



Higher National Unit specification

General information

Unit title: Electrochemistry (SCQF level 8)

Unit code: H92T 35

Superclass: RD

Publication date: May 2015

Source: Scottish Qualifications Authority

Version: 01

Unit purpose

This Unit is designed to provide learners with the underpinning knowledge of electrochemical equilibria and a range of applied electrochemical techniques.

Outcomes

On successful completion of the Unit the learner will be able to:

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

Credit points and level

1 Higher National Unit credit at SCQF level 8: (8 SCQF credit points at SCQF level 8)

Recommended entry to the Unit

Access to this Unit is at the discretion of the centre. However it is anticipated that learners will have experience of Chemistry at HNC level or equivalent. Where this Unit is delivered as part of a HN Science Group Award it is advisable that learners should have completed the HN Units H936 34 *Physical Chemistry: Theory and Laboratory Skills* and H92Y 34 *Inorganic Chemistry: Theory and Laboratory Skills*.

Higher National Unit Specification: General information (cont)

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Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

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.

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.

Higher National Unit specification: Statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

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. Learners 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

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

Higher National Unit specification: Statement of standards (cont)

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Evidence Requirements for this Unit

Outcome 1

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

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills across all Outcomes 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.

Outcome 2

A checklist will be used to record the results of the learner's practical work on at least two occasions. Learners must also complete a laboratory diary or pro forma. For one of the experiments carried out the learner must also produce a laboratory report which demonstrates the learner's 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.



Higher National Unit Support Notes

Unit title: Electrochemistry (SCQF level 8)

Unit Support Notes are offered as guidance and 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 ΔG , ΔH , ΔS 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 approaches to delivery 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.

Higher National Unit Support Notes (cont)

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Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Assessment for Outcome 1 will be by an end of Unit test, worth 50 marks, with a pass mark of 30 (60%) and should be weighted 15 marks from electrochemical cells, 15 marks from conductimetry, 10 marks each from electrodes and electrogravimetry. The assessment should consist of structured questions, which should include explanations of the relevant theory and calculations based on experimental data.

Given the range of topics outlined, there is scope to ask a range of questions on different cells, electrodes, etc. It is envisaged that learners 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.

There is plenty of scope within the suggested content to allow a large number of different assessments to be prepared. While the weighting of the marks should remain as stated, the actual topics covered can vary at each assessment.

Outcome 2 is a practical Outcome and a laboratory diary recording all experimental results should be kept as well as laboratory reports. Learners 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 laboratory report.

A laboratory diary or pro forma 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 Control of Substances Hazardous to Health (COSHH) assessments should be emphasised at all times.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Higher National Unit Support Notes (cont)

Unit title: Electrochemistry (SCQF level 8)

Opportunities for developing Core and other essential 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.

History of changes to Unit

| Version | Description of change | Date |
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General information for learners

Unit title: Electrochemistry (SCQF level 8)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

This is a 1 credit Unit at level SCQF level 8 and is intended to be delivered as part of the HND Applied Chemical Sciences Group Award. It is likely to be delivered in the second year of the Group Award.

On completion of this Unit you should be able to:

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

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 (including keeping a laboratory diary, using checklists and completing a report) for Outcome 2.