



Higher
Course Assessment
Specification



Higher Design and Manufacture Course Assessment Specification (C719 76)

Valid from August 2014

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Please refer to the note of changes at the end of this Course Assessment Specification for details of changes from previous version (where applicable).

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Course outline

Course title:	Higher Design and Manufacture
SCQF level:	6 (24 SCQF credit points)
Course code:	C719 76
Course assessment code:	X719 76

The purpose of the Course Assessment Specification is to ensure consistent and transparent assessment year on year. It describes the structure of the Course assessment and the mandatory skills, knowledge and understanding that will be assessed.

Course assessment structure

Component 1 — Assignment	70 marks
Component 2 — Question Paper	70 marks
Total marks	140 marks

This Course includes six SCQF credit points to allow additional time for preparation for Course assessment. The Course assessment covers the added value of the Course.

Equality and inclusion

This Course Assessment Specification has been designed to ensure that there are no unnecessary barriers to assessment. Assessments have been designed to promote equal opportunities while maintaining the integrity of the qualification.

For guidance on assessment arrangements for disabled learners and/or those with additional support needs, please follow the link to the Assessment Arrangements web page: www.sqa.org.uk/sqa/14977.html.

Guidance on inclusive approaches to delivery and assessment of this Course is provided in the *Course Support Notes*.

Assessment

To gain the award of the Course, the learner must pass all of the Units as well as the Course assessment. Course assessment will provide the basis for grading attainment in the Course award.

Course assessment

SQA will produce and give instructions for the production and conduct of Course assessments based on the information provided in this document.

Added value

The purpose of the Course assessment is to assess added value of the Course as well as confirming attainment in the Course and providing a grade. The added value for the Course will address the key purposes and aims of the Course, as defined in the Course Rationale. It will do this by addressing one or more of breadth, challenge, or application.

In this Course assessment, added value will focus on the following:

- ◆ breadth — drawing on knowledge and skills from across the Course
- ◆ challenge — requiring greater depth or extension of knowledge and/or skills
- ◆ application — requiring application of knowledge and/or skills in practical or theoretical contexts as appropriate

Through the Units, learners will develop skills, and knowledge and understanding of key concepts related to design and manufacture. To achieve success in the Course, learners must show that they can apply this knowledge and these skills to solve design problems in both practical and theoretical contexts.

The assignment requires learners to demonstrate aspects of challenge and application in a practical context. Learners will apply knowledge and skills from the Units to produce a solution to an appropriately challenging design problem.

The question paper requires learners to demonstrate aspects of breadth and application in theoretical contexts. Learners will apply breadth of knowledge from across the Units and depth of understanding, to produce descriptions and explanations related to theoretical design and manufacture contexts.

Grading

Course assessment will provide the basis for grading attainment in the Course award.

The Course assessment is graded A–D. The grade is determined on the basis of the total mark for all Course assessments together.

A learner's overall grade will be determined by their performance across the Course assessment.

Grade description for C

For the award of Grade C, learners will have demonstrated successful performance in all of the Units of the Course. In the Course assessment, learners will typically have demonstrated successful performance in relation to the mandatory skills, knowledge and understanding for the Course.

Grade description for A

For the award of Grade A, learners will have demonstrated successful performance in all of the Units of the Course. In the Course assessment, learners will typically have demonstrated a consistently high level of performance in relation to the mandatory skills, knowledge and understanding for the Course.

Credit

To take account of the extended range of learning and teaching approaches, remediation, consolidation of learning and integration needed for preparation for external assessment, six SCQF credit points are available in Courses at National 5 and Higher, and eight SCQF credit points in Courses at Advanced Higher. These points will be awarded when a grade D or better is achieved.

Structure and coverage of the Course assessment

The Course assessment will consist of two Components: an assignment and a question paper. The question paper will have two Sections.

Component 1 — assignment

The purpose of the assignment is to assess the learner's ability to apply skills, knowledge and understanding to solve a design task in a given context. It assesses the learner's ability to communicate, generate and refine ideas and apply modelling and/or prototyping skills in presenting a potential solution.

The assignment will give learners an opportunity to:

- ◆ generate, explore and refine a range of creative ideas in response to brief or situation
- ◆ apply graphic and modelling techniques appropriate to stage and design activity and which communicate necessary information and details
- ◆ demonstrate knowledge and understanding of materials and processes through application when resolving design tasks and providing solutions and justifying design decisions
- ◆ demonstrate knowledge and understanding of design issues through application when resolving design tasks and providing solutions and justifying design decisions

Time will be required for:

- ◆ preparation for the assignment, which could include considering exemplar assignments and practising required skills
- ◆ carrying out the stages of the assignment, with teacher guidance and support
- ◆ reviewing and evaluating the learner's progress and justifying design decisions

The assignment should clearly demonstrate the application of knowledge and skills, at an appropriate level from both the Design, and the Materials and Manufacturing Units (as defined in the 'Further mandatory information on Course coverage' section of this document).

