Higher
Course
Specification

Higher Design and Manufacture

Course code:	C819 76
Course assessment code:	X819 76
SCQF:	level 6 (24 SCQF credit points)
Valid from:	session 2018–19

This document provides detailed information about the course and course assessment to ensure consistent and transparent assessment year on year. It describes the structure of the course and the course assessment in terms of the skills, knowledge and understanding that are assessed.

This document is for teachers and lecturers and contains all the mandatory information you need to deliver the course.

This edition: September 2018 (version 2.0)

Contents

Course overview

The course consists of 24 SCQF credit points which includes time for preparation for course assessment. The notional length of time for candidates to complete the course is 160 hours.

The course assessment has two components.

Component	Marks	Duration
Component 1: question paper	80	2 hours and 15 minutes
Component 2: assignment	90	see 'Course assessment' section

Recommended entry	Progression
Entry to this course is at the discretion of the centre. Candidates should have achieved the National 5 Design and Manufacture course or equivalent qualifications and/or experience prior to starting this course.	♦ other SQA qualifications in design and manufacture or related areas ♦ further study, employment and/or training

Conditions of award

The grade awarded is based on the total marks achieved across all course assessment components.

Course rationale

National Courses reflect Curriculum for Excellence values, purposes and principles. They offer flexibility, provide time for learning, focus on skills and applying learning, and provide scope for personalisation and choice.

Every course provides opportunities for candidates to develop breadth, challenge and application. The focus and balance of assessment is tailored to each subject area.

This course allows candidates to develop the knowledge and skills they need to appreciate design and manufacturing industries, and to contribute and adapt to the opportunities they offer.

Candidates develop knowledge of design and commercial manufacture together with the creative and practical skills required to design solutions to real problems. Candidates also gain an understanding of the impact of design and commercial manufacture on everyday life and the environment.

The course encourages candidates to take a broad view of design and manufacture. They do this by making decisions and taking responsibility for their own actions, generating and developing ideas, applying knowledge, and justifying decisions. These transferrable skills place candidates in a strong position regardless of the career path they choose.

Purpose and aims

The main purpose of the course is to allow candidates to develop the skills and knowledge associated with designing and manufacturing.

Candidates study the lifecycle of products from their inception through design, manufacture, and use, including their disposal and/or re-use. It helps candidates to appreciate the impact commercial manufacture has on design and the need for balance and compromise when developing successful commercial products.

Candidates develop:

- research skills
- skills in designing products
- knowledge and understanding of materials and commercial manufacture
- knowledge and understanding of design factors
- an understanding of the impact of design and manufacturing technologies on society, the environment and the world of work

Who is this course for?

The course is suitable for candidates attracted by the creative and practical activities required to design and manufacture commercial products. It allows candidates to be innovative and resourceful when exploring and resolving problems. The course provides a foundation for those considering further study or a career in design, manufacturing, engineering, science, marketing, and related disciplines.

The course also offers a complementary practical experience for those studying subjects in the technologies and expressive arts.

Course content

The course has two areas of study:

Design

Candidates study the design process from brief to design proposal. This helps them to develop skills in initiating, developing, articulating and communicating design proposals. Candidates explore and refine design proposals using the design/make/test process and by applying knowledge of materials, processes and design factors to reach a viable solution. This helps them to develop an understanding of the iterative nature of the design process. Candidates also develop an understanding of the factors that influence the design, marketing and use of commercial products.

Manufacture

Candidates study the manufacture of commercial products. They develop knowledge of materials, manufacturing and production processes and strengthen their understanding of how these influence the design of products. This provides candidates with the knowledge and understanding required to develop a viable design proposal for a commercial product and to plan its production.

Integrating the two areas of study is fundamental to delivering the course successfully. It helps candidates to understand the relationship between designing products and manufacturing products and it helps them to see how this connection influences a product's lifecycle. By combining the study of design with the study of manufacturing, candidates also learn to appreciate the impact design and manufacturing technologies have on society, the environment and the world of work.

Skills, knowledge and understanding

Skills, knowledge and understanding for the course

The following provides a broad overview of the subject skills, knowledge and understanding developed in the course:

- researching and evaluating existing product types
- selecting and using a range of research techniques and evaluating their usefulness
- selecting and applying a range of idea-generation techniques
- writing a detailed specification based on research
- applying a range of creative design skills when refining and resolving product design tasks that cover key design challenges
- selecting and using graphic techniques to visually represent design solutions, justifying the choice of techniques
- selecting, using, and evaluating a range of simple modelling and manufacturing techniques to represent design ideas in three dimensions
- planning the manufacture of a commercial product and analysing its effectiveness

- selecting and using a range of tools, equipment, software and materials for designing, making and testing models and prototypes
- evaluating personal design proposals and associated manufacturing practicalities, and applying suggestions for improvement
- developing broad knowledge and understanding of the impact of a range of design and manufacturing technologies on our environment and society
- critically evaluating a range of factors that influence the design and manufacture of products
- developing knowledge and understanding of a broad range of industrial and commercial manufacturing processes and the properties and uses of materials

Skills, knowledge and understanding for the course assessment

The following provides details of skills, knowledge and understanding sampled in the course assessment:

Assignment		**Question paper**	
Skill	**Candidates demonstrate the ability to:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
Carry out research into a given brief	♦ analyse a design brief ♦ carry out research ♦ present research	Brief	♦ the purpose of the design brief in the design process ♦ open and closed design briefs
		Research and evaluation	♦ the purpose of research and evaluation — throughout the design process — of existing products ♦ information gathered through research or evaluation ♦ methods of gathering information — primary and secondary research ♦ the key stages of the following techniques — comparisons — questionnaires — surveys — tests and test rigs — user trial — user trip

Assignment		Question paper	
Skill	**Candidates demonstrate the ability to:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
Produce a specification	♦ incorporate research findings into a design specification	Specification	♦ the purpose of, and information specified in, the following specification types: — product design — performance — technical
Generate initial ideas	♦ generate initial ideas	Idea-generation techniques	♦ the use of idea-generation techniques ♦ the key stages/activities of the following idea-generation techniques: — analogy — brainstorming — lifestyle/mood board — morphological analysis
Demonstrate practical modelling skills	♦ demonstrate practical modelling skills	Modelling in the design process	♦ the use of modelling during the design process to: — generate and explore — test and refine — communicate ♦ the purpose of, and information gained from: — physical models: sketch models, block models, scale models, test rigs and prototypes — computer-generated models and simulations ♦ benefits and drawbacks of rapid prototyping
Apply modelling techniques	♦ use modelling to develop a design proposal		

Assignment		Question paper	
Skill	**Candidates demonstrate the ability to:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
Apply graphic techniques	♦ use graphics to develop a design proposal	Graphics in the design process	♦ the purpose and appropriate use of graphic techniques when developing, resolving and communicating ideas throughout the design process ♦ the advantages of using manual and computer-generated graphics in the design process
Develop ideas	♦ explore ideas ♦ refine ideas ♦ apply knowledge and understanding of materials, manufacture and assembly processes ♦ apply knowledge and understanding of design issues	Function	♦ the influence of function on the design of products ♦ primary and secondary functions
		Performance	♦ the influence of performance on the design of products ♦ fitness for purpose of products ♦ the influence of planned obsolescence on the manufacturer, consumer and the environment ♦ maintenance issues associated with products ♦ value for money
		Safety	♦ the influence of safety on the design of products ♦ how to ensure safety in products

Assignment		Question paper	
Skill	**Candidates demonstrate the ability to:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
		Market	♦ the influence of the target market on the design and marketing of products ♦ technology push ♦ market pull ♦ economics ♦ product lifecycles: introduction, maturity, growth, and decline ♦ the influence of fashion, market trends, style ♦ marketing techniques to influence sales ♦ niche marketing ♦ branding
		Aesthetics	♦ the aesthetics of products ♦ influences on the aesthetics of products
		Ergonomics	♦ the influence of ergonomics on the design of products ♦ anthropometrics ♦ psychology ♦ physiology

Assignment		Question paper	
Skill	**Candidates demonstrate the ability to:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
		Materials used in the commercial manufacture of products	♦ properties and appropriate uses of: — thermoplastics: ABS, acrylic, nylon, polypropylene, polystyrene, polythene, polyvinyl chloride — thermosetting plastics: melamine formaldehyde, urea formaldehyde — elastomers — ferrous metals/alloys: cast iron, mild steel, high-speed steel, stainless steel — non-ferrous metals/alloys: aluminium, brass, copper, tin, zinc — hardwoods: ash, beech, mahogany, oak — softwoods: spruce, pine — manufactured boards: plywood, blockboard, chipboard, hardboard, MDF, flexiply veneered boards — composite materials: carbon-fibre plastics, glass-reinforced plastic ♦ the influence materials have on the design and manufacture of products ♦ methods used to identify materials in commercially manufactured products ♦ developments in new materials and their impact on products

Assignment		Question paper	
Skill	**Candidates demonstrate the ability to:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
		Processes used in the commercial manufacture of products	♦ appropriate uses and identifying features of: — bending — blow moulding — compression moulding — die casting — drop forging — extrusion — injection moulding — piercing and blanking — press forming — rotational moulding — sand casting — vacuum forming — 3D printing — laser cutting ♦ appropriate uses and identifying features of: — chrome plating — galvanising — plastic dip coating

Assignment		Question paper	
Skill	**Candidates demonstrate the ability to:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
		Processes used in the commercial manufacture of products (continued)	♦ manufacturing features of component parts: complexity, cross section along its length, draft angles, ejection marks, flashing, injection points, shear marks, split lines, surface finish, symbols and labels, thinning of sheet material, wall thickness ♦ the purpose of bosses, location pins, ribs and webs ♦ issues that influence the processes used in commercially manufactured products
		Assembly methods used in the commercial manufacture of products	♦ methods used to join material: — adhesive, carcass and frame joints, knock-down fittings, nuts, bolts, screws, snap and press fit, riveting, spot welding, arc welding, thermal bonding ♦ methods used to identify assembly methods in commercially manufactured products ♦ issues that influence the assembly of commercially manufactured products

Assignment		Question paper	
Skill	**Candidates demonstrate the ability to:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
Produce a plan for commercial manufacture	♦ plan the commercial manufacture of a proposal	Production and planning systems	♦ one-off production, batch production, mass production ♦ methods used to improve production — automation — CAD/CAM — CNC machining — Gantt and flow charts — jigs — just-in-time production — standard components
		People who influence design	♦ the roles and responsibilities of people who influence the design of products — designers — ergonomists — lawyers — production engineers — project manager — market researchers — materials technologists ♦ communication between members of design team ♦ advantages and disadvantages of in-house design team and sub-contracting

Assignment		Question paper	
Skill	**Candidates demonstrate the ability to:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
		Intellectual property rights	♦ the purpose of intellectual property rights ♦ methods of protecting intellectual property rights: copyright, design rights, patents, and trademarks
		Impact of design and manufacture on society, the environment and the world of work	♦ methods designers and manufacturers can use to limit a product's impact on the environment — design for recyclability — design for re-use — efficiency ♦ the impact traditional and new manufacturing technologies have on society, the environment and the workforce ♦ the impact of material on the environment and society ♦ methods to support sustainability ♦ investigation of a product's sustainability and its impact on the environment

Skills, knowledge and understanding included in the course are appropriate to the SCQF level of the course. The SCQF level descriptors give further information on characteristics and expected performance at each SCQF level, and can be found on the SCQF website.

Skills for learning, skills for life and skills for work

This course helps candidates to develop broad, generic skills. These skills are based on SQA's Skills Framework: Skills for Learning, Skills for Life and Skills for Work and draw from the following main skills areas:

2 Numeracy

2.2 Money, time and measurement

4 Employability, enterprise and citizenship

4.4 Enterprise

5 Thinking skills

5.3 Applying
5.4 Analysing and evaluating
5.5 Creating

You must build these skills into the course at an appropriate level, where there are suitable opportunities.

