-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION

GENERAL INFORMATION

-Module Number- **3251023** **-Session-1993-94**

-Superclass- **RC**

-Title- **HEAT TRANSFER**

-DESCRIPTION-

GENERAL COMPETENCE FOR UNIT: Constructing simple energy balances for physical processes and explaining the application and heat transfer and heat transfer principles.

OUTCOMES

1. explain the application of heat transfer;

2. explain the application of heat transfer principles used in process operations;

3. construct simple energy balances for physical processes.

CREDIT VALUE: 1 NC Credit

ACCESS STATEMENT: Industrial Science 1;
Process Plant 1.

For further information contact: Committee and Administration Unit, SQA, Hanover House, 24 Douglas Street, Glasgow G2 7NQ.

This specification is distributed free to all approved centres. Additional copies may be purchased from SQA (Sales and Despatch section) at a cost of £1.50 (minimum order £5).

NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION

STATEMENT OF STANDARDS

UNIT NUMBER: 3251023

UNIT TITLE: HEAT TRANSFER

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

OUTCOME

1. EXPLAIN THE APPLICATION OF HEAT TRANSFER

PERFORMANCE CRITERIA

(a) The description of heat transfer mechanisms is correct.
(b) The explanation of the application of heat transfer mechanisms is correct.

RANGE STATEMENT

The range statement for this outcome is specified within the performance criteria.

EVIDENCE REQUIREMENTS

Written evidence of the ability to describe heat transfer, the different types and explanation of its application.

OUTCOME

2. EXPLAIN THE APPLICATION OF HEAT TRANSFER PRINCIPLES USED IN PROCESS OPERATIONS

PERFORMANCE CRITERIA

(a) The explanation of factors affecting heat transfer by conduction is correct.
(b) The explanation of factors affecting heat transfer by convection is correct.
(c) The explanation of factors affecting heat transfer by radiation is correct.
(d) The explanation of the application of heat transfer is correct for given situations.

RANGE STATEMENT

The range statement for this outcome is specified within the performance criteria.

EVIDENCE REQUIREMENTS

Written evidence of the ability to explain the factors affecting heat transfer by conduction, convection and radiation.

OUTCOME

3. CONSTRUCT SIMPLE ENERGY BALANCES FOR PHYSICAL PROCESSES

PERFORMANCE CRITERIA

(a) The calculation of energy changes for processes including a single phase and phase changes is correct.
(b) The presentation of an energy balance for a process in tabular form is correct.

RANGE STATEMENT

The range statement for this outcome is specified within the performance criteria.

EVIDENCE REQUIREMENTS

Written evidence of the ability to calculate energy changes and present an energy balance.

ASSESSMENT RECORDS

In order to achieve this unit, candidates are required to present sufficient evidence that they have met all the performance criteria for each outcome within the range specified. Details of these requirements are given for each outcome. The assessment instruments used should follow the general guidance offered by the SQA assessment model and an integrative approach to assessment is encouraged. (See references at the end of support notes).

Accurate records should be made of assessment instruments used showing how evidence is generated for each outcome and giving marking schemes and/or checklists, etc. Records of candidates' achievements should be kept. These records will be available for external verification.

SPECIAL NEEDS

In certain cases, modified outcomes and range statements can be proposed for certification. See references at end of Support Notes.

NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION

SUPPORT NOTES

UNIT NUMBER 3251023

UNIT TITLE HEAT TRANSFER

SUPPORT NOTES: This part of the unit specification is offered as guidance. None of the sections of the support notes is mandatory.

NOTIONAL DESIGN LENGTH: SQA allocates a notional design length to a unit on the basis of time estimated for achievement of the stated standards by a candidate whose starting point is as described in the access statement. The notional design length for this unit is 40 hours. The use of notional design length for programme design and timetabling is advisory only.

PURPOSE This module is suitable for candidates wishing to gain an understanding of heat transfer. This module would be suitable for full-time and day release candidates and could form part of the National Certificate Group Award in Processing.

SQA publishes summaries of NC units for easy reference, publicity purposes, centre handbooks, etc. The summary statement for this unit is as follows:

This module will enable you to develop an understanding of the application of heat transfer and the associated techniques. You will also learn how to construct simple energy balances.

CONTENT/CONTEXT This section is for guidance only and the content/context relevant to the candidate's area of study/employment should be chosen.

Conduction, convection, radiation. Fourier equation. Thermal conductivity of materials (including insulators, composites). Co-current and counter-current flow. Forced and natural convection.

Radiation: black body, concept of heat transfer co-efficient reflective surfaces; absorptivity, emmissivity. Stephan Bolziman Law applied to simple geometries.

Sensible heat, heat for chemical change, enthalpy.

Effects on heat transfer: scaling, 'fouling' films.

Properties and usable temperature ranges of heat transfer media: water, steam, oil, gases, metals, liquefied gases, molten salts.

Economics of heat exchange, conservation of energy. Use of 'waste' heat.

GENERATING EVIDENCE A candidate-centred, resource-based learning approach is recommended.

The outcomes in this module need not be taught separately and it is likely that an integrated approach will be used. The outcomes do not need to be tackled in the order shown.

During the work of the module, candidates should have several opportunities to develop practical and problem-solving skills.

Each candidate should be assessed at appropriate points throughout the module. Where a candidate is unsuccessful in achieving an outcome, provision should be made for remediation and reassessment.

ASSESSMENT PROCEDURES Centres may use Instruments of Assessment which are considered by tutors/trainers to be the most appropriate. Examples of Instruments of Assessment are as follows:

Outcomes 1 and 2	It is recommended that for these outcomes structured questions are set. An appropriate number of questions should be answered in order that the candidate adequately demonstrates the performance criteria.
Outcome 3	An assignment may be used here within which the candidate could record calculations and produce tables.

RECOGNITION Many SQA NC units are recognised for entry/recruitment purposes. For up-to-date information see the SQA guide 'Recognised and Recommended Groupings'.

REFERENCES

1. Guidelines for Module Writers.
2. SQA's National Standards for Assessment and Verification.
3. For a fuller discussion on assessment issues, please refer to SQA's Guide to Assessment.
4. Procedures for special needs statements are set out in SQA's guide 'Students with Special Needs'.