National Unit Specification: general information

UNIT Properties of Heat, Light and Sound in Construction (SCQF level 6)

CODE F3JP 12

SUMMARY

This Unit is suitable for candidates who aspire to a career in the construction industry or related fields of endeavour as technicians, technologists or other related professions.

The Unit introduces the basic principles of heat, light and sound relevant to construction and develops skills in completing calculations in relation to these principles. It includes the understanding of units and quantities in heat, light and sound and their application to basic problem solving. Candidates will be introduced to basic problems relating to heat energy and transfer, natural and artificial lighting and sound generation, propagation and attenuation, together with their application in elements building science.

OUTCOMES

1 Identify and interpret units, quantities and scales in heat, light and sound.
2 Solve basic calculations in heat, light and sound.
3 Identify construction industry related contexts in which the principles of heat, light and sound are applied.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained the following, or equivalent:

- Standard Grade Mathematics or Physics at General level

Administrative Information

Superclass: TH

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Version: 01

National Unit Specification: general information (cont)

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CREDIT VALUE

1 credit at Higher (6 SCQF credit points at SCQF level 6*).

**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.*

CORE SKILLS

There is no automatic certification of Core Skills or Core Skill components in this Unit. Opportunities for developing aspects of Core Skills are highlighted in *Guidance on Learning and Teaching Approaches.*

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.

OUTCOME 1

Identify and interpret units, quantities and scales in heat, light and sound.

Performance Criteria

(a) Identify and interpret appropriate units, quantities and scales in relation to heat.
(b) Identify and interpret appropriate units, quantities and scales in relation to light.
(c) Identify and interpret appropriate units, quantities and scales in relation to sound.

OUTCOME 2

Solve basic calculations in heat, light and sound.

Performance Criteria

(a) Solve calculations in heat transfer correctly.
(b) Solve calculations in light and illumination correctly.
(c) Solve calculations relating to sound levels correctly.

OUTCOME 3

Identify construction industry related contexts in which the principles of heat, light and sound are applied.

Performance Criteria

(a) Identify contexts of heat loss, heat gain, energy consumption and good insulation practice.
(b) Identify appropriate light levels and good design practice relating to natural and artificial lighting.
(c) Identify appropriate sound levels and the measurement and control of noise nuisance.

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required which demonstrates that the candidate has achieved all Outcomes by meeting all the Performance Criteria within Outcomes.

Written and/or recorded oral evidence is required to demonstrate that the candidate has achieved all Outcomes to the standard stated in the Performance Criteria.

National Unit Specification: statement of standards (cont)

UNIT Properties of Heat, Light and Sound in Construction (SCQF level 6)

In this Unit an appropriate instrument of assessment would be a question paper consisting of short answer, restricted response question and a series of calculations. Assessment of this Unit should not exceed three hour. Evidence will be gathered at appropriate points throughout the delivery of the Unit. Assessments must be manageable and practicable for centres and candidates.

Although delivery of the Unit will cover all of the points below for each Outcome, assessment of these Outcomes must cove the following:

Outcome 1 — a minimum of 11 from 14

- Units of heat (energy) and power
- Scales of temperature
- Specific heat
- Latent heat
- Thermal conductivity (K-value)
- Thermal transmittance (U-value)
- Visible radiation and colour
- Luminous intensity and flux
- Illuminance
- Reflectance
- Nature of sound
- Sound pressure and power
- Decibel scale
- Typical values

Outcome 2 — a minimum of six from 10

- Heat transfer
- Gas laws
- Heat losses
- Numerical problems in heat transfer
- Calculation of light levels from simple theory
- Calculation of luminous intensity and flux
- Inverse square law of illumination
- Basic decibel calculations
- Sound propagation and attenuation
- Sound insulation

Outcome 3 — a minimum of seven from 11

- Examples of heat gain and heat loss
- Energy levels associated with good heating practice
- Examples of good insulation practice
- Appropriate temperature environments for different activities
- Appropriate lighting levels for different activities

National Unit Specification: statement of standards (cont)

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- Good lighting design practice
- Natural daylight in buildings
- Appropriate sound levels for different contexts
- Human perception and noise nuisance
- Examples of noise nuisance
- Noise control

In the event of reassessment being required, a candidate should be assessed using an alternative instrument for any Outcome not attained.

The Assessment Support Pack for this Unit provides appropriate sample assessment materials. Where centres wish to develop their own assessment materials they should refer to the Assessment Support Pack to ensure a comparable standard.

National Unit Specification: support notes

UNIT Properties of Heat, Light and Sound in Construction (SCQF level 6)

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 of class contact time.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

This Unit is an optional Unit in the National Certificate in Built Environment and Civil Engineering at SCQF level 6 and can also be taken as a freestanding Unit.