Course assessment

Course assessment is based on the information provided in this document.

The course assessment meets the key purposes and aims of the course by addressing:

- 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

This enables candidates to:

- develop skills and knowledge and understanding of key concepts related to design and manufacture
- apply this knowledge and these skills to solve design problems in both practical and theoretical contexts
- demonstrate aspects of challenge and application in a practical context
- apply knowledge and skills to produce a solution to a challenging design problem
- demonstrate aspects of breadth and application in theoretical contexts
- apply breadth of knowledge and depth of understanding to produce descriptions and explanations related to theoretical design and manufacture contexts

Course assessment structure: question paper

Question paper 80 marks

The question paper has 80 marks out of a total of 170 marks for the course assessment.

It assesses knowledge and understanding from the following areas of design and manufacturing:

Area	Range of marks
♦ design	30–50 marks
♦ materials and manufacture	26–42 marks
♦ impact of design and manufacturing technologies on society, the environment, and the world of work	4–8 marks

Details of these areas can be found in the ‘Skills, knowledge and understanding for the course assessment’ table in this document.

The question paper has two sections:

Section 1 has 25 marks and consists of a single question based on the design and manufacture of two similar products. The question focuses on design factors and the justification of materials and manufacturing processes used in their commercial manufacture. It follows a similar format each year and gives candidates 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

The question requires candidates to give reasoned responses to a range of question types.

Section 2 has 55 marks and consists of six or seven questions that focus on the design and manufacture of commercial products and the impact design and manufacturing technologies have on society, the environment and the world of work. The questions require candidates to use integration of knowledge and understanding from across the course.

Setting, conducting and marking the question paper

The question paper is set and marked by SQA, and conducted in centres under conditions specified for external examinations by SQA.

Candidates have 2 hours and 15 minutes to complete the question paper.

Specimen question papers for Higher courses are published on SQA's website. These illustrate the standard, structure and requirements of the question papers candidates sit. The specimen papers also include marking instructions.

Course assessment structure: assignment

Assignment 90 marks

The assignment has 90 marks out of a total of 170 marks for the course assessment.

The assignment assesses the ability of candidates to apply design skills to develop a proposal according to a set brief. It provides an opportunity to demonstrate the skills as listed in the 'Skills, knowledge and understanding for the course assessment' table in this document. Marks are awarded as follows:

Area	Marks
♦ carrying out research into a given brief	5 marks
♦ producing a specification	3 marks
♦ generating initial ideas	8 marks
♦ exploring ideas	12 marks
♦ refining ideas	6 marks
♦ applying knowledge and understanding of materials and assembly processes	10 marks
♦ applying knowledge and understanding of design	12 marks
♦ applying graphic techniques	12 marks
♦ demonstrating practical modelling skills	8 marks
♦ producing a plan for commercial manufacture	6 marks
♦ applying modelling techniques	8 marks

Candidates should be fully prepared before undertaking the assignment — they should have gained the design skills required and be aware of the requirements of the assessment.

Setting, conducting and marking the assignment

The assignment is:

- set by SQA
- issued annually
- conducted under some supervision and control
- submitted to SQA for external marking

All marking is quality assured by SQA.

Assessment conditions

Time

Candidates generate evidence of their design skills by responding to a set brief. They produce evidence for the assignment over an extended period of time. This allows them to develop and refine their work before it is presented for assessment.

Supervision, control and authentication

The assignment is produced under some supervision and control. This means that:

- candidates do not need to be directly supervised at all times
- the use of resources, including the internet, is not tightly prescribed
- the work an individual candidate submits for assessment is their own
- teachers and lecturers can provide reasonable assistance

Teachers and lecturers must put in place measures to ensure that the work an individual candidate submits for assessment is their own.

Teachers and lecturers must also retain the candidate's work between assessment sessions.

Resources

There are no restrictions on the resources to which candidates may have access while producing their assignment.

Reasonable assistance

Candidates must undertake the assessment independently. However, reasonable assistance may be provided prior to the formal assessment process taking place. The term 'reasonable assistance' is used to try to balance the need for support with the need to avoid giving too much assistance. If any candidates require more than what is thought to be 'reasonable assistance', they may not be ready for assessment or they may have been entered for the wrong level of qualification.

Candidates can seek clarification regarding the assessment task if they find it unclear. In this case, the clarification should normally be given to the whole class.

If a candidate is working on their assignment and is faced with more than one possible solution to a problem, then teachers and lecturers may explore options with them. The teacher or lecturer and candidate can discuss the pros and cons of each option, and the candidate can then decide on a solution based on the discussion.

Once candidates have submitted their completed assignment for assessment, it must not be changed by teachers or lecturers or candidates.

Evidence to be gathered

Volume

Candidates must present their work on a maximum of 12 A3-sized sheets or equivalent. This total includes four pro forma sheets which are issued annually with the assignment:

- research and specification pro formas (two sheets)
- a planning for commercial manufacture pro forma
- practical modelling skills pro forma

This information is given to indicate the volume of evidence required. No penalty will be applied.

There is no word count.

Grading

Candidates' overall grades are determined by their performance across the course assessment. The course assessment is graded A–D on the basis of the total mark for all course assessment components.

Grade description for C

For the award of grade C, candidates will typically have demonstrated successful performance in relation to the skills, knowledge and understanding for the course.

Grade description for A

For the award of grade A, candidates will typically have demonstrated a consistently high level of performance in relation to the skills, knowledge and understanding for the course.

Equality and inclusion

This course is designed to be as fair and as accessible as possible with no unnecessary barriers to learning or assessment.

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

Further information

The following reference documents provide useful information and background.

- Higher Design and Manufacture subject page
- Assessment arrangements web page
- Building the Curriculum 3–5
- Guide to Assessment
- Guidance on conditions of assessment for coursework
- SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work
- Coursework Authenticity: A Guide for Teachers and Lecturers
- Educational Research Reports
- SQA Guidelines on e-assessment for Schools
- SQA e-assessment web page

The SCQF framework, level descriptors and handbook are available on the SCQF website.

Appendix: course support notes

Introduction

These support notes are not mandatory. They provide advice and guidance to teachers and lecturers on approaches to delivering the course. Please read them in conjunction with this course specification and the specimen question paper and/or coursework.

Developing skills, knowledge and understanding

This section provides further advice and guidance about skills, knowledge and understanding that you could include in the course. Teachers and lecturers have considerable flexibility to select contexts that will stimulate and challenge candidates, offering both breadth and depth.

The following tables provide advice on developing the skills, knowledge and understanding required for this course, together with some suggested teaching activities and approaches.

Topic	Guidance on developing design skills	Suggested activities and approaches
This table provides guidance on developing design skills. These skills could be useful to candidates when carrying out their course assessment task. Some of the skills, knowledge and understanding required at this level are new and others build on existing skills gained as part of the National 5 course or during the broad general education phase.		
Carry out research into a given brief	Teachers and lecturers should give candidates a range of focused tasks and activities to help them develop the skills to: ♦ plan, develop and use a range of research techniques correctly ♦ identify areas to research ♦ identify information that would inform a specification ♦ select appropriate research techniques to gather information ♦ use primary and secondary research techniques ♦ present information	Direct input from teachers and lecturers: ♦ teacher presentation to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to select and use appropriate research techniques Activities supported by teachers and lecturers: ♦ plan and carry out a design brief analysis ♦ class or group discussion to identify key areas to research and the information required to generate a specification ♦ using primary and secondary research to gather information Candidate activities: ♦ analyse a design brief ♦ identify areas to research from a given design brief ♦ justify why they used particular research techniques ♦ practise using research techniques to gather information ♦ practise identifying and presenting valid information ♦ practise completing the 'research and specification' pro forma (use specimen or past course assessment tasks)

Topic	Guidance on developing design skills	Suggested activities and approaches
Produce a specification	Teachers and lecturers should give candidates a range of focused tasks and activities to help them develop the skills to: ♦ identify important issues and/or factors to include in a design specification ♦ select research findings to inform the design specification ♦ produce a specification based on research	Direct input from teachers and lecturers: ♦ introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to select and use appropriate research techniques Activities supported by teachers and lecturers: ♦ plan and carry out a design brief analysis ♦ class or group discussion to identify information to include in a design specification ♦ class or group activity to develop specifications for a range of different products or design briefs ♦ class or group activity to plan and carry out a design brief analysis (selecting appropriate research techniques) ♦ develop a specification considering each design factor listed in the course specification ♦ develop a specification to reduce a product's impact on the environment and improve its sustainability ♦ analyse effective and ineffective specifications ♦ rewrite ineffective specifications Candidate activities: ♦ produce a detailed specification by: — identifying and justifying information included in a specification

Topic	Guidance on developing design skills	Suggested activities and approaches
		— incorporating valid findings of research into a detailed specification ♦ practise completing design brief pro formas (use specimen or past course assessment tasks)
Generate initial ideas	Teachers and lecturers should give candidates a range of focused tasks and activities to help them develop the skills to: ♦ develop the thinking skills required to generate creative and original ideas ♦ seek alternative solutions to any given problem, situation or scenario ♦ use idea-generation techniques ♦ communicate initial ideas using appropriate techniques Candidates should develop methods to generate and present their ideas quickly: it should not be a laboured activity. Sketching and modelling are useful techniques for communicating ideas. Teachers and lecturers should introduce different idea-generation techniques that candidates can use to start or maintain a flow of ideas, and that then allow them to develop their own way of working.	Direct input from teachers and lecturers: ♦ teacher presentation to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to use idea-generation techniques Activities supported by teachers and lecturers: ♦ class or group activity to generate 50 things to do with items such as a brick, cube, or flower pot (candidates could present their ideas verbally, in writing or by sketches) ♦ class or group activity to develop a morphological analysis presented in a matrix for a given design task or brief (use matrix individually to generate ideas) ♦ identify other products that could be used as a starting point for generating ideas for a specified product (for example the form and size of a shower gel bottle could be adapted into another handheld product; a clothes peg could be adapted into a method of attaching a light to a bike) ♦ design challenge: generate a range of initial ideas for a given design brief by exploiting the properties of different materials

Topic	Guidance on developing design skills	Suggested activities and approaches
		Candidate activities: ♦ develop and communicate a proposal to meet a design specification by: — generating initial ideas — using creative-thinking techniques — using idea-generation techniques — using sketching, modelling annotation to communicate their ideas ♦ raise their awareness of the wide range of different approaches, solutions and concepts that have been developed for existing products ♦ practise generating initial ideas under assessment conditions (use specimen and past course assessment tasks)

Demonstrate practical modelling skills	Teachers and lecturers should give candidates a range of focused tasks and activities to help them develop the skills to: ♦ use tools and machinery to cut, shape and form a range of suitable modelling materials ♦ construct physical models appropriate to their purpose and stage of the design process ♦ select appropriate materials for the purpose of the model Candidates should demonstrate practical skills, whether producing simple card models, test block models or detailed presentation models. Candidates should develop good working practices for recording and demonstrating their modelling skills. Candidates should develop their practical modelling skills alongside use of modelling in the design process. Teachers and lecturers should ensure that candidates have the necessary time and specific instructions to develop their practical modelling skills.	Direct input from teachers and lecturers: ♦ introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to make physical models from different materials at different stages of the design process Activities supported by teachers and lecturers: ♦ design challenges: — make a sketch model, scale model and presentation model from card — make a sketch model and block model from Styrofoam — make a test rig — make a presentation model — develop a proposal only using models ♦ photograph physical models to record and demonstrate practical skills Candidate activities: ♦ develop and communicate a proposal to meet a design specification by: — selecting and making appropriate models — using and demonstrating practical skills ♦ practise making models under assessment conditions (use specimen and past course assessment tasks) ♦ practise recording evidence of practical modelling skills on the pro forma