The assignment will have 70 marks out of a total of 140 marks which represents 50% of the total mark for the Course assessment.

Marks will be awarded for:

- ◆ generating ideas
- ◆ exploring and refining ideas
- ◆ applying graphic techniques
- ◆ applying modelling techniques
- ◆ applying knowledge and understanding of materials and processes
- ◆ applying knowledge and understanding of design issues

Evidence will be in the form of a design folio.

Component 2 — question paper

The purpose of the question paper is to assess the learner's ability to retain and integrate knowledge and understanding from across the Course.

The question paper will have 70marks out of a total of 140 marks. This represents 50% of the total marks for the Course assessment.

The question paper will require the learner to demonstrate:

- ◆ a broad understanding of the impact of a range of design and manufacturing technologies on our environment and society
- ◆ the critical evaluation of a range of factors that influence the design and manufacture of products
- ◆ an understanding of a broad range of industrial and commercial manufacturing processes and the properties and uses of materials

The question paper will have two Sections.

Section 1 of the question paper will have 25 marks. It will consist of a single question, based on a product type, and will require extended and reasoned responses. The question will follow a similar format each year and will test the learners' knowledge and understanding of core areas from across the Course. The question will also require the learner to integrate this knowledge.

This question will focus on design factors and justification of materials and manufacturing processes associated with a product.

It will give learners an opportunity to demonstrate:

- ◆ knowledge and understanding of how products are influenced by materials and processes
- ◆ knowledge of how products are influenced by design factors

Within each of these broad areas, questions will sample across the main topics, so that each question paper will have some marks related to each of the following sub-topics:

- ◆ design process (including communication and modelling)
- ◆ design factors
- ◆ materials selection and use
- ◆ production planning and industrial processes

Section 2 of the question paper will have 45 marks. It will consist of five or six questions. The responses will require integration of knowledge and understanding from across the Course. Questions will be based on products which are illustrated or products with which the learners are familiar.

It will give learners an opportunity to demonstrate knowledge and understanding specified in the table provided in the 'Further mandatory information on Course coverage' section at the end of this *Course Assessment Specification*.

Setting, conducting and marking of assessment

Question paper

The question paper will be set and marked by SQA, and conducted in centres under conditions specified for external examinations by SQA. Learners will complete this question paper in 2 hours.

Controlled assessment — assignment

The assignment is:

- ◆ set by SQA
- ◆ conducted under some supervision and control

Evidence will be internally marked by centre staff in line with SQA marking instructions.

Setting the assessment

Set by SQA.

All marking will be quality assured by SQA.

A bank of assignments will be provided and there will be choice from this bank.

Conducting the assessment

Conducted under some supervision and control

The assignment will be carried out under open book conditions, but supervised to ensure that the work presented is the learner's own work.

The teacher/lecturer may also give learners support and guidance to help them progress through each stage of the assignment; where any significant amount of support is provided, this should be reflected in the marks awarded.

While the learner may be provided with feedback to help them achieve the next stage of the assessment, they are not allowed to be re-assessed on stages already completed.

The assignment is designed to discriminate between learners, and therefore would be expected to provide a wide range of marks. Stronger learners should be able to complete the assignment successfully with minimal support and guidance. Weaker learners may not be able to complete all aspects of the assignment within a reasonable time, or may require significant assistance, and so would achieve a lower total mark.

Once the assignment has been completed and assessed, it should **not** be returned to the learner for further work to improve their mark.

Further mandatory information on Course coverage

The following gives details of mandatory skills, knowledge and understanding for the Higher Design and Manufacture Course. Course assessment will involve sampling the skills, knowledge and understanding. This list of skills, knowledge and understanding also provides the basis for the assessment of the Units of the Course.

The Course assessment (assignment and question paper) will require learners to draw on and apply knowledge of any of the concepts listed below. This table should be read in conjunction with the descriptions of the question paper and assignment.

Component 1 — assignment

The purpose of the assignment is to assess the learner's ability to apply skills, knowledge and understanding to solve a design task in a given context. It assesses the learner's ability to generate, explore and refine ideas, apply graphic and modelling techniques and to apply their knowledge and understanding of materials, processes and design issues to generate a design proposal.

The assignment Component of Course assessment will require learners to draw on and apply skills, knowledge and understanding as required, from the topic areas listed in the table below.

Design topic areas (assignment) — as required, or limited by a given design task.

Design process	Identification of a problem	Situation analysis.
	Brief	Purpose, statement of problem, target market. Open brief, closed brief. Design brief analysis.
	Research	Sources of recorded and non-recorded information, methods of gathering information. Analysis, application and presentation of researched material.
	Specification	Types and purpose of specifications: brief, product design specification, performance specification, marketing specification and technical specification. Application of researched material to produce a product design specification.
	Idea generation	Morphological analysis, thought showers, technology transfer, analogy, and lateral thinking. Application of idea generation techniques. Mood and lifestyle boards.