This Unit is set in an introductory context in relation to construction endeavour. The contexts to be illustrated will provide the candidate with an appreciation of the application of the principles of heat, light and sound in a range of situations relating to buildings and other aspects of construction. This Unit forms a basic introduction to the topics and candidates will explore these topics and their applications in greater depth at HN level, in a degree programme or in employment.

Outcome 1 enables candidates to gain knowledge and understanding of the terminology, units, quantities and scales associated with the expression of heat, light and sound as listed in the content section above.

In Outcome 2, candidates will explore the physical laws associated with the nature of heat, light and sound. In addition, the candidate will be introduced to the application of those laws in relation to heat transfer, illumination and sound propagation and attenuation.

In Outcome 3, candidates will be introduced to examples of the application of the principles of heat, light and sound in good practice relating to the construction industry. Examples of appropriate heating, lighting and sound levels for different contexts should be studied. These may relate to both the internal and external environments as appropriate.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

For such a Unit as this, a suitable approach would be the use of illustrative methods, citing as many in-service situations as possible. The approach should be practice-based with, where possible, a considerable practical demonstration element in the teaching framework. Where neither equipment-based measuring nor laboratory testing facilities are available, profitable use of video, DVD, or online resources could be made. At this level, the use of computer based teaching packages may be advantageous as a back-up to tutor-candidate interaction.

In Outcome 1, the classroom is likely to be the focus of attention and key elements involve the correct use of terminology (for example in the use of the terms ‘heat’ as opposed to ‘temperature’), the mastering of definitions, and concept of dimensional consistency in formulae.

A good environment for delivering the content of Outcome 2 would be by demonstration in a laboratory testing context, where the various measurements in relation to heat, light and sound, and their interrelationship may be illustrated by practical work. It is unlikely that time would allow large-scale candidate participation in the testing process, but this section of the Unit might be integrated with other Units (depending on the schedule of Units contained within the options in specific centre programmes). Calculations should draw upon practice-based examples. Thus, mathematical rigour and practical demonstration can proceed together in relation to this Outcome.

It should be noted that Outcome 3 does not require primarily the solution of calculations in relation to the types of situations mentioned. The concept of acceptable standards for different circumstances in regard to buildings and other construction-related environments (proximity to roads for example) should be introduced. Allied to this, examples of good materials in relation to heat insulation, lighting and sound insulation should be introduced. At this stage, field visit(s) may be of use, for example to inspect facilities where appropriate and available.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit candidates will be:

- demonstrating their understanding of the physical laws relating to the nature of heat, light and sound
- completing calculations as they apply these principles to construction issues

These offer opportunities to develop aspects of the Core Skills of:

- *Numeracy*
- *Problem Solving*

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of 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 communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003), SQA Guidelines on e-assessment for Schools (BD2625, June 2005).*

The assessment instruments for each Outcome in this Unit may be offered separately, or it may be possible to integrate the assessments to encompass more than one Outcome. One possibility might be to take the example of a building and develop a single integrated instrument around such a practical example. The total amount of time dedicated to summative assessment should not exceed three hours. Candidates will be permitted to take class notes, formula and calculators into the assessment and all calculation methods should be demonstrated.

National Unit Specification: support notes (cont)

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This Unit gives candidates an introductory experience in the principles of heat, light and sound as applied to situations relevant to construction. Candidates will develop their knowledge and understanding of basic principles, terminology, units and quantities as well as elements of practical application; however, the assessment instruments for this Unit will focus upon the application of that knowledge and understanding in appropriate level problem solving.

Outcome 1 should be assessed through a series of short answer and/or restricted response questions involving the determination of quantities, the application of scales and the appropriate expression and use of units in relation to heat, light and sound.

Outcome 2 should be assessed through a series of calculations to solve problems at an appropriate level related to the topics of heat, light and sound and thus to demonstrate the required knowledge and understanding.

Outcome 3 should be assessed through a series of short answer and/or restricted response questions involving the items noted in the Performance Criteria for the Outcome.

Candidates should achieve a satisfactory mark in the open-book assessments for each of the Outcomes. The standard to be applied is shown in the assessment support pack. Sampling of material from the lists of content for each Outcome will be carried out, the range of topics selected being appropriate to ensure that the Performance Criteria related to each Outcome will be achieved if the pass mark is met or exceeded. In the event that assessment instruments are given for combinations of Outcomes, candidates must demonstrate that they have met the Performance Criteria for each Outcome.

Assessment will carried out in controlled and supervised conditions and will involve combinations of short answer and/or restricted response questions appropriate to the three Outcomes: appropriate understanding of units, scales and quantities for Outcome 1, numerical problem solving for Outcome 2 and broad qualitative responses in Outcome 3. It is possible to envisage a single integrated assessment involving a case-study.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

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. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* **(www.sqa.org.uk)**.