National Unit Specification: general information

UNIT Building Craft Science and Mechanics (SCQF level 6)

CODE F6N3 12

SUMMARY

This Unit is suitable for candidates undertaking a Modern Apprenticeship in Carpentry and Joinery and will develop the candidate's knowledge and understanding of carpentry and joinery related scientific principles and building mechanics. Through conducting simple experiments this Unit will demonstrate the principles of sound building design and allow candidates to apply these principles in the workplace.

OUTCOMES

1 Conduct and report simple laboratory experiments.
2 Correctly identify basic scientific principles in relation to practical building situations.
3 Correctly identify the properties of a range of building materials.
4 Demonstrate a basic understanding of leverage and equilibrium.
5 Demonstrate a basic understanding of simple forces in structural components.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates undertaking the Professional Development Award in Carpentry and Joinery at SCQF level 6 must meet the requirements of the Modern Apprentices which include being employed in the relevant craft industry.

CREDIT VALUE

1 credit at SCQF level 6 (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.*

Administrative Information

Superclass: TE

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Version: 01

National Unit Specification: general information (cont)

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CORE SKILLS

There is no automatic certification of Core Skills or Core Skill components in this Unit.

Opportunities for developing aspects of the following Core Skills are highlighted in Support Notes of this Unit.

- *Problem Solving* at SCQF level 4
- *Working with Others* at SCQF level 4
- *Information and Communication Technology* at SCQF level 3
- *Numeracy* at SCQF level 4
- *Communication* at SCQF level 4

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

Conduct and report simple laboratory experiments.

Performance Criteria

(a) Conduct a simple laboratory experiment related to the density of building materials.
(b) Conduct two simple laboratory experiments related to surface tension.
(c) Conduct two simple laboratory experiments related to capillarity.
(d) Conduct a simple laboratory experiment related to water absorption of building materials.
(e) Compile a report of the findings for each experiment.

OUTCOME 2

Correctly identify basic scientific principles in relation to practical building situations.

Performance Criteria

(a) Correctly identify the scientific principles of density in relation to a practical situation.
(b) Correctly identify the scientific principles of permeability and im-permeability in relation to a practical situation.
(c) Correctly identify the scientific principles of capillarity and surface tension in relation to a practical situation.
(d) Correctly identify the scientific principle of absorption in relation to a practical situation.
(e) Correctly identify the scientific principle of insulation in relation to a practical situation.

OUTCOME 3

Correctly identify the properties of a range of building materials.

Performance Criteria

(a) Correctly identify the properties of structural materials.
(b) Correctly identify the properties of permeable materials.
(c) Correctly identify the properties of im-permeable materials.
(d) Correctly identify the properties of insulation materials.

National Unit Specification: statement of standards (cont)

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OUTCOME 4

Demonstrate a basic understanding of leverage and equilibrium.

Performance Criteria

(a) Demonstrate the principle of moments in relation to problems of leverage.
(b) Demonstrate the principle of moments in relation to problems of equilibrium.
(c) Calculate support reactions of simply supported beams carrying point loads.

OUTCOME 5

Demonstrate a basic understanding of simple forces in structural components.

Performance Criteria

(a) Identify compressive, tensile and shear forces in a range of structural members.
(b) Demonstrate correctly how existing forces are resisted in structural components.

National Unit Specification: statement of standards

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EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that the candidates have achieved this Unit to the standard specified in all the Outcomes and Performance Criteria. All working practices must be in line with relevant and current Health and Safety legislation and regulations. A Risk Assessment and Method Statement must be completed **prior** to any practical activities taking place.

Performance and product evidence for Outcome 1 supplemented with an assessor observation checklist should be used to confirm the candidate has individually met the standards specified in the Performance Criteria. Written and/or oral evidence is also required for Outcome 1 which demonstrates that the candidate can use data to obtain results, make conclusions and recognise the relationship between scientific principles and the practical situation for each experiment undertaken. The evidence for this Outcome should be obtained under controlled, supervised conditions in a building craft science laboratory.

For Outcome 1, candidates must work in pairs to undertake and evidence the following experiments:

1 Density using:
   (a) Physical measurement
   (b) Displacement.
2 Absorption of water/porosity of building materials.
3 Capillary action: the upward movement of moisture (against gravity) in narrow spaces.
4 Surface tension: adhesion – solid to liquid; cohesion — gas to liquid.
5 Preventative measures on capillary action and surface tension:
   (a) Capillary groove
   (b) Damp Proof Courses
   (c) Drips/throats.
6 Additional craft experiments:
   (a) Determination of the moisture content of timber
   (b) Bulk density and solid density of building materials
   (c) Efflorescence
   (d) Corrosion of metals.

Written and/or oral evidence for Outcomes 2, 3, 4 and 5, supplemented with an assessor observation checklist, should be used to confirm the candidate has individually met the standards specified in the Performance Criteria

These Evidence Requirements will me met by the completion of the Training and Assessment Programme (TAP) in Carpentry and Joinery.

National Unit Specification: support notes

UNIT Building Craft Science and Mechanics (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.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

This Unit has been developed as a mandatory Unit in the Professional Development Award in Carpentry and Joinery at SCQF level 6, which is a mandatory component of the Modern Apprenticeship in Carpentry and Joinery.

The successful completion of this Unit will develop candidates underpinning knowledge and skills relating to scientific principles and basic building mechanics in practical situations by means of conducting basic experiments. The scientific principles would include: capillarity; surface tension; density; absorption and insulation, as well as being linked directly to properties of construction materials. As a result of conducting these experiments candidates will also be able to develop skills in problem solving and report writing.

