

-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

**Hanover House
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NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number- 3181021 -Session- 1991-92
-Superclass- RD

-Title- INTRODUCING METALS AND ELECTROCHEMISTRY
(x¹/₂)

-DESCRIPTION-

Purpose This module is designed to introduce the student to some of the basic concepts of chemistry. It is suitable for students in a wide range of vocational areas.

It could be used as part of an integrated programme of modules including other Stage 1 Chemistry or Science modules, or used as a stand-alone module.

Preferred Entry Level 3181001 Introducing Fundamentals of Chemistry.

Outcomes The student should:

1. relate the nature and use of metals to their properties;
2. apply concepts of oxidation and reduction in various electrochemical processes;
3. construct simple electrochemical and electrolysis cells.

Assessment Procedures Acceptable performance in the module will be satisfactory achievement of all the Performance Criteria specified for each Outcome.

The following abbreviations are used below:

PC Performance Criteria
IA Instrument of Assessment

Note: The Outcomes and PCs are mandatory and cannot be altered. The IA may be altered by arrangement with SQA. (Where a range of performance is indicated, this should be regarded as an extension of the PCs and is therefore mandatory.)

OUTCOME 1 RELATE THE NATURE AND USE OF METALS TO THEIR PROPERTIES

- PCs
- (a) The prediction of the order of reactivity of unknown metals given experimental data on their reactions and the reaction of their compounds is correct.
 - (b) The selection of a metal for a particular use given data, is valid with respect to its properties.

IA Objective Questions and Assignment

3 objective questions and an assignment to assess the student's ability to relate the nature and use of metal in relation to their properties.

The 3 objective questions should be allocated to Performance Criterion (a). It may be appropriate to use multiple choice or short answer questions. For each question the student should be given experimental data for 3 unknown metals, the experimental data should be based on more than one reaction. At least one of the questions should involve reduction of metal oxides.

The assignment for Performance Criterion (b) should give the student the opportunity to research a metal for a particular use from a selection of information.

The selection should take account of factors such as occurrence, cost and density, as well as reactivity. The student should produce documented evidence for the assignment.

Satisfactory achievement of the Outcome will be demonstrated by the student producing 3 correct responses to (a) and satisfactory documented evidence for (b). A checklist could be used to ensure reliability and interpretation of the student's performance for (b).

**OUTCOME 2 APPLY CONCEPTS OF OXIDATION AND REDUCTION
IN VARIOUS ELECTROCHEMICAL PROCESSES**

- PCs
- (a) The selection of the oxidation and reduction ion electron equations for a given redox reaction is accurate.
 - (b) The prediction of direction of electron flow in a given electrochemical cell is correct.
 - (c) The prediction of the products at the electrodes during the electrolysis of a given compound is correct.

IA Structured Questions

4 structured questions to assess the student's ability to apply the concepts of oxidation and reduction to various electrochemical processes.

There should be 2 structured questions on electrochemical cells (which use metal/metal systems only). These questions will assess Performance Criteria (a) and (b).

There should be 2 structured questions on electrolysis cells (whose solute ions only are discharged). These questions will assess Performance Criteria (a) and (c).

Satisfactory achievement of the Outcome will be demonstrated by the student achieving the specified Performance Criteria for each structured question.

**OUTCOME 3 CONSTRUCT SIMPLE ELECTROCHEMICAL AND
ELECTROLYSIS CELLS**

- PCs
- (a) The preparation for the experimental procedure is correct with respect to:
 - (i) experimental design;
 - (ii) setting up of apparatus.
 - (b) The experimental procedures carried out are correct with respect to safety.
 - (c) The constructed cell is effective with respect to producing electricity or electrode products.
 - (d) The recorded observations are valid.

IA Assignments

2 assignments to assess the student's ability to construct a simple electrochemical cell and a simple electrolysis cell.

A checklist should be devised to ensure a reliable interpretation of the student's practical performance for Performance Criteria (a)-(c).

The student should be given apparatus and chemicals and will be required to design and construct an effective electrochemical cell and an effective electrolysis cell.

The student will be required to prepare documented evidence which outlines design, the procedures used and observations for Performance Criterion (d).

Satisfactory achievement of the Outcome will be demonstrated by the student achieving all the Performance Criteria for both assignments.

**The following sections of the descriptor are offered as guidance.
They are not mandatory.**

CONTENT/CONTEXT

Safety regulations and safe working practices and procedures should be observed at all times.

Corresponding to Outcomes 1-3:

1. Metals as thermal and electrical conductors; specific characteristics (density, strength, malleability) including occurrence and cost related to uses; reaction of metals with oxygen, water and dilute acid; method of extraction related to reactivity of the metal; blast furnace; alloys and their uses; displacement reactions; ion-electron equations involving metals; reactivity series.
2. Nature of batteries; function of electrolyte; metal/metal electrochemical cells; relate voltage and direction of electron flow to construction of electrochemical series; reactions of metals as oxidation; ion-electron equations for oxidation/reduction in electrochemical cells; displacement reaction as redox reactions; electrolysis in simple melts or solutions of compounds whose ions are discharged; extraction of metals by electrolysis; aluminium extraction; electroplating; anodising.
3. Construction of simple electrochemical cells involving two different metals; various designs for such cells; measurement of voltage and direction of electron flow; observation of electrode reactions; construction of electrolysis cells; need for d.c. input; observation of electrode reactions; use of such cells in metal extraction; purification of copper; electroplating; anodising.

SUGGESTED LEARNING AND TEACHING APPROACHES

During the work of the module students should have several opportunities to develop their practical and problem-solving skills. Each student should be assessed at appropriate points throughout the module. Where a student is unsuccessful in achieving an Outcome, provision should be made for remediation and reassessment.

Laboratory practical work is likely to play a significant part in this module. Illustrative practical work to show extraction of metals from their compounds in a number of ways and to show displacement reactions could apply to Outcomes 1 and 2. The student must carry out practical work in the construction of both an electrochemical cell and an electrolysis cell for Outcome 3. These and other such cells also relate to Outcome 2.

Safety considerations should be observed at all times.

A student-centred, resource-based approach is likely to be the most flexible for this module. Outcome 3 should be integrated with Outcome 2. All Outcomes can be integrated with other Stage 1 Chemistry modules.

Selection of data, including ion-electron equations, from a Data Book and drawing conclusions are important problem-solving activities for the completion of Outcomes 1 and 2. Reinforcement and remediation could be accomplished through commercially available computer software packages. Tutor exposition and demonstration may be required for consolidation of the Outcomes.