Topic	Guidance on developing design skills	Suggested activities and approaches
Use modelling	Teachers and lecturers should give candidates a range of focused tasks and activities to help them develop the skills to: ♦ select and use appropriate modelling types at different stages of the design process ♦ use modelling to generate and communicate ideas ♦ use modelling to explore issues such as aesthetics, ergonomics, assembly ♦ use modelling to refine issues such as aesthetics ergonomics, assembly ♦ test issues such as stability, strength, ease of use and safety ♦ use modelling to analyse and evaluate ideas and proposals ♦ use modelling to gain feedback and justify design decisions ♦ modify and adapt models at appropriate points during the development of a design proposal Materials, construction, accuracy and detail should be appropriate to the model's purpose and stage in the design process. Candidates should develop good working practices for recording, saving and presenting modelling activities when developing their design proposals.	Direct input from teachers and lecturers: ♦ introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to use models at each stage of the design process ♦ demonstrate how to use and record information gained from modelling Activities supported by teachers and lecturers: ♦ group activity: present models at different stages of the design process for peer evaluation and feedback ♦ design challenges: — use models to help generate initial ideas — use models to resolve functional issues — use models to explore and refine aesthetics — use models to refine ergonomics — use modelling to test and evaluate ideas or proposal — use modelling to provide manufacturing details ♦ photograph and present use of models Candidate activities: ♦ develop and communicate a proposal to meet a design specification by: — selecting and using suitable modelling types at appropriate points during the design process — recording information gained from modelling

Topic	Guidance on developing design skills	Suggested activities and approaches
	It is likely that use of modelling will be developed alongside practical modelling skills and modelling in the design process. However, time and specific instructions should be provided in order for candidates to develop their skills to use models to develop design proposals.	♦ practise using models under assessment conditions (use specimen and past course assessment tasks)
Apply graphic techniques	Teachers and lecturers should give candidates a range of focused tasks and activities to help them develop the skills to: ♦ produce different types of graphics; freehand sketching, formal drawings and CAD ♦ use appropriate graphics at different stages of the design process; idea-generation, exploration, refinement and planning ♦ use graphics to present information: sizes and dimensions, assembly, manufacturing features and details ♦ use graphic techniques to generate and communicate ideas; visualise ideas, refine aesthetics, investigate and analyse ideas and proposals Graphic techniques are an integral part of the course; candidates develop these skills alongside many other topics. Teachers and lecturers should ensure that candidates have the necessary time and specific instructions to develop their graphic skills.	Direct input from teachers and lecturers: ♦ introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to produce appropriate graphics to communicate and develop design proposals ♦ break down graphic skills into stages: — sketching 2D shapes — combining 2D shapes to construct complex shapes — sketching basic 3D forms — combining basic forms to create complex forms ♦ analyse the use of graphics in existing or exemplar design folios Activities supported by teachers and lecturers: ♦ design challenge: — develop or communicate specific information such as: exploring aesthetics; refining ergonomics; parts assembly; construction details; sizes and dimensions — create a CAD drawing to communicate manufacturing details

Topic	Guidance on developing design skills	Suggested activities and approaches
	Candidates should have the opportunity to develop a range of graphic techniques that they can use proficiently to develop design proposals. Production of graphics should not be laboured, or detract from the development of the proposal.	Candidate activities: ♦ develop and communicate a proposal to meet a design specification by: — selecting and using appropriate graphics when developing design proposals ♦ practise sketching 3D objects in 2D and 3D objects in 2D ♦ keep a sketch book ♦ create orthographic sketches of existing products ♦ sketch and record information from product teardowns (manufacturing and assembly features) ♦ time sketching tasks
Developing ideas (exploring)	Teachers and lecturers should give candidates a range of focused tasks and activities to help them develop the skills to: ♦ experiment and use idea-generation techniques when required ♦ think creatively when exploring different options and alternatives ♦ identify areas to improve or enhance a design proposal ♦ identify and resolve problems ♦ experiment with materials, processes and assembly ♦ explore alternative options for function, performance, aesthetics, safety and ergonomics	Direct input from teachers and lecturers: ♦ introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to develop a design proposal by exploring: — design factors — materials, processes and assembly ♦ demonstrate how to: — use ongoing research and evaluation to explore a design proposal — apply idea-generation techniques when exploring a design proposal

Topic	Guidance on developing design skills	Suggested activities and approaches
	♦ critically reflect on changes and alterations before making further modifications ♦ carry out additional research to inform exploration ♦ carry out ongoing evaluation against the brief and specification ♦ consider the interrelationship between design factors when making changes and alterations ♦ consider the impact that changes to one aspect of the design has on other aspects of the design ♦ consider balance and compromise Exploring ideas is a key design skill that depends on applying skills, knowledge and understanding developed during the course. This is rarely a linear process focused on improving a design solution. Successful exploration should be divergent, seeking alternatives which may or may not be successful. Teachers and lecturers should encourage candidates to: ♦ experiment, interact, test and evaluate their own design work during exploration ♦ use a range of different modelling and graphic techniques when exploring their ideas	Activities supported by teachers and lecturers: ♦ class or group discussion to develop creative-thinking skills (what and how could existing products be changed) ♦ in a group, identify factors and aspects of existing products to explore and present information on possible changes ♦ structure a design development focusing on one design factor at a time (ensure candidates appreciate the interrelationship between design factors and their impact on manufacture) ♦ design challenges: — provide candidates with research, a specification and initial ideas so design work focuses on exploration only — introduce new materials during the development stage and explore how this influences and impacts on the design's performance and manufacture — seek and explore different approaches and alternatives, considering each of the design factors listed in the course specification for existing products — change an open design brief to a closed design brief during the development stage to encourage candidates to change their focus — introduce further specification points to create new challenges or constraint ♦ group activity: present development for peer evaluation and feedback to stimulate and encourage exploration through discussion

Topic	Guidance on developing design skills	Suggested activities and approaches
		Candidate activities: ♦ develop and communicate a proposal to meet a design specification by: — using idea-generation techniques — identifying important aspects of the product and exploring alternatives to each aspect identified — using ongoing research and evaluation to stimulate exploration — considering design factors and the interrelationship between them — exploring the use of different materials, manufacturing and assembly methods and considering the impact on design factors and the environment
Developing ideas (refining)	Teachers and lecturers should give candidates a range of focused tasks and activities to help them develop the skills to: ♦ evaluate design decisions against the brief and specification ♦ make informed adjustments and modifications to factors such as function, performance, aesthetics, safety and ergonomics ♦ carry out additional research to inform refinement ♦ develop manufacturing details ♦ justify choice of materials and processes ♦ justify choice of assembly methods ♦ finalise sizes and dimensions	Direct input from teachers and lecturers: ♦ teacher presentation to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to integrate design skills and knowledge to refine a design proposal ♦ demonstrate how to test and evaluate design proposals ♦ demonstrate activities required to determine final sizes and dimensions ♦ demonstrate how to develop manufacturing and assembly details

Topic	Guidance on developing design skills	Suggested activities and approaches
	Refinement should focus on improving a design solution, confirming materials, manufacture and assembly choices and developing manufacturing and assembly details. Teachers and lecturers should encourage candidates to: ♦ test and evaluate ideas when refining their design work ♦ use a range of different modelling and graphic techniques when refining their ideas Refining design proposals requires a range of skills, knowledge and understanding developed during the course. Teachers and lecturers should ensure that candidates have the necessary time and specific instructions to develop their refinement skills.	Activities supported by teachers and lecturers: ♦ carry out a product analysis to identify and justify the use and impact of materials, processes and assembly methods ♦ evaluate a design proposal to identify areas of refinement ♦ design challenge: — modelling task to refine and confirm manufacturing details — modelling task to refine ergonomics and establish final sizes and dimensions ♦ teardown lab: disassemble an existing product and transfer manufacturing details into a design proposal ♦ produce orthographic sketches to communicate manufacturing details from a block model of a simple handheld product ♦ develop a CAD model and use it to produce dimensioned drawings ♦ develop manufacturing details from an image of an existing product ♦ provide a task that requires specific or focused refinement to meet a specification Candidate activities: ♦ develop and communicate a proposal to meet a design specification by: — using ongoing research and evaluation — refining function, performance and ergonomics — establishing final sizes and dimensions

Topic	Guidance on developing design skills	Suggested activities and approaches
		— considering production costs — confirming materials, processes and assembly methods ♦ develop manufacturing and assembly details ♦ practise applying knowledge and understanding of materials, manufacture and assembly under assessment conditions (use specimen and past course assessment tasks)
Developing ideas (applying knowledge and understanding of materials, manufacture and assembly processes)	Teachers and lecturers should give candidates a range of focused tasks and activities to help them develop the skills to: ♦ consider the influence and impact of materials, manufacture and assembly on function, performance, aesthetics, market, safety, ergonomics and the environment ♦ use properties and qualities of materials to develop the functional, performance, aesthetic and ergonomic aspects of design proposals ♦ compare the benefits and drawbacks of materials, manufacture and assembly ♦ consider the limitations and possibilities of different materials, manufacture and assembly ♦ use knowledge and understanding of materials, manufacture and assembly to develop manufacture and assembly details ♦ justify materials, manufacture and assembly ♦ communicate information about materials, manufacture and assembly	Direct input from teachers and lecturers: ♦ teacher presentation to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how knowledge and understanding of the following can influence and impact on the design and production of products: — properties, attributes and limitations of materials — manufacturing processes and manufacturing features — assembly features and methods ♦ analyse poor and effective application of knowledge and understanding in existing or exemplar folios Activities supported by teachers and lecturers: ♦ class or group discussion to explore how materials, manufacture and assembly influence the design of products ♦ class or group discussion to develop creative-thinking skills (how could existing products be changed)

Topic	Guidance on developing design skills	Suggested activities and approaches
	♦ consider the possible impact on the environment and society of materials, manufacture and assembly The skill of applying knowledge and understanding of materials, manufacture and assembly is developed alongside knowledge and understanding of materials, manufacture and assembly. Teachers and lecturers should ensure that candidates have the necessary time and specific instructions to apply their knowledge and understanding to their own design work. Having a sound knowledge and understanding of materials, manufacture and assembly enhances a candidate's ability to generate, explore and refine their ideas. Candidates should clearly demonstrate how they use knowledge and understanding. Labelling sketches and drawings with materials, processes and assembly methods used does not demonstrate how the materials have been used or how they influenced a design development.	♦ product analysis (understand the impact of materials, manufacture and assembly used in existing products) ♦ discussing their design work with their peers ♦ presenting their own design work to the class Candidate activities: ♦ develop and communicate a proposal to meet a design specification by: — using knowledge and understanding of materials, manufacture and assembly to inform and evaluate changes and proposals — using knowledge and understanding of materials, manufacture and assembly to develop and refine ideas — recording and justifying the changes and decisions made — reflecting on the impact that changes made during the exploration and refinement process have on function, aesthetics, performance, market and ergonomics — providing valid annotations based on more than personal opinion ♦ practise applying knowledge and understanding of materials, manufacture and assembly under assessment conditions (use specimen and past course assessment tasks)

