk assessment which covers most hazards, contains material which is generally relevant to the investigation undertaken, is in some detail and is generally accurate.</p> <p>Includes a list of references which is linked to a fairly wide range of sources and which includes some detail about the sources.</p> <p>Produces an account which is generally clear and is generally easy to understand, in which specialist vocabulary is used appropriately most of the time, and in which spelling of technical terms is generally accurate.</p>	<p>Works safely most of the time.</p> <p>Demonstrates competent manipulative skills in a wide range of practical procedures and resolves minor problems without help.</p> <p>Demonstrates a reasonable degree of organisation in approach to practical work, makes most observations and/or measurements carefully and pays attention to some of detail most of the time.</p>	<p>The level of demand in the investigation is intermediate because:</p> <p>Experimental procedures extend beyond activities undertaken as a normal part of the chemistry course and are used in new situations;</p> <p>Chemical ideas which have been met before are used in new situations;</p> <p>There is some evidence of innovation or creativity in devising experimental procedures and/or, if appropriate, in solving emerging problems.</p>

Marks	Descriptors for Skill C (Communication) (5 marks)	Descriptors for Skill G (Manipulation) (5 marks)	Descriptors for Skill H (Demand) (5 marks)
	Select, organise and communicate relevant information. (risk assessment, references, clarity, vocabulary, QWC)	Demonstrates safe and skilful techniques and processes. (safety, manipulative skills, organisation)	Develop and apply familiar and new chemical knowledge and processes in demanding situations. (procedures, chemical ideas, innovation/creativity)
5	Includes a risk assessment which covers all hazards, contains material all of which is relevant to the investigation undertaken, contains full details and is accurate. Includes a list of references which is linked to a comprehensive and appropriate range of sources which includes detail about the source: linked effectively to specific parts of the written account. Produces an account which is very clear and easy to understand, in which specialist vocabulary is used appropriately all of the time and in which spelling of technical terms is accurate.	Works safely all of the time. Demonstrates highly developed manipulative skills in all practical procedures and resolves most problems without help. Demonstrates a highly organised approach to practical work, makes all observations and/or measurements with great care and pays great attention to detail.	The level of demand in the investigation is high because: Experimental procedures used in the investigation have not been previously met or are familiar procedures which are developed and used in new and unfamiliar situations; Chemical ideas used in the investigation have not been previously met or are familiar ideas which are developed and used in new and unfamiliar situations; There is clear evidence of innovation or creativity in devising experimental procedures and/or, if appropriate, in solving emerging problems.

Intermediate marks should be awarded to provide the best match between a candidate's performance and the descriptors.