

## SQA Advanced Unit Specification

### General information for centres

**Unit title:** Building Science

**Unit code:** HT85 47

**Unit purpose:** This Unit is designed to enable candidates to apply the principles of building science to heat transfer, condensation, sound and noise measurement and the principles of light and light measurement.

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

- 1 Apply the principles of heat transfer in building design.
- 2 Apply the principles of psychrometry to the occurrence of condensation in building design.
- 3 Apply the principles of sound and noise measurement in building design.
- 4 Apply the principles of light and light measurement in building design.

**Credit points and level:** 1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7\*).

*\*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 National 1 to Doctorates.*

**Recommended prior knowledge and skills:** It would be an advantage for candidates to have a basic understanding and knowledge of heat light and sound. Such understanding and knowledge may be evidenced by the possession of an appropriate National Certificate Unit or equivalent. The Unit includes all the basic principles necessary to allow candidates possessing other qualifications or experience to succeed in this Unit.

**Core Skills:** There are opportunities to develop the Core Skill(s) of Communication, Numeracy, Problem Solving, 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:** It is possible to assess candidates either on an individual Outcome basis, combination of Outcomes or by a single holistic assessment combining all Outcomes. The assessment paper/s should be composed of an appropriate balance of short answer, restricted response and

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structured questions. Assessments should be conducted under supervised, controlled conditions. A single assessment covering all outcomes should not exceed two hours in duration. It should be noted that candidates must achieve all the minimum evidence specified for each Outcome in order to pass this Unit.

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.

An exemplar instrument of assessment and marking guidelines have been produced to provide an example of the type of evidence required to demonstrate achievement of the aims of this Unit and to indicate the national standard of achievement at SCQF level 7.

## **Unit specification: statement of standards**

**Unit title:** Building Science

**Unit code:** HT85 47

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.

Throughout the unit emphasis will be placed where appropriate on the application of Health and safety and Sustainability. Safe working practice should be looked at in accordance with current safety codes of practice and regulations. Sustainability should include reference to criteria affecting sustainability on the environment and the legislation promoting sustainability.

### **Outcome 1**

Apply the principles of heat transfer in building design

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

- ◆ Heat transfer by conduction, convection and radiation
- ◆ Heat transfer across composite building elements
- ◆ U value
- ◆ Fabric energy loss from simple building
- ◆ Ventilation heat loss from simple building

#### **Evidence Requirements**

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ identify, explain and quantify modes of heat transfer from buildings

Evidence for the knowledge and/or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **three out of five** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all three items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under open book conditions and as such candidates should be allowed to bring textbooks, handouts or notes to the assessment.

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### Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment of this Outcome might be combined with that for Outcomes 2, 3, and 4 to form a single assessment paper.

### Outcome 2

Apply the principles of psychrometry to the occurrence of condensation in building design

#### Knowledge and/or skills

- ◆ Moisture content of air
- ◆ Relative humidity
- ◆ Psychrometric Chart
- ◆ Dew Point temperature

#### Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ identify, explain and quantify properties of moist air and the occurrence of condensation in buildings

Evidence for the knowledge and/or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **two out of four** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to both items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under open book conditions and as such candidates should be allowed to bring textbooks, handouts or notes to the assessment.

### Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment of this Outcome might be combined with that for Outcomes 1, 3, and 4 to form a single assessment paper.

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### Outcome 3

Apply the principles of sound and noise measurement in building design

#### Knowledge and/or skills

- ◆ Sound power, intensity and pressure levels
- ◆ Decibel Scale
- ◆ Sound Attenuation
- ◆ Noise reduction
- ◆ Noise levels

#### Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ explain and quantify acoustic properties of building environments

Evidence for the knowledge and/or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **three out of five** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all three items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under open book conditions and as such candidates should be allowed to bring textbooks, handouts or notes to the assessment.

#### Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment of this Outcome might be combined with that for Outcomes 1, 2, and 4 to form a single assessment paper.

### Outcome 4

Apply the principles of light and light measurement in building design

#### Knowledge and/or skills

- ◆ Light Sources
- ◆ Units of light
- ◆ Lighting levels

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### Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ identify explain and quantify characteristics of lighting in relation to building environments

Evidence for the knowledge and/or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **two out of three** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to both items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under open book conditions and as such candidates should be allowed to bring textbooks, handouts or notes to the assessment.

### Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment of this Outcome might be combined with that for Outcomes 1, 2, and 3 to form a single assessment paper.

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### Administrative Information

<b>Unit code:</b>	HT85 47
<b>Unit title:</b>	Building Science
<b>Superclass category:</b>	TD
<b>Date of publication:</b>	August 2017
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### Unit specification: support notes

#### Unit title: Building Science

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 has been written in order to allow candidates to develop knowledge understanding and skills in the following areas:

- 1 Applying the principles of heat transfer in building design.
- 2 Applying the principles of psychrometry to the occurrence of condensation in building design.
- 3 Applying the principles of sound and noise measurement in building design.
- 4 Applying the principles of light and light measurement in building design.