Topic	Guidance on developing design skills	Suggested activities and approaches
Developing ideas (applying knowledge and understanding of design)	Teachers and lecturers should give candidates a range of focused tasks and activities to help them develop the skills to: ♦ identify important design issues and factors that influence the development and refinement of design proposals ♦ use knowledge and understanding of appropriate design issues and factors to explore and refine a design proposal ♦ analyse the influence and impact of function, performance, aesthetics, market, safety and ergonomics ♦ ensure proposal matches the brief and specification ♦ use knowledge and understanding to ensure the proposal suits its purpose ♦ use knowledge and understanding to ensure the proposal meets the demands of the target market ♦ use knowledge and understanding to ensure the proposal is safe and user-friendly ♦ analyse the impact on the environment of the product being developed The skill of applying knowledge and understanding of design is developed alongside knowledge and understanding of design. Teachers and lecturers should ensure that candidates have the necessary time and specific instructions to apply their knowledge and understanding to their own design work.	Direct input from teachers and lecturers: ♦ teacher presentation to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how knowledge and understanding of design can be used to explore and refine design proposals ♦ demonstrate how knowledge and understanding of sustainability and the environment can be used to explore and refine design proposals Activities supported by teachers and lecturers: ♦ class or group discussion to identify what design issues and factors influence the design of products ♦ class or group discussion to develop creative-thinking skills (how could existing products be changed, considering design factors) ♦ product analysis (understand the impact of design issues and factors existing products) ♦ carry out a product evaluation Candidate activities: ♦ develop and communicate a proposal to meet a design specification by: — using knowledge and understanding of design factors to inform and evaluate changes and proposals — using knowledge and understanding of design factors to develop and refine ideas

Topic	Guidance on developing design skills	Suggested activities and approaches
	Having a sound knowledge and understanding of design issues and factors enhances candidates' ability to generate, explore and refine their ideas. Candidates should clearly demonstrate how they use knowledge and understanding. Labelling sketches and drawings with a generic statement such as 'looks comfortable, has good aesthetics' does not demonstrate how design issues and factors have been used or how they influenced a design proposal's development.	— recording and justifying the changes and decisions made — reflecting on the impact that changes made during the exploration and refinement have on function, aesthetics, performance, market and ergonomics ♦ apply knowledge and understanding of design under assessment conditions (use specimen and past course assessment tasks)
Produce a plan for commercial manufacture	Teachers and lecturers should give candidates a range of focused tasks and activities to help them develop the skills to: ♦ extract information from exploration and refinement ♦ communicate final sizes and dimensions ♦ select and justify materials used for each component part ♦ select and justify manufacture used for main component parts ♦ select and justify assembly methods and process used ♦ communicate manufacturing and assembly details Planning for manufacture is likely to involve using information gained during exploration and refinement.	Direct input from teachers and lecturers: ♦ teacher presentation to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate the skills required to plan the commercial manufacture ♦ case studies on manufacture and assembly of products Activities supported by teachers and lecturers: ♦ class or group discussion covering the cost associated with manufacturing products ♦ product analysis (understand the impact of materials, manufacture and assembly used in existing products) ♦ teardown existing products (identify and use existing manufacturing and assembly methods and features) ♦ product evaluation

Topic	Guidance on developing design skills	Suggested activities and approaches
	However, additional information may be required to finalise decisions on commercial manufacture. Additional research into critical sizes, materials, manufacturing and assembly may be required. The skills to produce a plan for commercial manufacture are developed alongside knowledge and understanding of materials, processes, assembly and production planning systems. Teachers and lecturers should ensure that candidates have the necessary time and specific instructions to apply their knowledge and understanding to their own design work.	♦ design challenge: develop manufacturing details for a block model or image of existing products (transfer information gained from analysis and teardown activities) ♦ identify assembly features and methods that aid assembly of existing products Candidate activities: ♦ develop and communicate a proposal to meet a design specification by: — identifying and communicating information about the main component parts (sizes, materials, manufacturing and assembly features) of their own design proposals — creating dimensioned sketches and/or drawings to communicate manufacturing details and construction — justifying materials, processes and assembly methods — producing a parts list — communicating information about assembly ♦ practise completing the 'planning for commercial manufacture' pro forma under assessment conditions (use specimen and past course assessment tasks)

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
This table provides guidance on developing the knowledge and understanding that is assessed in the question paper. Some of the knowledge and understanding required at this level is new and some builds on existing skills gained as part of the National 5 course or during the broad general education phase.		
Brief	Candidates should develop and demonstrate knowledge and understanding of: ♦ the purpose of the design brief in the design process, for example: — outlines main objectives — identifies important constraints or limitations ♦ open and closed design briefs, for example: — benefits and drawbacks to a client of setting an open or closed design brief — benefits and drawbacks to the designer of working to an open or closed design brief	Direct input from teachers and lecturers: ♦ presentation from teacher or lecturer to introduce topic, provide information and instructions (theory lessons) ♦ provide examples of open and closed design briefs ♦ go through exemplar design folios to highlight the influence of the design brief ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussions on the benefits and drawbacks of open and closed design briefs ♦ create design brief for different situations and scenarios (based on some initial research) Candidate activities: ♦ write an open and closed design brief ♦ carry out a design brief analysis ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
Research and evaluation	Candidates should develop and demonstrate knowledge and understanding of: ♦ the purpose of research throughout the design process, for example: — informing the design specification — clarifying and informing decisions made during exploration and refinement ♦ the purpose of researching existing products, for example: — identifying the issues and factors that influence the design, manufacture and marketing of products — identifying and justifying materials, processes and assembly methods used to manufacture products ♦ the purpose of evaluation throughout the design process, for example: — testing ideas and solutions and providing feedback on design decisions — identifying areas for further development ♦ the purpose of evaluating existing products, for example: — identifying how and why products are successful — identifying design opportunities — identifying strengths and weaknesses ♦ information gathered through research or evaluation, for example: — benefits of research and evaluation	Direct input from teachers and lecturers: ♦ teacher presentation to introduce topic, provide information and instructions (theory lessons) ♦ go through exemplar folios to highlight where and why research and evaluation were carried out and what techniques were used ♦ demonstrate how to use different research and evaluation techniques ♦ provide audio-visual clips and/or videos — brainstorming — user trial — test rigs ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussion to identify information required, key areas to research or factors and/or issues to evaluate, and methods to use ♦ set challenges to gather information that can only be obtained using specific research and evaluation techniques ♦ plan and carry out a design brief analysis ♦ plan and carry out a product evaluation

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	— appropriate use of information — presentation of results and/or information ♦ methods of gathering information using primary research, for example: — evaluations of existing products, prototypes or models — product comparisons — questionnaires and surveys — tests and test rigs — user trials and user trips — appropriate use of primary research ♦ methods of gathering information using secondary research, for example: — books and journals — product reviews — appropriate use of secondary research ♦ key stages of comparisons, for example: — identify information required — decide which aspects of the products to compare — select appropriate products to compare — compare results ♦ key stages of questionnaires, for example: — identify what information is required — establish who and how many people will complete the questionnaire — select question types	Candidate activities: ♦ use primary and secondary research to carry out research into existing products ♦ evaluate existing products to identify design opportunities (possible start for design activity) ♦ use evaluation techniques to inform the development of their own design work ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	— trial questionnaire — distribution, collection and analysis of responses and/or results ♦ key stages of surveys (similar to questionnaire) ♦ key stages of tests and test rigs, for example: — establish information required — identify suitable method of testing — carry out tests — record and analyse results ♦ key stages of user trials, for example: — define purpose of the user trial — invite appropriate people to take part, depending on information required — observe, record and analyse user interactions during the trial ♦ key stages of user trips, for example: — define purpose of the user trip — identify where the product will be used — use the product and record strengths, weaknesses and opinions regarding its function, performance, ease of use and aesthetics — record and analyse results	

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
Specification	Candidates should demonstrate knowledge and understanding of: ♦ the purpose of and information specified in a product design specification, for example: — provides direction to the designer and design team — defines specific parameters for the design and manufacture of a product — used to evaluate changes, decisions and proposals — usually contains specific information on a product's function, aesthetics, performance, safety, ergonomics, retail and production costs, location of use and impact on the environment ♦ the purpose of and information specified in a performance specification, for example: — summarises the performances a product must meet without specifying how — usually contains specific information covering: complying with legislation, standards and regulations, sustainability and meeting guarantee requirements ♦ the purpose of and information specified in a technical specification, for example: — provides specific technical details required to manufacture a product — usually contains specific information relating to materials, processes, assembly, dimensions, production costs	Direct input from teachers and lecturers: ♦ introduce topic, provide information and instructions (theory lessons) ♦ provide examples of different types of design specification ♦ case studies to complement theory lessons and exemplify the use of different types of specifications Activities supported by teachers and lecturers: ♦ class or group discussion to identify types of information included in different specifications ♦ class or group produce a design, performance and technical specification for the same product Candidate activities: ♦ select information from a list of points and allocate to product, performance or technical specification ♦ gather examples of product, performance or technical specification ♦ evaluate own design work using design specification throughout design process ♦ answer relevant past paper questions ♦ reference textbooks

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
Idea-generation techniques	Candidates should develop and demonstrate knowledge and understanding of: ♦ the use of idea-generation techniques, for example: — when, how and why they are used ♦ the key stages or activities required when using analogy, for example: — identify suitable stimuli — gather information and/or images — select suitable information to transfer, adapt or use to create ideas ♦ the key stages or activities required when using brainstorming, for example: — planning: identify the purpose of the brainstorming session, consider the size of the group, invite suitable people to take part — conducting: get group to rephrase the question, have a warm-up session, establish rules, set a time limit, avoid moments of silence and maintain momentum, record every thought — summary: discuss most unusual ideas, disregard weakest ideas, and identify most promising ideas ♦ the key stages or activities required when using lifestyle or mood board, for example: — identify desired lifestyle and/or mood — gather appropriate images — create a collage of images	Direct input from teachers and lecturers: ♦ introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to use different idea-generation techniques ♦ go through exemplar folios to highlight where and why idea-generation techniques were used ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group task: plan and carry out a brainstorming session to generate initial ideas in response to an open design brief (could be used as a starting point for a focused exploration task) ♦ create lifestyle or mood board in groups for unfamiliar niche markets (use information to explore and refine the aesthetics of a product) ♦ class or group morphological analysis could be combined with a brainstorming session to identify aspects or factors important to the design and generate a range of parameters for each aspect or factor

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	— summarise reason for lifestyle and/or mood created ♦ the key stages or activities required when using morphological analysis, for example: — planning: analyse the problem and/or product, identify factors important to solving the problem or improving the product, generate a range of different parameters for each factor, produce a matrix — using: randomly or systematically select an option from each factor to produce different alternatives — summary: disregard weakest ideas, identify most promising ideas	Candidate activities: ♦ complete a partially completed morphological analysis ♦ create a morphological analysis matrix to generate ideas for a given topic, challenge or brief ♦ use idea-generation techniques during the development of their own design work ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks
Modelling in the design process	Candidates should develop and demonstrate knowledge and understanding of: ♦ the use of modelling during the design process to generate, explore, test, refine and communicate, for example: — appropriate use of sketch models, block models, scale models, test rigs, prototypes, computer-generated models and simulations — benefits and drawbacks ♦ the purpose of and information gained from physical models, for example: — communicate with clients, manufacturers and consumers to provide feedback	Direct input from teachers and lecturers: ♦ teacher presentation to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to use different modelling types ♦ case study on the use of models ♦ go through exemplar folios to highlight where and why modelling has been used ♦ provide audio-visual clips or videos — especially with areas that are not as easy to demonstrate, for example simulation, test rigs and rapid prototyping ♦ provide relevant past paper questions

