

## SQA Advanced Unit Specification

### General information for centres

**Unit title:** Electrochemistry

**Unit code:** HV9C 48

**Unit purpose:** This Unit is designed to provide candidates with the underpinning knowledge of electrochemical equilibria and a range of applied electrochemical techniques

On completion of the Unit the candidate should be able to:

- 1 Describe and use the principles of electrochemistry.
- 2 Perform laboratory techniques involving electrochemistry.

**Credit points and level:** 1 SQA Credit at SCQF level 8: (8 SCQF credit points at SCQF level 8\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.*

**Recommended prior knowledge and skills:** Access to this Unit is at the discretion of the centre. However it is anticipated that candidates will have experience of Chemistry at SQA Advanced Certificate level or equivalent. Where this Unit is delivered as part of a SQA Advanced Science Group Award it is advisable that candidates should have completed the Units SQA Advanced Fundamental Concepts of Physical Chemistry (HV98 47) and SQA Advanced Fundamental Concepts of Inorganic Chemistry (HV96 47).

**Core Skills:** There may be opportunities to gather evidence towards the Core Skill of Problem Solving and Communication at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

**Context for delivery:** If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

**Assessment:** Outcome 1 will be assessed using a closed-book end of Unit test and Outcome 2 should be assessed by practical activity. Candidates will be assessed on their practical ability including the ability to follow written or oral instruction, adherence to health and safety procedures, collection and storage of data, analysis of data and quality of final lab report.

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### Unit specification: statement of standards

**Unit title:** Electrochemistry

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The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

### Outcome 1

Describe and use the principles of electrochemistry

#### Knowledge and/or skills

- ◆ electrochemical cells
- ◆ electrodes in analytical chemistry
- ◆ electrogravimetry
- ◆ conductimetry

#### Evidence requirements

Evidence should be gathered using a closed-book end of Unit assessment under supervised conditions.

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ use IUPAC conventions for electrochemical cells
- ◆ describe and explain terms in conductimetry
- ◆ describe electrogravimetric techniques
- ◆ describe electrodes used in analytical chemistry
- ◆ perform calculations from electrochemical data

#### Assessment guidelines

Given the range of topics outlined in the support notes, there is scope to ask a range of questions on different cells, electrodes etc. It is envisaged that candidates will be given the chance to show that they understand the principles of a range of electrochemical applications and can carry out calculations from experimental data.

The assessment could be worth a total of 50 marks and should be weighted 15 marks for from electrochemical cells, 15 marks from conductimetry, 10 marks each from electrodes and electrogravimetry. Given the integrated nature of the knowledge and skills an overall mark of at least 30 out of 50 (60%) would be a pass. The assessment should consist of structured questions, which should include explanations of the relevant theory and calculations based on experimental data.

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### Outcome 2

Perform laboratory techniques involving electrochemistry

#### Knowledge and/or skills

- ◆ follow instructions to perform a range of electrochemical experiments
- ◆ work in a safe manner regarding current health and safety regulations
- ◆ achieve consistent and accurate results
- ◆ report the results clearly and concisely
- ◆ identify sources of experimental errors and estimate size of errors as appropriate

#### Evidence requirements

A checklist will be used to record the results of the candidate's practical work on at least two occasions. Candidates must also complete a laboratory diary or proforma. For one of the experiments carried out the candidate must also produce a laboratory report which demonstrates the candidates ability to plan and evaluate the laboratory exercise and to report the work accurately and to discuss the relationship between the results and the electrochemistry involved

#### Assessment guidelines

This Unit lends itself to study by a number of practical experiments. Some of these are suggested in the support notes. If analytical work is being assessed, candidates should be judged on the accuracy of their results as well as their ability to produce a laboratory report.

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### Administrative information

<b>Unit code:</b>	HV9C 48
<b>Unit title:</b>	Electrochemistry
<b>Superclass category:</b>	RD
<b>Date of publication:</b>	November 2017
<b>Version:</b>	01
<b>Source:</b>	SQA

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## SQA Advanced Unit Specification

### Unit specification: support notes

#### Unit title: Electrochemistry

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

### Guidance on the content and context for this Unit

Outcome 1 should cover the following topics:

Electrochemical cells: reduction potentials, IUPAC nomenclature and conventions, Nernst equation, concentration cells, activity coefficients, determination of  $\Delta G$ ,  $\Delta H$ ,  $\Delta S$  from emf measurements.

Electrodes: types should include calomel electrodes,  $\text{Ag}|\text{AgCl}|\text{Cl}^-$  electrodes, glass electrodes, pH including solid state, ion selective electrodes (metal ions and anions).

Electrogravimetry: Lectures should cover Faraday's Laws and electrodeposition techniques.

Conductance: Lectures should cover conductance, conductivity, cell constants, molar conductivity at infinite dilution, degree of dissociation, solubility and solubility product. Kohlrausch's Law.

Conductivity of electrolytes — strong and weak electrolytes.

The practical Outcome may be covered using a variety of electrochemical experiments eg

- ◆ electrogravimetry
- ◆ pH experiments (eg. pH titrations, determination of pKa etc)
- ◆ ion selective electrode experiments including direct measurement, calibration curves, standard addition methods and titration methods
- ◆ conductance and conductivity experiments

### Guidance on the delivery and assessment of this Unit

This Unit will require a mixture of delivery methods. Formal classes will be needed to cover the main theory aspects, while extended laboratory time will be required for Outcome 2. Tutorial support could be used to enhance the learning. Self directed study might well be a good way to cover some of the topics in Outcome 1.

Assessment for Outcome 1 will be by an end of Unit test, worth 50 marks, with a pass mark of 30 (60%). The suggested format for the paper is given under the evidence requirements. Lecturers should ensure that the question paper covers the range of topics given in the support notes. There is plenty scope within the suggested content to allow a large number of different question papers to be prepared. While the weighting of the marks should remain as stated, the actual topics covered can vary from paper to paper.

Outcome 2 is a practical Outcome and a lab diary recording all experimental results should be kept as well as writing lab reports.

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A laboratory diary or proforma will be kept and learners should be introduced to Standard Operating Procedures (SOPs). Laboratory reports should be in an appropriate format. Health and Safety, in regard to risk and COSHH assessments should be emphasised at all times.

### **Open learning**

While Outcome 1 could be covered via distance learning, it is harder to see how this would be possible for Outcome 2. If a candidate was employed in a laboratory position, then it may be possible for the experimental work to be carried out away from college. Steps would have to be taken to ensure that the work could be verified as that of the candidate. A blended learning approach may be possible, with candidates only attending college for the laboratory work.

### **Equality and inclusion**

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements).

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### General information for candidates

#### Unit title: Electrochemistry

This is a 1 credit Unit at level SCQF level 8 and is intended to be delivered as part of the SQA Advanced Diploma in Applied Sciences and SQA Advanced Diploma Chemistry frameworks. It is likely to be delivered in the second year of the programmes.

On completion of this Unit you should be able to:

- 1 Describe and use the principles of electrochemistry.
- 2 Perform laboratory techniques involving electrochemistry.

The main components of the Unit are described in more detail below:

- ◆ Outcome 1 is a theory based Outcome and will cover topics such as Electrochemical cells, Electrodes, Electrogravimetry and Conductance.
- ◆ Outcome 2 consists of a range of practical electrochemical experiments which could include Electorgravimetry, Polarography or Conductance and conductivity experiments.

#### Assessment

Assessment of this Unit will be by a closed-book end of Unit test for Outcome 1 and by a minimum of two practical activities which includes keeping a lab diary and using checklists and by completion of one report for Outcome 2.