

## Higher National Unit Specification

### General information for centres

**Unit title:** Applications of Transition Metal Compounds

**Unit code:** DP5T 35

**Unit purpose:** This Unit is a specialised Unit designed to be part of the HND Chemistry award. It may also be suitable for inclusion in the HND Applied Sciences course. Candidates will study the role of inorganic elements and compounds as catalysts in selected organic syntheses. In addition the role of some elements in biochemical systems will be studied.

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

- 1 Explain the role of inorganic compounds in homogeneous catalysis and biochemical systems.
- 2 Perform experiments to demonstrate the role of transition elements in action.

**Credit points and level:** 1 HN 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 Access 1 to Doctorates.*

**Recommended prior knowledge and skills:** Access to this Unit is at the discretion of the centre, however it would be a distinct advantage if candidates had prior knowledge of coordination chemistry. Completion of the Unit: Transition Metal Chemistry or its equivalent is recommended.

**Core Skills:** There may be opportunities to gather evidence towards the Core Skill of Problem Solving and Communication at Higher level 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 an end of Unit assessment. The assessment should be a closed-book test under supervised conditions. Outcome 2 will be assessed using two practical exercises designed to demonstrate practical applications of transition elements. These will be assessed by a checklist and laboratory diary and a report for one of the experiments.

## Higher National Unit specification: statement of standards

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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

Explain the role of inorganic compounds in homogeneous catalysis and biochemical systems

#### Knowledge and/or skills

- ◆ chemistry of transition elements
- ◆ inorganic reaction mechanisms
- ◆ transition metal complexes as homogeneous catalysts
- ◆ biochemical systems involving inorganic elements

#### Evidence requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can pass an end of Unit assessment. Evidence should be gathered using a holistic closed book assessment under supervised conditions. The pass mark for the overall assessment will be 60%. For assessment structured questions should be used, which allow the candidate to demonstrate an understanding of reaction mechanisms, and a range of catalytic and biochemical systems.

#### Assessment guidelines

The assessment should be devised to allow candidates to demonstrate each of the knowledge and skills statements. The use of structured questions will ensure that all aspects of the course can be assessed.

The assessment could be worth 50 marks. The marks could be allocated as follows.

- ◆ 10 marks on the chemistry of transition elements
- ◆ 10 marks on reaction mechanisms
- ◆ 15 marks on catalytic systems
- ◆ 15 marks on biochemical systems

The pass mark should be 60%

The recommended assessment has been designed to produce evidence of achievement. This assessment, while addressing all the relevant Knowledge and Skills may not readily provide specific, discrete evidence that each item has been met. However, the threshold of attainment is deemed to provide satisfactory evidence that achievement of the Outcome has been demonstrated or could be inferred.

## **Higher National Unit specification: statement of standards (cont)**

**Unit title:** Applications of Transition Metal Compounds

### **Outcome 2**

Perform experiments to demonstrate the role of transition elements in action

#### **Knowledge and/or skills**

- ◆ follow instructions to perform a range of chemical experiments
- ◆ work in a safe manner regarding current health and safety regulations
- ◆ consistent and accurate results
- ◆ clear and concise reports
- ◆ role of the transition element in the experiments
- ◆ 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 discuss the results.

#### **Assessment guidelines**

Candidates will have the opportunity to develop their practical skills in both analytical and synthetic techniques

## **Administrative Information**

<b>Unit code:</b>	DP5T 35
<b>Unit title:</b>	Applications of Transition Metal Compounds
<b>Superclass category:</b>	RD
<b>Date of publication:</b>	August 2005
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## Higher National Unit specification: support notes

### Unit title: Applications of Transition Metal Compounds

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

This Unit is a very good follow up to Transition Metal chemistry. Candidates will have been introduced to the theory of coordination chemistry. This Unit should build on this work and look at the specific chemistry of some transition elements. Some topics to be covered include:

Trends in oxidation states within the transition elements, Latimer Diagrams, or other oxidation state diagrams, detailed chemistry of selected transition elements. Centres need not be restricted on which metals to choose, but should cover at least two eg Cr and Fe etc. There is no need to only cover 3d elements, some work could be done on second and third row metals.

Inorganic reaction mechanisms should be introduced, including ligand exchange reaction, redox reactions and oxidative addition reactions. This can then be extended to introducing the roles of transition metal complexes in homogeneous catalysis using Wilkinson's Catalyst, Zeigler-Natta catalyst plus any other suitable examples.

Finally the role of transition elements in biological systems should be covered, including FE in Haemoglobin, Co in Vitamin B12, etc. Centres are free to choose examples as they see fit.

Outcome 2 lends itself to a range of practical exercises, from simple observational exercises looking at reactions of selected transition elements, to reaction rate experiments looking at ligand exchange reactions. Given the expense of the chemicals and the nature of the practical work, it may be difficult to deliver specific laboratory exercises on biological systems and homogeneous catalysis. However centres could develop a series of practicals which demonstrate the range of properties shown by transition elements.

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

This Unit would be delivered towards the end of the HND Chemistry course, and would be particularly suitable for those students intending to progress to university. Some of the work particularly in looking at the chemistry of specific elements would lend itself to directed learning. It may be possible to integrate this with some kind of poster/oral presentation by the students. They may learn from each other if each student covers different elements.

The assessment for Outcome 1 is by a closed book test. If students have studied different elements, the questions in the assessment would have to be general enough to give each candidate an equal chance of success.

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

## Higher National Unit specification: support notes (cont)

**Unit title:** Applications of Transition Metal Compounds

### 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.

### Candidates with additional support needs

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on the SQA website [www.sqa.org.uk](http://www.sqa.org.uk).

## General information for candidates

### Unit title: Applications of Transition Metal Compounds

This Unit is designed as a specialist Unit, which will be delivered in the second year of the HND Chemistry or HND Applied Science courses. It is unlikely to be delivered as a stand-alone Unit, although some colleges may see some merit in having it as an option in other science based HND courses.

On completion of this Unit you should be able to:

- 1 Explain the role of inorganic compounds in homogeneous catalysis and biochemical systems
- 2 Perform experiments to demonstrate the role of transition elements in action

Outcome 1 will discuss the chemistry of specific transition elements, some freedom to select a metal of interest to you may be possible. Different inorganic reaction types and their mechanisms will be covered, in particular you will look at oxidative addition reactions and their application in homogeneous catalysis. Finally you will look at the role transition elements have in a range of biological systems, eg haemoglobin, vitamin B12 etc.

Outcome 2 you will carry out a range of practical exercises to demonstrate the range of uses of transition metal complexes. Some reaction rate experiments will also be carried out to demonstrate the kinetics part of the course.

#### Assessment

Outcome 1 will be covered using a closed book end of Unit assessment. Outcome 2 will be assessed on the basis of your performance in the laboratory, and on the laboratory report produced. A minimum of two practicals will be assessed and a report for one experiment performed will be used for assessment purposes.