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	— test physical issues such as balance, strength, function — analyse, evaluate and refine ergonomics — can be used to refine proportions and evaluate aesthetics — test rigs can replicate long-term test in a short period of time — prototypes allow thorough evaluation before going into production ♦ the purpose of and information gained from computer-generated models and simulations, for example can be: — linked to computer-numerical controlled (CNC) machines for rapid prototyping, sent quickly to members of a design team via the internet, altered quickly and changed into other drawing types without the need for redrawing — simulations can be used to test design proposals without risk to the user or the environment — simulations can replicate long-term tests in a short period of time ♦ benefits and drawbacks of rapid prototyping, for example: — reduces product development time — automated production of prototypes or components from a CAD drawing or model — subtractive rapid prototyping (CNC) uses actual materials — additive rapid prototyping (stereolithography, fused deposition modelling [FDM], and 3D printing) can	Activities supported by teachers and lecturers: ♦ class discussion on the uses of modelling ♦ class or group task: gather examples of modelling types and identify when to use them and the information they provide ♦ group design challenge to refine and test design proposal (could be used to develop practical modelling skills) ♦ use CNC or 3D printing or laser cutter to manufacture a standard component as the start of a class design challenge Candidate activities: ♦ use modelling techniques during the development of their own design work ♦ investigate the use of rapid prototyping in the design industry ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	produce complex forms that can't be created by traditional modelling techniques — time-consuming to produce — requires investment in hardware, software and training	
Graphics in the design process	Candidates should develop and demonstrate knowledge and understanding of: ♦ the purpose and appropriate use of graphic techniques when developing, resolving and communicating ideas throughout the design process, for example: — reasons for using different graphic techniques — information communicated by graphic techniques ♦ the advantages of using manual graphics in the design process, for example: — speed and freedom to explore during the initial stages of the design process — little investment required ♦ the advantages of using computer-generated graphics in the design process, for example: — can produce different drawing types from the one computer model — can make changes and adjustments without the need for redrawing — use of libraries of standard components — can be linked to 3D printer or CNC machine — ease of communication	Direct input from teachers and lecturers: ♦ presentation by teacher or lecturer to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to generate and use different graphic techniques ♦ go through exemplar folios to highlight where and why graphics techniques have been used ♦ provide audio-visual clips or videos — manual and computer graphics ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class discussions on use of graphics ♦ group activity to identify where manual and computer-generated graphics could be used to communicate information and gather examples ♦ class or group activity to identify graphics techniques to communicate information to different members of the design team ♦ class or group activity to identify different types of information that need to be communicated when developing design proposals

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
		Candidate activities: ♦ use graphic techniques during the development of their own design work ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks
Function	Candidates should develop and demonstrate knowledge and understanding of: ♦ the influence of function on the design of products, for example: — features or aspects of a product such as controls, handles or grips included to improve function — influence on selection of materials, manufacture and assembly — efficiency — form follows function ♦ primary and secondary functions, for example: — difference between primary and secondary functions — influence of primary and secondary function on products	Direct input from teachers and lecturers: ♦ presentation by teacher or lecturer to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to use different research and evaluation techniques to analyse or evaluate the function of products ♦ case studies to complement theory lessons covering the features and issues that contribute to the function of products ♦ provide audio-visual clips or videos — products testing ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussion in order to identify aspects and issues that influence the function of products ♦ plan and carry out product analysis to investigate a product's function ♦ plan and carry out a product evaluation to rate a product's function

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
		Candidate activities: ♦ carry out user trips on a range of different products to identify aspects and issues that influence function ♦ develop a questionnaire to analyse or evaluate a product's function ♦ carry out a comparison study of the same type of product aimed at different target markets or from different price ranges ♦ apply knowledge and understanding of function to explore and refine their own design work ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks
Performance	Candidates should develop and demonstrate knowledge and understanding of: ♦ the influence of performance on the design of products, for example: — features or aspects of products that have been incorporated due to performance issues ♦ fitness for purpose of products, for example: — issues that influence the fitness for purpose of products such as: intended use, target market, end user, where it will be used and life expectancy — the influence of fitness for purpose on function, performance, safety, market, aesthetics and ergonomics of products	Direct input from teachers and lecturers: ♦ presentation by teacher or lecturer to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to use different research and evaluation techniques to analyse or evaluate the function of products ♦ case studies on design obsolescence ♦ provide audio-visual clips or videos — planned obsolescence ♦ provide relevant past paper questions

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	♦ the influence of planned obsolescence on the manufacturer, consumer and environment, for example: — manufacturer: need for continued research and development, increased and predictable sales, efficient use of resources, possible loss of reputation, need to consider disposal and sustainability — consumers: constant supply of products, products are more affordable, constant pressure to update — environment: increased waste and pollution, promotes efficient use of resources and design for recycling ♦ maintenance issues associated with products, for example: — ease of cleaning and repairing — availability of replacement parts ♦ value for money	Activities supported by teachers and lecturers: ♦ class or group discussion in order to identify aspects and issues that influence the performance of products ♦ plan and carry out product analysis to investigate a product's performance ♦ plan and carry out a product evaluation to rate a product's fitness for purpose, life expectancy, maintenance and value for money Candidate activities: ♦ carry out user trips on a range of different products to identify aspects and issues that influence performance ♦ develop a questionnaire to analyse or evaluate a product's performance ♦ carry out a comparison study of the same type of product used for different purposes ♦ apply knowledge and understanding of performance to explore and refine their own design work ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks
Safety	Candidates should develop and demonstrate knowledge and understanding of: ♦ the influence of safety on the design of products, for example:	Direct input from teachers and lecturers: ♦ presentation by teacher or lecturer to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to use different research and evaluation techniques to analyse or evaluate the safety of products

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	— features and aspects of products that are included to ensure safety — influence on the selection of materials, processes and assembly ♦ how to ensure safety in products, for example: — testing design proposals — adhering to BSI and CE standards and regulations	♦ case studies to complement theory lessons covering the features and issues that contribute to the safety of products ♦ provide audio-visual clips or videos — products testing ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussion to identify aspects and issues that influence the safety of products ♦ develop tests to evaluate safety ♦ plan and carry out product analysis to investigate a product's safety ♦ plan and carry out a product evaluation to rate a product's safety Candidate activities: ♦ carry out tests to establish the safety of products ♦ carry out user trips on a range of different products to identify aspects and issues that influence a product's safety ♦ develop a questionnaire to analyse or evaluate a product's safety ♦ carry out a comparison study of the same type of product ♦ investigate product recalls ♦ apply knowledge and understanding of safety to explore and refine their own design work ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
Market	Candidates should develop and demonstrate knowledge and understanding of: ♦ the influence of the target market on the design and marketing of products, for example: — how the target market influences the function, performance, user interface, aesthetics, price and promotion of products ♦ technology push, for example: — what is technology push and how it is used to develop products — benefits and drawbacks of using technology push to develop products ♦ market pull, for example: — what is market pull and how it is used to develop products — benefits and drawbacks of using a market pull approach when developing products ♦ economics, for example: — development, marketing and production costs (materials, tooling, economies of scale and labour costs) ♦ product lifecycle: introduction, growth, maturity and decline, considering, for example: — methods to encourage sales at each stage of the product lifecycle — how the product lifecycle is used to plan the evolution of products	Direct input from teachers and lecturers: ♦ presentation by teacher or lecturer to introduce topic, provide information and instructions (theory lessons) ♦ case studies to complement theory lessons (costs associated with producing and marketing a product) ♦ provide audio-visual clips or videos — marketing strategies, economics or branding ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussion to consider the influence the target market has had on products ♦ plan and carry out product analysis to investigate the influences and impacts of the target market, technology push and market pull on a product ♦ investigate the marketing strategies used at each stage of the product lifecycle Candidate activities: ♦ investigate and gather examples of products developed from technology push or market pull ♦ investigate the use of branding ♦ compare mass-marketed products with niche-marketed products ♦ answer relevant past paper questions ♦ reference textbooks

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	♦ the influence of fashion, market trends, style, for example: — influence on aesthetics, sales and life expectancy ♦ marketing techniques to influence sales, for example: — pricing strategies — sales promotions and advertising — product placement ♦ niche marketing, for example: — influence on the price, promotion and placement of niche products — advantages and disadvantages ♦ branding, for example: — use of branding — benefits and drawbacks to the manufacturer and consumer of branding	

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
Aesthetics	Candidates should develop and demonstrate knowledge and understanding of: ♦ influences on the aesthetics of products, for example: — the target market and end user — location of use — fashion and style — materials, processes and assembly — look, feel, smell, sound and taste ♦ aesthetics of products, for example: — aesthetic elements: form, proportion, colour, texture, balance, harmony and contrast — impact of look, feel, smell, sound and taste on the appeal and success of products	Direct input from teachers and lecturers: ♦ presentation by teacher or lecturer to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to use different research and evaluation techniques to analyse or evaluate the aesthetics of products ♦ case studies to complement theory lessons covering the features and issues that contribute to aesthetics of products ♦ provide audio-visual clips or videos — aesthetics design — fashion and style ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussion to identify aspects and issues that influence the aesthetics of products ♦ plan and carry out product analysis to investigate the influences on and impacts of aesthetics ♦ plan and carry out a product evaluation to rate a product's aesthetics Candidate activities: ♦ analyse or evaluate the aesthetics of different products ♦ carry out a comparison study of the same type of product ♦ apply knowledge and understanding of aesthetics to explore and refine their own design work ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
Ergonomics	Candidates should develop and demonstrate knowledge and understanding of: ♦ the influence of ergonomics on the design of products, for example: — overall form, size of products and position of aspects and component parts — ensures comfort and ease of use ♦ anthropometrics, for example: — use of anthropometric data — how anthropometrics influences the design of products ♦ psychology, for example: — why is psychology considered when designing products — how psychology influences the design of products ♦ physiology, for example: — why is physiology considered when designing products — how physiology influences the design of products	Direct input from teachers and lecturers: ♦ presentation by teacher or lecturer to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to use different research and evaluation techniques to analyse or evaluate the ergonomics of products ♦ case studies to complement theory lessons covering the features and issues that contribute to the ergonomics of products ♦ provide audio-visual clips or videos — ergonomics ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussion to identify aspects and issues that influence the ergonomics of products ♦ develop tests to evaluate ergonomics ♦ plan and carry out product analysis to investigate the influences on and impacts of ergonomics ♦ plan and carry out a product evaluation to rate a product's comfort and ease of use ♦ investigate a range of everyday products or objects to exemplify ergonomics in action — for example tin openers, bottles, chairs, crutches, remote controls — to ignite class discussion and give candidates examples that they can refer to in question paper responses

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
		♦ investigate how anthropometric data influences the size and form of products and the position of their component parts Candidate activities: ♦ carry out tests to evaluate ergonomics ♦ carry out user trips on a range of different products and identify human interactions that influenced their comfort and ease of use ♦ develop questions for a questionnaire to analyse or evaluate a product's ergonomics ♦ carry out a comparison study of the same type of product ♦ apply knowledge and understanding of ergonomics to explore and refine their own design work ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks
Materials used in the commercial manufacture of products	Candidates should develop and demonstrate knowledge and understanding of: ♦ the properties and appropriate uses of: — thermoplastics: ABS, acrylic, nylon, polypropylene, polystyrene, polythene, polyvinyl chloride — thermosetting plastics: melamine formaldehyde, urea formaldehyde — elastomers	Direct input from teachers and lecturers: ♦ introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to identify materials ♦ case studies to complement theory lessons covering properties and uses of materials ♦ case studies to investigate new and composite materials in action

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	— ferrous metals and alloys: cast iron, mild steel, high-speed steel, stainless steel — non-ferrous metals and alloys: aluminium, brass, copper, tin, zinc — hardwoods: ash, beech, mahogany, oak — softwoods: spruce, pine — manufactured boards: plywood, blockboard, chipboard, hardboard, MDF, flexiply veneered boards — composite materials: carbon-fibre plastics, glass-reinforced plastic ♦ the influence materials have on the design and manufacture of products, for example: — how and why materials influence function, performance, safety, aesthetics and ergonomics — how and why materials influence manufacturing processes, methods of assembly and cost of production ♦ methods used to identify materials in commercially manufactured products, for example: — observations (look and feel of the material) — identification symbols and labels — tests and comparisons ♦ developments in new materials and their impact on products, for example: — properties of new materials — influence on design, manufacture, use of products	♦ provide audio-visual clips or videos — material testing and identification, product teardowns ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussion on the influence of materials on the design and manufacture of products ♦ group activities: — analyse the commercial production of a product by identifying and justifying the materials used — carry out tests and activities to identify a range of materials used in the manufacture of products — identify products that have changed due to new materials Candidate activities: ♦ identify and justify materials used to manufacture a range of existing products ♦ identify new materials and investigate how they influence the design and evolution of products ♦ internet research to investigate properties of materials ♦ apply knowledge and understanding of materials to explore and refine their own design work ♦ answer relevant past paper questions ♦ reference textbooks