	Development and refinement of ideas	Synthesis of ideas. Justification and recording of decisions taken. Presentation techniques. Modelling techniques.
	Evaluation	Surveys, questionnaires, user trips/trials, observation, testing, test rigs, comparison to other products, and comparison to specification. Application of evaluation techniques, presentation of results.
Design factors	Function	Primary and secondary functions, fitness for purpose, safety in use.
	Performance	Design for re-use, for recycling, planned obsolescence, value for money, ease of maintenance, environmental aspects.
	Market	Consumer demands, end user, social expectations, niche marketing, branding, introduction of new products, economics, product life cycle, needs, wants, technology push, market pull.
	Aesthetics	Factors influencing aesthetics (line, shape, form, colour, proportion, contrast, pattern, texture, harmony, balance), influences of fashion, market trends, style.
	Ergonomics	Anthropometrics, psychology, physiology.
Communication and modelling	Graphic techniques	The use of graphic techniques, as required, in communicating design ideas, information and detail effectively eg the use of annotated sketches, orthographic drawings, isometric, oblique, one point and two point perspective, exploded views, dimensioned views, illustration techniques, CAD, use of scale. Use of graphic techniques to: develop, communicate and resolve ideas.
	Range of modelling techniques and materials	The use of modelling, as required, as it supports designing eg the use of scale models, mock-ups, fully crafted

		<p>prototypes, test models, computer generated models, part product models, simulations and rapid prototyping.</p> <p>Use of appropriate modelling materials, as required, such as paper, card, corrugated card, MDF, wire, pipe cleaners, foam, clay, modelling compound, balsa wood, expanded foam, sheet plastic, construction kits, smart materials.</p> <p>The application of modelling techniques, as required, to: develop, communicate, evaluate and resolve ideas.</p>
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Materials and manufacturing topic areas (assignment) — as required, or limited by given design task.

Learners should be able to demonstrate knowledge of materials and processes used in the commercial manufacture of products. They should be able to demonstrate knowledge of the characteristics of materials which make them suitable for producing particular products. They should be able to identify materials used in existing products and apply their knowledge of materials to the design of new products. It should be noted that learners may refer to materials outside of the list given providing the material has appropriate characteristics for the intended use.

For the assignment, learners should draw upon these applying knowledge and understanding of, as required, or limited by the given design task.

Planning for manufacture	Production and planning systems	One-off, batch, mass, line, flow. Gantt charts, flow charts, project planning, JIT, jigs, patterns, standard components, CAD/CAM, CNC machining (automation) and rapid prototyping.
Materials and processes	Plastics (including composites)	Polythene (high and low density), polyvinyl chloride, polystyrene, nylon, cellulose acetate, acrylic, polypropylene, ABS, epoxy resin, melamine formaldehyde, urea formaldehyde, polyester resin, glass-reinforced plastic, carbon-fibre plastics, elastomers including, where appropriate, labelling and symbols.
	Metals	Mild steel, carbon steel, stainless steel, high-speed steel, cast iron, brass, bronze, aluminium and aluminium alloys, copper, tin, lead, zinc.

	Woods	Beech, oak, ash, mahogany, teak, walnut, balsa, Scots pine, red cedar, Parana pine, spruce.
	Timber derivatives	Manufactured boards — fibreboards, plywood, block-board, chip-board, hard-board, and veneer.
	Properties of materials	Justification of the selection of materials based upon their properties in the design, manufacturing and use of products.
	Plastic processes	Cutting, injection-moulding, extrusion, rotational moulding, vacuum-forming, blow-moulding, laminating, rapid prototyping, joining, compression moulding, calendering, casting, bending, fabrication, coating, forming, adhesive bonding, finishing.
	Metal processes	Cutting, turning, milling, die-casting, sand casting, lost wax casting, pressing, stamping, punching, extrusion, spot welding, arc welding, adhesive bonding, riveting, fitted joints, bolts, screws, piercing and blanking, drop forging, finishing.
	Wood processes	Cutting, drilling, turning, routing, laminating, spindle moulding, adhesive bonding, knock-down fittings, finishing.
	Identification of commercial processes	Form, material, split lines, injection points, ejector points, shrinkage, draft angle, intricate form, clean and precise, flash, thinning of sheet material, shear marks, cross-section over length, surface finish (texture/detail).
Society, environment and the world of work	The impact of design and manufacturing technologies on society and the environment and the world of work	Energy efficiency, sustainability, pollution, materials innovation, design for recyclability, design for re-use.

Component 2 — question paper

The purpose of the question paper is to assess the learner's ability to retain and integrate knowledge and understanding from across the Course.