This Unit at SCQF level 7 is a unit within the SQA Advanced Certificate/SQA Advanced Diploma Built Environment awards.

In designing this Unit the unit writers have identified the range of topics they would expect to be covered by lecturers. The writers have also given recommendations as to how much time should be spent on each outcome. This has been done to help lecturers to decide what depth of treatment should be given to the topics attached to each of the outcomes.

#### 1 Apply the principles of heat transfer in building design (10 hours)

Heat loss from buildings is an important issue in complying with Regulations and from the sustainability of the building aspect sends messages from the environmental and economic viewpoints. Design of heating systems and compliance with SAP Regulations is dealt with in other specialist units but some knowledge of the calculation of U-values and fabric heat loss will be useful in illustrating the relevance of this knowledge within this Unit.

- ◆ heat transfer mechanisms
- ◆ affect of heat transfer mechanisms on buildings
- ◆ U value calculation for different types of cavity walls and roof materials given the materials, thickness and conductivity
- ◆ fabric loss calculation for simple one or two roomed building, for example a shop and a store with all relevant information supplied



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### **2 Apply the principles of psychrometry to the occurrence of condensation in building design (10 hours)**

Condensation problems are a major concern in modern buildings. Design of building elements to prevent interstitial condensation and the use of relative humidity in air conditioning design is dealt with in other specialist units but some knowledge of the use of Psychrometric Charts will be useful in illustrating the relevance of this knowledge within this Unit.

- ◆ condensation mechanisms
- ◆ affect of condensation mechanisms on buildings
- ◆ experiment to show evaporation and condensation
- ◆ use of Psychrometric Chart
- ◆ minimising risk of condensation by efficient design of structures
- ◆ positioning of vapour barriers
- ◆ acceptable air conditions

### **3 Apply the principles of sound and noise measurement in building design (10 hours)**

Impact and airborne sound transfer through buildings is a major problem. The physics of sound is highly complex and can only be dealt with at a basic level in this outcome.

- ◆ sound transfer mechanisms
- ◆ affect of sound transfer mechanisms on buildings
- ◆ practical examples and demonstrations of sound transfer
- ◆ sound generation and measuring equipment
- ◆ suitable noise reduction situations
- ◆ floating floor
- ◆ quiet room adjacent to noisy area

### **4 Apply the principles of light and light measurement in building design (10 hours)**

No distinction is made within this outcome between natural and artificial light as their relationship is dealt with in other specialist units.

- ◆ characteristics of the eye
- ◆ principles of light reflection and refraction
- ◆ the colour spectrum
- ◆ their affect on lighting design
- ◆ measurement of light levels in work areas
- ◆ typing
- ◆ drawing
- ◆ kitchen
- ◆ workshop
- ◆ comparison of recommended levels with readings taken

## Guidance on the delivery and assessment of this Unit

It is recommended that evidence for learning outcomes is achieved through well planned course work, assignments and projects. Assessment may be formative and summative and both may feature as part of the process. Although assessments must be focused on the individual achievement of each candidate, group work and role play activities may contribute to the assessment. Integrative assignments and project work will help to link this Unit with other related units.

The volume of evidence required for each assessment should take into account the overall number of assessments being contemplated within this unit and the design of the overall teaching programme.

In designing the assessment instrument/s, opportunities should be taken to generate appropriate evidence to contribute to the assessment of Core skills units.

Where available, evidence from the workplace can also be incorporated to enhance the learning outcomes, provided that this evidence is appropriate and authenticated as the candidate's own work.

### *Opportunities for developing Core Skills*

The following grid provides a general guide to opportunities for the development of Core Skills in this Unit. Opportunities for the development of Core Skills at the output level are more fully identified in the Core Skills Signposting Guide.

Core Skill	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5
<b>1 Communication</b>					
Reading	3	3	3	3	
Writing					
Oral					
<b>2 Numeracy</b>					
Using Number	3	3	3	3	
Using Graphical Information	3	3	3	3	
<b>3 IT</b>					
Using Information Technology					
<b>4 Problem Solving</b>					
Critical Thinking	3	3	3	3	
Planning and Organising					
Reviewing and Evaluating					
<b>5 Working with Others</b>					

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### **Open learning**

Given that appropriate materials exist this unit could be delivered by distance learning, which may incorporate some degree of on-line support. However with regard to assessment planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that assessments were conducted under controlled, supervised conditions.

### **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](http://www.sqa.org.uk/assessmentarrangements).

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### **General information for candidates**

#### **Unit title:** Building Science

This Unit has been designed to allow you to develop knowledge, understanding and skills in Building Science and specifically heat light and sound in relation to building environments.

- 1 Apply the principles of heat transfer in building design.
- 2 Apply the principles of psychrometry to the occurrence of condensation in building design.
- 3 Apply the principles of sound and noise measurement in building design.
- 4 Apply the principles of light and light measurement in building design.

The formal assessment for the Unit may be undertaken as one single assessment paper lasting no more than two hours or learning outcomes individually assessed. Whichever assessment process is adopted it will be conducted under controlled supervised conditions.