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
Processes used in the commercial manufacture of products	Candidates should develop and demonstrate knowledge and understanding of: ♦ appropriate uses and identifying features of bending, for example: — forms wood, metal or plastic, with little or no joining, to create strong structures for products such as furniture and playground equipment — identified by radiused corners, possible stress marks from cold bending ♦ appropriate uses and identifying features of blow moulding, for example: — mass-produces seamless hollow container with a thin wall thickness such as bottles and containers — identified by simple symmetrical shape, thin uniform wall thickness, flashing, no joins or internal features ♦ appropriate uses and identifying features of compression moulding, for example: — produces large and small component parts with complex shapes and variable wall thicknesses from thermosetting plastics such as electrical fittings, pot and cooker handles — identified by complexity of from draft angles, ejection marks, flashing, surface finish and wall thickness ♦ appropriate uses and identifying features of die casting, for example:	Direct input from teachers and lecturers: ♦ presentation by teacher or lecturer to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to identify manufacturing features and processes ♦ case studies to complement theory lessons covering the uses of different manufacturing processes ♦ provide audio-visual clips or videos — processes — commercial manufacture ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussion on the selection and use of processes used to manufacture a range of different products ♦ analyse the commercial production of a product by identifying and justifying the manufacturing and assembly methods used ♦ teardown lab activities to identify manufacturing features and methods ♦ group work to investigate the commercial manufacture of a range of existing products — for example, printer trays and components for injection moulding, Easter egg casings for vacuum forming, water bottles for blow moulding, monopoly pieces for die casting — highlighting identifying features and making decisions as a group

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	— mass-produces complex, accurate metal parts efficiently with a high level of autonomy such as toy cars, pencil sharpeners and iron sole plates — identified by draft angles, ejection marks, flashing, split lines, injection points, high-quality surface finish and wall thickness ♦ appropriate uses and identifying features of drop forging, for example: — produces metal components with increased strength, durability and impact resistance, frequently used to manufacture tools and equipment — identified by the improved strength, form, surface finish, and flashing ♦ appropriate uses and identifying features of extrusion, for example: — mass-produces simple or complex cross-sectional profiles in plastic and metals such as window frames, curtain rails and electrical cabling — identified by identical cross-sectional profile along the length of the component, smooth surface texture, usually has uniform wall thickness ♦ appropriate uses and identifying features of injection moulding, for example: — mass-produces complex, accurate parts efficiently with a high level of autonomy to produce products such as casings for electrical products, frames for sunglasses and car parts	Candidate activities: ♦ carry out activities to identify and justify processes used to manufacture a range of products ♦ internet research to investigate manufacturing processes ♦ apply knowledge and understanding of manufacturing processes to explore and refine their own design work ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	— identified by draft angles, ejection marks, flashing, split lines, injection points, high-quality surface finish and wall thickness ♦ appropriate uses and identifying features of piercing and blanking, for example: — mass-produces simple and complex shapes accurately from sheet metal such as washers and key blanks — identified by shear marks, repetition and accuracy ♦ appropriate uses and identifying features of press forming, for example: — produces accurate bends, forms and deep draws in sheet metal to produce products such as kitchen sinks and drinks cans — identified by forms created, accuracy, radiused corners and stress marks (deep drawing) ♦ appropriate uses and identifying features of rotational moulding, for example: — produces large or small lightweight hollow forms in small or large volumes to produce products such as plastic toys, barriers and dust bins — identified by hollow form, excellent surface finish, uniform wall thickness thicker in corners, flashing ♦ appropriate uses and identifying features of sand casting, for example: — produces large and small solid and hollow metal components in low volumes to produce products such as one-off components and engine parts	

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	— identified by surface texture, draft angles, rounded corners and fillets, usually requires further finishing and secondary processes ♦ appropriate uses and identifying features of vacuum forming, for example: — low- and high-volume production of simple plastic components made from plastic sheet to produce products such as plastic cups packaging and bathtubs — identified by simple form, thin and varying wall thickness, draft angles ♦ appropriate uses and identifying features of 3D printing, for example: — low-volume production of accurate complex forms in plastic and metal to produce products such as bespoke and specialised components — identified by complex form, surface texture (visible signs of layering and structure to support overhangs) ♦ appropriate uses and identifying features of laser cutting, for example: — low-volume production of simple and complex component parts in wood, metal and plastic sheet material, efficient at cutting internal shapes to produce products such as jewellery and lighting — identified by the fact that it is cut from thin sheet materials, accuracy, quality of cut, scorch marks ♦ appropriate uses and identifying features of chrome plating, for example:	

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	— provides durable, hygienic, protective and decorative finish for metal and plastic — identified by quality mirrored chrome finish ♦ appropriate uses and identifying features of galvanising, for example: — provides durable and protective finish for steel and iron — identified by its characteristic ‘spangled’ finish ♦ appropriate uses and identifying features of plastic dip-coating, for example: — durable, hygienic, protective and decorative finish for metal — identified by smooth coloured finish ♦ methods and activities to identify the processes used to commercially manufacture products, for example: — disassembly and observation — consideration of components’ complexity and form — manufacturing features, materials and volume of production — function, performance and aesthetics — affordability and availability ♦ the purpose of bosses, location pins, ribs and webs, for example: — aiding assembly — strengthening — reducing the risk of distortion	

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	♦ issues that influence the processes used to commercially manufacture products, for example: — volume and cost of production — materials — functional, performance and safety requirements — complexity of form and aesthetics — accuracy required — method of assembly	
Assembly methods used in the commercial manufacture of products	Candidates should develop and demonstrate knowledge and understanding of: ♦ methods used to join material: adhesive, carcass and frame joints, knock-down fittings, nuts, bolts, screws, snap and press fit, riveting, spot welding, arc welding, thermal bonding, for example: — features, uses, benefits and drawbacks of the joining methods specified above ♦ features that aid assembly of component parts, for example: — bosses, location pins and ribs — symmetrical and asymmetrical parts — labelling ♦ methods used to identify assembly methods in commercially manufactured products, for example: — disassembly and reassembly — visual inspection of component parts	Direct input from teachers and lecturers: ♦ teacher presentation to introduce topic, provide information and instructions (theory lessons) ♦ demonstrate how to identify assembly features and methods ♦ case studies on the use of assembly features and methods ♦ provide audio-visual clips or videos — commercial assembly of products ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussion on the issues that influence the assembly of commercial products ♦ analyse the commercial production of a product by identifying and justifying the assembly feature methods used

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	♦ issues that influence the assembly of commercially manufactured products, for example: — volume of production — assembly process — materials — function, performance, safety and aesthetics — life expectancy — impact on the environment	♦ teardown lab activities to identify assembly features that aid assembly ♦ group work to investigate the commercial assembly of a range of existing products ♦ design challenge: redesign an existing product to be flat-packed ♦ design challenge: incorporate bosses, location pins and ribs to refine a design proposal Candidate activities: ♦ carry out activities to identify and justify assembly methods used to manufacture a range of products ♦ internet research to investigate processes and assembly methods used ♦ apply knowledge and understanding of assembly to explore and refine their own design work ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks
Production and planning systems	Candidates should develop and demonstrate knowledge and understanding of: ♦ issues that influence one-off, batch, mass production, for example: — consumer demand and predicted sales — unit cost — investment	Direct input from teachers and lecturers: ♦ introduce topic, provide information and instructions (theory lessons) ♦ case studies into use of one-off, batch, mass production ♦ provide audio-visual clips or videos — production systems — automation — CAM ♦ provide relevant past paper questions

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
	— work force — product type — flexibility ♦ methods used to improve production, for example: — automation improves production as it reduces workforce; reduces errors; increases production; has the potential to run 24 hours a day — CAD/CAM improves production as it provides flexible manufacturing systems; reduces workforce; increases efficiency — Gantt and flow charts improve the production process as they enable complex tasks to be split up; identification of critical tasks; organise the workforce; improve time management — jigs improve production as they reduce human error; hold, support and locate component parts; reduce the need for marking-out; increase productivity; increase reliability, accuracy and quality; reduce the need for skilled labour — just-in-time production improves production as it reduces initial investment, reduces waste, shortens lead time, limits excess stock, allows flexibility — standard components improve the production process as they provide reliable components with known quality, reduce assembly time, reduce costs	Activities supported by teachers and lecturers: ♦ class or group discussions on the issues that influence the assembly of commercial products ♦ analyse the commercial production of a product by identifying and justifying the production systems used ♦ group work to identify existing products manufactured using one-off, batch, mass production ♦ create Gantt and flow charts to plan a project or task (does not have to be focused on design) ♦ group design challenge to design and manufacture a jig that lower school can use to manufacture a product ♦ teardown activities to identify the use of standard components in existing products Candidate activities: ♦ investigate the use of just-in-time production ♦ answer relevant past paper questions as homework tasks ♦ internet research to investigate different production systems ♦ reference textbooks

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
People who influence design	Candidates should develop and demonstrate knowledge and understanding of: ♦ roles and responsibilities of people who influence the design of products, for example: — how each member of the design team influences the design and manufacture of commercial products — why and when members of the design team would be consulted during the design process ♦ communication between members of the design team, for example: — what information would be communicated — appropriate methods of communicating information ♦ advantages and disadvantages of in-house design team and sub-contracting, for example: — advantages of in-house design teams — always available, have specific expertise, reliable, less risk of sharing information with the competition — disadvantages of in-house design teams: inflexible with restricted knowledge and expertise — advantages of sub-contracting: wide range of expertise, adaptable and flexible to changes in the market — disadvantages of sub-contracting: team members may be unavailable or unreliable, increases the risk of sharing information with the competition	Direct input from teachers and lecturers: ♦ presentation by teacher or lecturer to introduce topic, provide information and instructions (theory lessons) ♦ case studies on people who influence the design of products ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussions on in-house design teams and sub-contracting ♦ develop different design teams for different design projects, justify who to include and what they would contribute ♦ design team challenge: allow candidates to adopt and experience various roles and work with other team members while developing a design proposal Candidate activities: ♦ identify information required by different members of the design team and how to communicate it ♦ answer relevant past paper questions as homework tasks ♦ internet research to investigate processes and assembly methods used ♦ reference textbooks

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
Intellectual property rights (IPR)	Candidates should develop and demonstrate knowledge and understanding of: ♦ the purpose of IPR, for example: — allows designer, inventor or company to profit for their ideas — provides legal protection ♦ methods of protecting IPR: copyright, design rights, patents and trademarks, for example: — steps required to obtain copyright, design rights, patents and trademarks — what is covered by copyright, design rights, patents and trademarks	Direct input from teachers and lecturers: ♦ presentation by teacher or lecturer to introduce topic, provide information and instructions (theory lessons) ♦ case studies on IPR ♦ provide audio-visual clips or videos — IPR ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussions on steps required to obtain copyright, design rights patents and trademarks ♦ identify situations and examples of products that are protected using copyright, design rights patents and trademarks ♦ 'Dragon's Den' type activities and use of video clips (for example *The Apprentice*, *Dragon's Den*) linked to IPR topics Candidate activities: ♦ answer relevant past paper questions as homework tasks ♦ internet research to investigate use and infringement of copyright, design rights patents and trademarks ♦ reference textbooks