The question paper Component of Course assessment will require learners to draw upon and apply knowledge and understanding of a sample from the topic areas listed below.

Design topic areas (question paper)		
Members of a design team		Designers, market researchers, accountants, engineers, manufacturers, lawyers, materials technologists, production specialists, marketing teams, ergonomists, consumers, retailers economists, sub-contractor. Relationships between team members and types of teams.
Design process	Brief	Purpose, statement of problem, target market. Open brief, closed brief. Design brief analysis.
	Research	Sources of recorded and non-recorded information, methods of gathering information. Analysis, application and presentation of researched material.
	Specification	Types and purpose of specifications: brief, product design specification, performance specification, marketing specification and technical specification. Application of researched material to produce a product design specification.
	Idea generation	Morphological analysis, thought showers, technology transfer, analogy, and lateral thinking. Application of idea generation techniques. Mood and lifestyle boards.

	Evaluation	Surveys, questionnaires, user trips/trials, observation, testing, test rigs, comparison to other products, and comparison to specification. Application of evaluation techniques, presentation of results.
Design factors	Function	Primary and secondary functions, fitness for purpose, safety in use.
	Performance	Design for re-use, for recycling, planned obsolescence, value for money, ease of maintenance, environmental aspects.
	Market	Consumer demands, end user, social expectations, niche marketing, branding, introduction of new products, economics, product life cycle, needs, wants, technology push, market pull.
	Aesthetics	Factors influencing aesthetics (line, shape, form, colour, proportion, contrast, pattern, texture, harmony, balance), influences of fashion, market trends, style.
	Ergonomics	Anthropometrics, psychology, physiology.
Communication and modelling	Graphic techniques	The role of graphic techniques in communicating design ideas.
	Range of modelling techniques and materials	The role of modelling as it supports designing.

Materials and manufacturing: topic areas (question paper)

Learners should be able to demonstrate knowledge of materials and processes used in the commercial manufacture of products. They should be able to demonstrate knowledge of the characteristics of materials which make them suitable for producing particular products. They should be able to identify materials used in existing products and apply their knowledge of materials to the design of new products. It should be noted that learners may refer to materials outside of the list given providing the material has appropriate characteristics for the intended use.

Planning for manufacture	Production and planning systems	One-off, batch, mass, line, flow. Gantt charts, flow charts, project planning, JIT, jigs, patterns, standard components, CAD/CAM, CNC machining (automation) and rapid prototyping.
Materials and processes	Plastics(including composites)	Polythene (high and low density), polyvinyl chloride, polystyrene, nylon, cellulose acetate, acrylic, polypropylene, ABS, epoxy resin, melamine formaldehyde, urea formaldehyde, polyester resin, glass-reinforced plastic, carbon-fibre plastics, elastomers including, where appropriate, labelling and symbols.
	Metals	Mild steel, carbon steel, stainless steel, high-speed steel, cast iron, brass, bronze, aluminium and aluminium alloys, copper, tin, lead, zinc.
	Woods	Beech, oak, ash, mahogany, teak, walnut, balsa, Scots pine, red cedar, Parana pine, spruce.
	Timber derivatives	Manufactured boards — fibreboards, plywood, block-board, chip-board, hard-board and veneer.
	Properties of materials	Justification of the selection of materials based upon their properties in the design, manufacturing and use of products.
	Plastic processes	Cutting, injection-moulding, extrusion, rotational moulding, vacuum-forming,

		blow-moulding, laminating, rapid prototyping. joining, compression moulding, calendaring, casting, bending, fabrication, coating, forming, adhesive bonding, finishing.
	Metal processes	Cutting, turning, milling, die-casting, sand casting, lost wax casting, pressing, stamping, punching, extrusion, spot welding, arc welding, adhesive bonding, riveting, fitted joints, bolts, screws, piercing and blanking, drop forging, finishing.
	Wood processes	Cutting, drilling, turning, routing, laminating, spindle moulding, , adhesive bonding, knock-down fittings, finishing
	Identification of commercial processes	Form, material, split lines, injection points, ejector points, shrinkage, draft angle, intricate form, clean and precise, flash, thinning of sheet material, shear marks, cross-section over length, surface finish (texture/detail).
Society, environment and the world of work	The impact of design and manufacturing technologies on society and the environment and the world of work	Energy efficiency, sustainability, pollution, materials innovation, design for recyclability, design for re-use, employment patterns, consumer choices and new or different skills required.

Administrative information

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History of changes to Course Assessment Specification

Course details	Version	Description of change	Authorised by	Date
	1.1	Additional information has been added to the Structure and coverage of the Course assessment section regarding the question paper. Component headings with supporting information have been included in the Further mandatory information on Course coverage section. House style corrections made throughout.	Qualification Development Manager	April 2014

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