The Unit would be offered to candidates from the construction and related services industries. The skills and knowledge and understanding are transferable within different working environments but the Unit is primarily aimed at candidates whose normal place of work would be a site, workshop or similar environment.

The Unit deals with the theory and practice associated with the direct link between scientific principles, building mechanics and the design of buildings. It is further complemented by Units dealing with related work in Carpentry and Joinery. There would be opportunity to integrate aspects of this Unit with others in the Carpentry and Joinery PDA, eg *Ground and Upper Floors; Window Construction; Timber Frames; Pitched Roofs and Materials, Products and Finishes* at SCQF level 6. It should be delivered as part of a structured programme of training and orientated to the context of the candidate's work and area of responsibility.

Health and Safety and Sustainability are integral and key to the Construction Industry therefore throughout the Unit emphasis will be placed where appropriate on the application of Health and Safety and Sustainability. Safety working practices should be looked at in accordance with current safety codes of practice and regulations. Sustainability should include reference to criteria affecting sustainability, impact of not implementing sustainability on the environment and the legislation promoting sustainability.

National Unit Specification: support notes (cont)

UNIT Building Craft Science and Mechanics (SCQF level 6)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

The following information may be helpful with regard to specific Outcomes:

Outcomes 1–3

An integrative approach could be used across Outcomes 1 to 3 where a programme of experiments is designed to promote investigative and problem solving skills, accuracy in detailed reporting, collection and use of data and summing up to form conclusions from information gained. This information should form a link between the experiment, the properties of materials used and their application in practical situations. It is intended that such investigation will develop an understanding of materials, their properties and the design technology used in domestic construction.

In Outcome 2 the practical building situations and applications the lecturer covers could include: Selection of materials; deterioration of materials and finishes; moisture penetration via absorption, gravity and capillary action; moisture ingress via door and window clearance spaces; use of damp-proof courses/membranes; capillary grooves; drips and throatings; control of rising damp; efflorescence; erosion; and corrosion.

Outcomes 4 and 5

Again an integrated approach should be adopted when delivering Outcomes 4 and 5 of this Unit and the content should be contextualised whenever and wherever possible.

The candidate should be introduced to the terminology related to basic building mechanics through the use of drawings, practical examples and lecturer led discussions. Terminology could include: mechanics; statics; dynamics; kinematics; mass; weight; force; fulcrums; forces-gravity; wind. The practical applications could include: Unit force; moment of force leverage; equilibrium; order of levers; pivotal beams on a fulcrum; simply supported beams.

Once candidates had grasped the basic concepts the topic could be further expanded into the types of everyday situations encountered by a craft operative. These would include ground and upper floors; flat and pitched roofs and would introduce candidates to mechanics; compression, tensile and shear forces; stress and strain. An important factor would be the explanation of the principles of triangulation conferring strength, stability, rigidity in framed structures and scaffolding as well as the important role beams and columns play in the design of buildings.

Where appropriate, opportunities should be taken throughout delivery of this Unit to meet the requirements of the generic Units of the Training and Assessment Programme including:

- Conform to Efficient Working Practices
- Conform to General Workplace Safety
- Move and Handle Resources
- Confirm Work Activities and Resources for the Work
- Develop and Maintain Good Working Relationships
- Confirm the Occupational Method of Work

National Unit Specification: support notes (cont)

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OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

There are opportunities to develop the Core Skill of *Problem Solving* at SCQF level 4. Candidates will need to take account of a range of factors in order to work efficiently and safely, such as the choice of equipment and materials used to conduct experiments and recording the results. A very important part of the experiment process is to gather the information and draw conclusions from the results. Individual discussions with assessors and the use of role play will enhance the evaluation of efficient working practices.

There are opportunities for candidates to develop the Core Skill of *Working with Other*s at SCQF level 4, particularly in Outcomes 1, 4 and 5. Candidates can agree responsibilities and provide support and information to each other during the practical group activities. Candidates will be working as part of a team of two in Outcome 1.

Opportunities also arise for candidates to develop the Core Skill of *Information and Communication Technology* at SCQF level 3 by researching, use of spreadsheets, e-learning and e-assessment.

Numeracy skills at SCQF level 4 could be developed through the interpretation of information from drawings and the practical use of calculation and formula application in Outcomes 1, 4 and 5.

Candidates will have the opportunity to develop *Communication* skills at SCQF level 4 through out conducting the experiments in Outcome 1, as they should be expected to communicate with others using the correct terminology, tone and style suited to the environment. Outcome 1 also provides the opportunity for report writing.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Assessments for this Unit are integrated throughout the Training and Assessment Programme (TAP) for Carpentry and Joinery. It is advised to use the TAP which has been developed centrally by SQA. Any other instruments of assessment used must be comparable to the TAP and have been through prior verification. It is expected that candidates will be given as much practise as possible, prior to being set assessment tasks.

The candidates' knowledge and understanding of scientific principles and basic building mechanics in relation to practical situations and properties of materials will be assessed through a question paper and conducted under controlled, supervised conditions.

Candidates will be required to conduct a range of experiments and compile a report for each to satisfy the requirements of Outcome 1.

Evidence will be gathered for Outcomes 2, 3, 4 and 5 through observation that the candidates have met the given standards. An assessor observation checklist/record can be used to record this evidence. Assessment should be conducted under controlled, supervised conditions.

National Unit Specification: support notes (cont)

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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).*

DISABLED CANDIDATES AND/OR THOSE WITH ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**