Topic	Further guidance on developing knowledge and understanding	Suggested activities and approaches
The impact of design and manufacture on society, the environment and the world of work	Candidates should develop and demonstrate knowledge and understanding of: ♦ methods designers and manufacturers can use to limit a product's impact on the environment, for example: — design for recyclability and/or re-use — reduction or use of alternative materials — efficient use of materials and processes in the manufacture and packaging of products ♦ impact of traditional and new manufacturing technologies on society, environment and workforce, for example: — created a consumer society — pollution and waste from traditional and new manufacturing technologies — impact on the volume and skill of the workforce ♦ impact of materials on the environment and society, for example: — positive and negative impact of materials — contribution to a throwaway society ♦ methods to support sustainability, for example: — reduce waste and pollution during production — improve transportation — increase product life expectancy — design efficient products ♦ investigation of a product's sustainability and its impact on the environment, for example: — identify issues that influence a product's sustainability — establish sustainability and impact on the environment of products	Direct input from teachers and lecturers: ♦ presentation by teacher or lecturer to introduce topic, provide information and instructions (theory lessons) ♦ case studies focusing on sustainable design ♦ clips or videos — environmental design — new manufacturing technologies — sustainability ♦ provide relevant past paper questions Activities supported by teachers and lecturers: ♦ class or group discussions to establish what contributes to and influences a product's sustainability and impact on the environment ♦ analysing the commercial production of a product by investigating its sustainability and impact on the environment Candidate activities: ♦ identify changes to a product following a teardown activity to reduce its impact on the environment ♦ identify products with a positive impact on the environment, and products with a negative impact on the environment ♦ investigate a product's sustainability and its impact on the environment ♦ answer relevant past paper questions as homework tasks ♦ reference textbooks

This table shows the relationship between the knowledge and understanding assessed in the question paper component of course assessment at both National 5 and Higher.
Please also refer to the 'skills, knowledge and understanding' tables in the course specifications for each level. Teachers and lecturers could use this table to: ♦ design and plan learning activities for multi-level teaching ♦ ensure seamless progression between levels ♦ identify important prior learning for Higher candidates

National 5		**Higher**	
Knowledge and understanding	**Candidates demonstrate knowledge and understanding of:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
		Brief	♦ the purpose of the design brief in the design process ♦ open and closed design briefs
Analysis of a brief	♦ gathering data ♦ key stages of the following research techniques: — questionnaires — user trips ♦ reasons for the selection of research techniques ♦ role of the product specification in the design process	Research and evaluation	♦ the purpose of research and evaluation — throughout the design process — of existing products ♦ information gathered through research or evaluation ♦ methods of gathering information — primary and secondary research

National 5		Higher	
Knowledge and understanding	**Candidates demonstrate knowledge and understanding of:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
Evaluation of products	♦ methods to evaluate products: — comparison to other products — user trials — comparison against specification — questionnaires		♦ key stages of the following techniques: — comparisons — questionnaires — surveys — tests and test rigs — user trial — user trip
Covered in 'analysis of a brief'		Specification	♦ the purpose of, and information specified in, the following specification types: — product design — performance — technical
Idea-generation techniques	♦ appropriate use of idea-generation techniques ♦ the key stages of the following idea-generation techniques: — morphological analysis — brainstorming	Idea-generation techniques	♦ the use of idea-generation techniques ♦ the key stages or activities of the following idea-generation techniques: — analogy — brainstorming — lifestyle or mood board — morphological analysis
Modelling in the design process	♦ use of modelling in the design process to: — generate and explore — test and refine — communicate ♦ the advantages of using modelling in the design process	Modelling in the design process	♦ use of modelling during the design process to: — generate and explore — test and refine — communicate

National 5		Higher	
Knowledge and understanding	**Candidates demonstrate knowledge and understanding of:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
	♦ reasons for selection of types of models: — sketch — scale — block — computer-generated		♦ the purpose of, and information gained from: — physical models: sketch models, block models, scale models, test rigs and prototypes — computer-generated models and simulations ♦ benefits and drawbacks of rapid prototyping
Graphics in the design process	♦ the use of graphics in the design process to: — generate and explore — test and refine — communicate ♦ the advantages of using graphics in the design process ♦ reasons for the selection of types of graphic techniques	Graphics in the design process	♦ the purpose and appropriate use of graphic techniques when developing, resolving and communicating ideas throughout the design process ♦ the advantages of using manual and computer-generated graphics in the design process
Function	♦ the influence of function on the design of products ♦ primary and secondary functions	Function	♦ the influence of function on the design of products ♦ primary and secondary functions
Performance	♦ the influence of performance on the design of products ♦ maintenance issues associated with products ♦ the influence of a product's life expectancy on design, manufacture, and the environment ♦ fitness for purpose of products ♦ safety issues associated with products	Performance	♦ the influence of performance on the design of products ♦ fitness for purpose of products ♦ the influence of planned obsolescence on the manufacturer, consumer and the environment ♦ maintenance issues associated with products ♦ value for money

National 5		Higher	
Knowledge and understanding	**Candidates demonstrate knowledge and understanding of:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
Covered in 'performance'		Safety	♦ the influence of safety on the design of products ♦ how to ensure safety in products
Market	♦ the influence of the target market on the design of products ♦ marketing techniques to influence sales ♦ the benefits of branding ♦ technology push and market pull	Market	♦ the influence of the target market on the design and marketing of products ♦ technology push ♦ market pull ♦ economics ♦ product lifecycles: introduction, maturity, growth and decline ♦ the influence of fashion, market trends, style ♦ marketing techniques to influence sales ♦ niche marketing ♦ branding
Aesthetics	♦ the aesthetics of products ♦ influences on the aesthetics of products	Aesthetics	♦ the aesthetics of products ♦ influences on the aesthetics of products
Ergonomics	♦ the influence of ergonomics on the design of products: — safety — comfort — ease of use ♦ the use of anthropometric data	Ergonomics	♦ the influence of ergonomics on the design of products: — anthropometrics — psychology — physiology

National 5		Higher	
Knowledge and understanding	**Candidates demonstrate knowledge and understanding of:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
Uses of common materials	♦ properties and appropriate use of: — hardwoods: beech, ash, mahogany, oak — softwoods: red pine and spruce — manufactured boards: plywood, flexi-ply, MDF, chipboard, hardboard — non-ferrous metals or alloys: aluminium, copper, brass — ferrous metals or alloys: cast iron, iron, mild steel, high-carbon steel, stainless steel — thermoplastics: ABS, acrylic, polypropylene, polystyrene — thermosetting plastics: urea formaldehyde, melamine formaldehyde	Materials used in the commercial manufacture of products	♦ properties and appropriate uses of: — thermoplastics: ABS, acrylic, nylon, polypropylene, polystyrene, polythene, polyvinyl chloride — thermosetting plastics: melamine formaldehyde, urea formaldehyde — elastomers — ferrous metals or alloys: cast iron, mild steel, high-speed steel, stainless steel — non-ferrous metals or alloys: aluminium, brass, copper, tin, zinc — hardwoods: ash, beech, mahogany, oak — softwoods: spruce, pine — manufactured boards: plywood, blockboard, chipboard, hardboard, MDF, flexiply veneered boards — composite materials: carbon-fibre plastics, glass-reinforced plastic ♦ the influence materials have on the design and manufacture of products ♦ methods used to identify materials in commercially manufactured products ♦ developments in new materials and their impact on products

National 5		Higher	
Knowledge and understanding	**Candidates demonstrate knowledge and understanding of:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
Commercial manufacture	♦ vacuum forming: uses, identifying features, patterns ♦ sand casting: uses, identifying features, patterns ♦ injection moulding: uses, identifying features ♦ rotational moulding: uses, identifying features ♦ die casting: uses, identifying features ♦ computer-aided manufacture (CAM): benefits, drawbacks ♦ laser cutter: uses, benefits, drawbacks ♦ 3D printer: uses, benefits, drawbacks ♦ the use of standard components and knock-down fittings ♦ types of manufacturing systems: mass and one-off	Processes used in the commercial manufacture of products	♦ appropriate uses and identifying features of: — bending — blow moulding — compression moulding — die casting — drop forging — extrusion — injection moulding — piercing and blanking — press forming — rotational moulding — sand casting — vacuum forming — 3D printing — laser cutting ♦ appropriate uses and identifying features of: — chrome plating — galvanising — plastic dip-coating ♦ manufacturing features of component parts: complexity, cross section along its length, draft angles, ejection marks, flashing, injection points, shear marks, split lines, surface finish, symbols and labels, thinning of sheet material, wall thickness ♦ purpose of bosses, location pins, ribs and webs ♦ issues that influence the processes used in commercially manufactured products

National 5		Higher	
Knowledge and understanding	**Candidates demonstrate knowledge and understanding of:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
Assembling	♦ the use of joining methods: — adhesives: PVA and epoxy resin — screws, nails, nuts and bolts — woodwork joints: mortise and tenon, lap, rub, halving, dowel, rebate, housings — pop-riveting — welding ♦ the use of tools for holding and clamping (there is no requirement for candidates to describe the tool or its component part): — vices and guards: machine, bench, hand, engineer's — G clamp — sash cramps ♦ the use of formers and jigs	Assembly methods used in the commercial manufacture of products	♦ methods used to join material: — adhesive, carcass and frame joints, knock-down fittings, nuts, bolts, screws, snap and press fit, riveting, spot welding, arc welding, thermal bonding ♦ methods used to identify assembly methods in commercially manufactured products ♦ issues that influence the assembly of commercially manufactured products
Covered in 'commercial manufacture'		Production and planning systems	♦ one-off production, batch production, mass production ♦ methods used to improve production — automation — CAD/CAM — CNC machining — Gantt and flow charts — jigs — just-in-time production — standard components

National 5		Higher	
Knowledge and understanding	**Candidates demonstrate knowledge and understanding of:**	**Knowledge and understanding**	**Candidates demonstrate knowledge and understanding of:**
People who influence design	♦ the role of people who influence the design of products: — designers — manufacturers — marketing teams — consumers — retailers	People who influence design	♦ the roles and responsibilities of people who influence the design of products: — designers — ergonomists — lawyers — production engineers — project manager — market researchers — materials technologists ♦ communication between members of design team ♦ advantages and disadvantages of in-house design team and sub-contracting
		Intellectual property rights (IPR)	♦ the purpose of IPR ♦ methods of protecting IPR: copyright, design rights, patents and trademarks
Impact of design and manufacturing technologies	♦ the impact of design and manufacturing technologies on society and the environment: — supply of affordable and accessible products — changes to workforce — energy consumption — pollution ♦ methods to support sustainability	Impact of design and manufacture on society, the environment and the world of work	♦ methods designers and manufacturers can use to limit a product's impact on the environment — design for recyclability — design for re-use — efficiency ♦ the impact traditional and new manufacturing technologies have on society, the environment and the workforce ♦ impact of material on the environment and society ♦ methods to support sustainability ♦ investigation of a product's sustainability and its impact on the environment

Topic	Candidates demonstrate knowledge and understanding of:	Candidates demonstrate knowledge and understanding of:
Tools for measuring and marking-out	♦ the use of measuring and marking-out tools (there is no requirement for candidates to describe the tool or its component parts): — callipers: outside and odd-leg — rule — dividers — gauges: marking and mortise — centre punch — scriber — squares: try and engineer's	
Machine and hand tools for cutting and forming materials	♦ use of hand tools (there is no requirement for candidates to describe the tool or its component parts): — saws: coping, tenon, hacksaw, junior hacksaw — chisels: mortise, bevel-edged — hammers: ball-pein, cross-pein, claw — mallets: wooden, hide — planes: jack, smoothing, rebate, plough — drill bits: twist, Forstner, countersink, centre — files — hand router — pliers — pop-rivet gun — screwdrivers — tin snips	

	— bending bars — taps and dies — nail punch — bradawl ♦ use of machine tools (there is no requirement for candidates to describe the tool or its component parts): — sander: disc and belt — pillar drill: setting-up and depth stop — scroll or fret saw — centre lathe: setting-up, parallel and step turning, taper turning, drilling, knurling — wood lathe: setting-up, preparing material, parting off, parallel turning, finishing — mortise machine: setting-up, depth stop — fluidiser — oven — strip heater	
Surface finishing	♦ surface finishing techniques: — sanding or abrading — polishing — varnishing — oiling — staining — waxing — painting or lacquering — dip-coating	

This table shows the relationship between the skills assessed in the assignment component of course assessment at both National 5 and Higher.

Teachers and lecturers could use this table to:

- design and plan learning activities for multi-level teaching
- ensure seamless progression between levels
- identify important prior learning for Higher candidates

Please also refer to the 'skills, knowledge and understanding' tables in the course specifications for each level.

National 5		**Higher**	
Skill	**Candidates demonstrate their ability to:**	**Skill**	**Candidates demonstrate their ability to:**
Analysing a brief	♦ carry out research ♦ incorporate research findings into a specification	Carry out research into a given brief	♦ analyse a design brief ♦ carry out research ♦ present research
		Produce a specification	♦ incorporate research findings into a design specification
Generating ideas	♦ generate ideas	Generate initial ideas	♦ generate initial ideas
Use of modelling	♦ apply modelling techniques to develop a design proposal	Apply modelling techniques	♦ use modelling to develop a design proposal
		Demonstrate practical modelling skills	♦ demonstrate practical modelling skills
Use of graphics	♦ use appropriate graphics to develop a design proposal	Apply graphic techniques	♦ use graphics to develop a design proposal
Developing ideas	♦ explore ideas towards a proposal ♦ refine ideas towards a proposal	Develop ideas	♦ explore ideas ♦ refine ideas

	♦ apply knowledge and understanding of design ♦ apply knowledge and understanding of materials and manufacture		♦ apply knowledge and understanding of materials, manufacture and assembly processes ♦ apply knowledge and understanding of design issues
Planning for manufacture	♦ produce a sequence of operations	Produce a plan for commercial manufacture	♦ plan the commercial manufacture of a proposal
Evaluating	♦ evaluate the design proposal		
Measuring and marking-out	♦ use a range of measuring and marking-out tools		
Using machine and hand tools	♦ use a range of machine and hand tools		
Assembling components	♦ prepare components for assembly ♦ assemble components		
Finishing	♦ prepare surfaces for finishing ♦ apply finish skilfully		

Approaches to learning and teaching

The Higher Design and Manufacture course has two areas of study: design; and materials and manufacturing.

Teachers and lecturers should use a range of teaching and learning strategies to ensure that candidates develop the skills, knowledge and understanding required to design products suitable for commercial manufacture.

Teachers and lecturers should take an integrated approach when delivering the course to ensure candidates understand the interrelationships between the skills, knowledge and understanding of design, and knowledge and understanding of materials and manufacture. Case studies, skills-builders, focused tasks, extended projects, product evaluation and product analysis are all ways of achieving this.

General guidance on design

Candidates develop the theoretical knowledge and understanding of design, together with the skills, knowledge and understanding required to develop their own design proposals.

Candidates should:

- develop their knowledge and understanding of:
  - the design process
  - design factors
- develop the skills to:
  - analyse a design brief and produce a specification
  - develop and communicate a design proposal
  - manufacture practical models

Candidates should investigate, analyse and evaluate a range of existing products considering their design, marketing, use and impact on the environment. This allows them to:

- develop research and evaluation skills, knowledge and understanding
- develop a deeper understanding of the design process
- appreciate the development of a design in terms of stages, activities and influences
- appreciate the influence of design factors
- understand the interrelationship between design factors
- understand the impact design factors have on materials, processes and assembly
- appreciate the impact the commercial production of products has on the environment
- contextualise their learning
- provide examples when responding to the question paper

They should also consider the roles and influence of members of the design team, communication, testing and IPR.

Developing a clear understanding of the design process and the impact design factors have on products helps candidates to develop their own design proposals. It allows them to identify areas of research, identify and develop important aspects of a design and apply knowledge and understanding to develop their own design proposals.

The development of thinking skills is an integral part of the course. Teachers and lecturers should create opportunities to allow candidates to develop creative-thinking skills, solve problems and apply knowledge and understanding to develop proposals and justify their design decisions. Candidates should be able to use information such as anthropometric data, costings, stock sizes and assembly processes to generate, explore and refine design proposals.

Teachers and lecturers should provide a range of opportunities to allow candidates to develop their communication skills. For example, candidates could carry out focused activities to gain graphic and modelling skills, and further develop these skills by using them to communicate and develop their own design proposals.

Candidates should develop practical modelling skills, together with the knowledge and understanding required to use modelling techniques in the design process.

Practical modelling skills differ from the craft skills assessed at National 5. Modelling skills are not restricted to a final prototype or presentation model, and accuracy is not measured against a working drawing. Candidates should develop the practical skills required to create models at different stages of the design process, using materials appropriate to the purpose and type of model.

Teachers and lecturers should ensure that design activities relate to realistic and relevant situations. This helps candidates to develop a range of skills and learn how to apply them independently.

General guidance on materials and manufacture

Candidates develop their theoretical knowledge and understanding of commercial manufacture, together with the skills, knowledge and understanding to develop and plan their own design proposals.

Candidates should:

- develop their knowledge and understanding of:
  - materials
  - commercial manufacture
- develop the skills to:
  - apply knowledge and understanding of materials, manufacture and assembly
  - analyse the production of commercial products

Candidates should have the opportunity to investigate, analyse and evaluate a range of existing products, considering materials, processes, assembly, production system, sustainability and impact on the environment.

This allows them to:

- develop research and analysis skills
- understand how materials and manufacture influence the design of products
- understand the impact of materials, processes and assembly on design factors
- appreciate the interrelationships between design, materials, manufacture and assembly
- understand the impact materials, manufacture and assembly have on the environment
- appreciate the interrelationship between design and manufacture
- contextualise their learning
- provide knowledge and understanding that can be applied to their own design work
- provide products and examples that they can reference in the question paper

Candidates should also gain knowledge of production and planning systems which they can apply to their own design work.

Candidates should be able to appreciate the limitations and experiment with the possibilities of using different materials, processes and assembly methods while developing their own design work.

Candidates should develop the skills required to analyse and evaluate the production of commercial products so that they can identify and justify materials, manufacturing and assembly processes and investigate sustainability and impact on the environment.

Candidates should understand the interrelationship between manufacture and design and the issues that influence a product's sustainability and impact on the environment. They should apply and transfer knowledge gained about the manufacture of existing products to their own design work. They could do this by studying and analysing a product's manufacture as part of their initial research, or by analysing products as part of their ongoing research during the development and planning stages of a design proposal.

Delivery

There is no prescribed method of delivering the Higher Design and Manufacture course. Teachers and lecturers should develop a course that best supports their candidates' needs.

Centres could develop a course comprising several short design tasks that run sequentially. Each task could have a different emphasis while allowing candidates to develop skills, knowledge and understanding of design and materials and manufacture. Candidates may experience some of the skills, knowledge and understanding more rigorously and in greater depth in each of the different design tasks.

This approach allows candidates to experience the design process several times, enabling them to practise and gain confidence when applying skills, knowledge and understanding.

Centres could also set integrated projects that run over an extended period, creating a focus and context for the learning. This requires candidates to work on one project at a time, with regular input from teachers and lecturers, focused activities and skills-builders covering the different skills, knowledge and understanding required to complete the project.

Teachers and lecturers could use both approaches when delivering the course to multi-level classes. Using both approaches also provides the opportunity to extend learning beyond Higher level.

However centres decide to deliver the course, they should ensure that candidates have the skills, knowledge and understanding required to produce a considered design proposal. Candidates should not simply make superficial changes that have little impact on a product's use, performance, appeal or manufacture.

Design tasks

Tasks should be engaging and relevant and require candidates to carry out genuine research, exploration and refinement. Tasks should allow candidates to generate and explore their own ideas through developing and applying creative-thinking techniques and knowledge and understanding of materials, manufacturing, design factors and the environment. Candidates should demonstrate creativity when generating, exploring and refining their ideas.

Assessment for learning

Centres should use a range of assessment techniques, including formative assessment, to ensure that candidates develop the skills, knowledge and understanding listed in this course specification.

Feedback and self- and peer-critique throughout the course help candidates to understand design ideas, concepts, solutions and practical activities, as well as the issues that need to be resolved when working in design and manufacture.

Teachers and lecturers should ensure that, where peer-feedback is used, it is practicably and theoretically correct, by encouraging follow-up discussions or exploring the feedback responses in greater depth.

Candidates often present an opinion as a preconception or a misconception — this can be a springboard for further experimental activities in testing those opinions. It is often more beneficial for candidates to arrive at the correct destination by themselves.

Using assessment information as a basis for directing candidates can improve performance.

Appropriate assessment strategies support learning by:

- enabling learning intentions and/or success criteria to be shared
- boosting candidates' confidence by providing supportive feedback
- adapting teaching and learning activities appropriately

Preparing for course assessment

Teachers and lecturers must ensure that candidates are fully prepared for both components of the course assessment. Candidates should be aware of the expectations and standards required for success. Centres should use careful planning, timing, delivery and assessment methods to support candidates in achieving their potential.

While the way in which individual centres prepare their candidates for assessment varies, all centres must provide time for candidates to:

- prepare for the question paper
- prepare for the course assessment task
- carry out the stages of the course assessment task

Candidates are only assessed on the skills, knowledge and understanding listed in the 'skills, knowledge and understanding' table in this course specification.

Throughout the course, teachers and lecturers should use both formative and summative assessment strategies to provide feedback and monitor candidates' progress. Candidates should be aware of their progress and have clear strategies to improve their performance. During the latter part of the course, it may be appropriate to use more formal, timed activities to assess candidates' readiness to undertake the course assessment.

Question paper

Teachers and lecturers must ensure that their candidates develop the skills required to respond to the question paper, as well as the assessable knowledge and understanding.

Candidates should develop the skills to:

- read questions and identify the focus of the question
- reference information, images and contexts provided in the question paper
- respond to question types and command words used in the question paper
- plan answers
- provide extended answers appropriate to the mark allocation
- answer questions under timed conditions

Candidates should apply their knowledge and understanding and develop their exam technique by completing specimen and past papers.

Course assessment task (assignment)

Teachers and lecturers must ensure that candidates develop the ability to apply and demonstrate the skills, knowledge and understanding assessed in the assignment.

Candidates should develop their ability to:

- work independently under similar conditions to those specified in the assignment
- demonstrate skills assessed in the assignment

- respond to a design task similar to that used in the assignment

Candidates should practise applying their design skills when completing similar activities to those they will encounter in the course assessment task. Teachers and lecturers could use the specimen coursework assessment, past live tasks or develop tasks similar to those in the specimen or live coursework assessment tasks.

Developing skills for learning, skills for life and skills for work

Teachers and lecturers should identify opportunities throughout the course for candidates to develop skills for learning, skills for life and skills for work.

Candidates should be aware of the skills they are developing and teachers and lecturers can provide advice on opportunities to practise and improve them.

SQA does not formally assess skills for learning, skills for life and skills for work.

There may also be opportunities to develop additional skills depending on approaches being used to deliver the course in each centre. This is for individual teachers and lecturers to manage.

This course specification lists the skills for learning, skills for life and skills for work that candidates should develop through this course.

The table below highlights opportunities to develop these skills.

2 Numeracy	
2.2 Money, time and measurement	Cost and value, measurement, dimension, anthropometrics, Gantt charts
4 Employability, enterprise and citizenship	
4.4 Enterprise	Working creatively to resolve design problems, co-operative working
5 Thinking skills	
5.3 Applying	Design knowledge to complex problems, modelling and conceptual thinking in communicating ideas
5.4 Analysing and evaluating	Situational analysis, product evaluation, thinking and analysing through modelling
5.5 Creating	Ideas, innovation and conceptual solutions to problems

Administrative information

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History of changes

Version	Description of change	Date
2.0	Course support notes added as an appendix	September 2018

Note: you are advised to check SQA's website to ensure you are using the most up-to-date version of this document.