

# Design and technology



The National Curriculum for England [www.nc.uk.net](http://www.nc.uk.net)

Key stages 1–4



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# Foreword

The National Curriculum lies at the heart of our policies to raise standards. It sets out a clear, full and statutory entitlement to learning for all pupils. It determines the content of what will be taught, and sets attainment targets for learning. It also determines how performance will be assessed and reported. An effective National Curriculum therefore gives teachers, pupils, parents, employers and their wider community a clear and shared understanding of the skills and knowledge that young people will gain at school. It allows schools to meet the individual learning needs of pupils and to develop a distinctive character and ethos rooted in their local communities. And it provides a framework within which all partners in education can support young people on the road to further learning.

Getting the National Curriculum right presents difficult choices and balances. It must be robust enough to define and defend the core of knowledge and cultural experience which is the entitlement of every pupil, and at the same time flexible enough to give teachers the scope to build their teaching around it in ways which will enhance its delivery to their pupils.

The focus of this National Curriculum, together with the wider school curriculum, is therefore to ensure that pupils develop from an early age the essential literacy and numeracy skills they need to learn; to provide them with a guaranteed, full and rounded entitlement to learning; to foster their creativity; and to give teachers discretion to find the best ways to inspire in their pupils a joy and commitment to learning that will last a lifetime.

An entitlement to learning must be an entitlement for all pupils. This National Curriculum includes for the first time a detailed, overarching statement on inclusion which makes clear the principles schools must follow in their teaching right across the curriculum, to ensure that all pupils have the chance to succeed, whatever their individual needs and the potential barriers to their learning may be.

Equality of opportunity is one of a broad set of common values and purposes which underpin the school curriculum and the work of schools. These also include a commitment to valuing ourselves, our families and other relationships, the wider groups to which we belong, the diversity in our society and the environment in which we live. Until now, ours was one of the few national curricula not to have a statement of rationale setting out the fundamental principles underlying the curriculum. The handbooks for primary and secondary teachers include for the first time such a statement.

This is also the first National Curriculum in England to include citizenship, from September 2002, as part of the statutory curriculum for secondary schools. Education in citizenship and democracy will provide coherence in the way in which all pupils are helped to develop a full understanding of their roles and responsibilities as citizens in a modern democracy. It will play an important role, alongside other aspects of the curriculum and school life, in helping pupils to deal with difficult moral and social questions that arise in their lives and in society. The handbooks also provide for the first time a national framework for the teaching of personal, social and health education. Both elements reflect the fact that education is also about helping pupils to develop the knowledge, skills and understanding they need to live confident, healthy, independent lives, as individuals, parents, workers and members of society.



Rt Hon David Blunkett  
Secretary of State for Education  
and Employment



Sir William Stubbs  
Chairman, Qualifications  
and Curriculum Authority

# About this booklet

This booklet:

- sets out the legal requirements of the National Curriculum in England for design and technology
- provides information to help teachers implement design and technology in their schools.

It has been written for coordinators, subject leaders and those who teach design and technology, and is one of a series of separate booklets for each National Curriculum subject.

The National Curriculum for pupils aged five to 11 is set out in the handbook for primary teachers.

The National Curriculum for pupils aged 11 to 16 is set out in the handbook for secondary teachers.

All these publications, and materials that support the teaching, learning and assessment of design and technology, can be found on the National Curriculum web site at [www.nc.uk.net](http://www.nc.uk.net).

# About design and technology in the National Curriculum

## The structure of the National Curriculum

The programmes of study<sup>1</sup> set out what pupils should be taught, and the attainment target sets out the expected standard of pupils' performance. It is for schools to choose how they organise their school curriculum to include the programmes of study for design and technology.

### The programmes of study

The programmes of study set out what pupils should be taught in design and technology at key stages 1, 2, 3 and 4 and provide the basis for planning schemes of work. When planning, schools should also consider the general teaching requirements for inclusion, use of language, use of information and communication technology, and health and safety that apply across the programmes of study.

The **Knowledge, skills and understanding** in the programmes of study identify the aspects of design and technology in which pupils make progress:

#### At all key stages

- developing, planning and communicating ideas
- working with tools, equipment, materials and components to make quality products
- evaluating processes and products
- knowledge and understanding of materials and components

#### At key stage 3, additionally

- knowledge and understanding of structures

#### And at key stages 3 and 4

- knowledge and understanding of systems and control

Teaching should ensure that knowledge and understanding are applied when developing ideas, planning, making products and evaluating them.

These aspects are developed through investigation and evaluation of products, product analysis, focused practical tasks, and design and make assignments in different contexts, as set out in **Breadth of study**.

Schools may find the DfEE/QCA exemplar schemes of work at key stages 1, 2 and 3 helpful to show how the programmes of study and attainment target can be translated into practical, manageable teaching plans.

The Government believes that schools should be encouraged to look for opportunities to teach both food and textiles as part of the range of contrasting materials that pupils should use as part of the key stage 3 programme of study.

<sup>1</sup> The Education Act 1996, section 353b, defines a programme of study as the 'matters, skills and processes' that should be taught to pupils of different abilities and maturities during the key stage.

## Attainment target and level descriptions

The attainment target for design and technology sets out the 'knowledge, skills and understanding that pupils of different abilities and maturities are expected to have by the end of each key stage'<sup>2</sup>. The attainment target consists of eight level descriptions of increasing difficulty, plus a description for exceptional performance above level 8. Each level description describes the types and range of performance that pupils working at that level should characteristically demonstrate.

In design and technology, the level descriptions indicate progression in the three aspects of **developing, planning and communicating ideas; working with tools, equipment, materials and components to make quality products; and evaluating processes and products**. Knowledge and understanding supports attainment in these three aspects.

The level descriptions provide the basis for making judgements about pupils' performance at the end of key stages 1, 2 and 3. At key stage 4, national qualifications are the main means of assessing attainment in design and technology.

Range of levels within which the great majority of pupils are expected to work	Expected attainment for the majority of pupils at the end of the key stage
Key stage 1 <b>1–3</b>	at age 7 <b>2</b>
Key stage 2 <b>2–5</b>	at age 11 <b>4</b>
Key stage 3 <b>3–7</b>	at age 14 <b>5/6</b>

## Assessing attainment at the end of a key stage

In deciding on a pupil's level of attainment at the end of a key stage, teachers should judge which description best fits the pupil's performance. When doing so, each description should be considered alongside descriptions for adjacent levels.

Arrangements for statutory assessment at the end of each key stage are set out in detail in QCA's annual booklets about assessment and reporting arrangements.

<sup>2</sup> As defined by the Education Act 1996, section 353a.

## Learning across the National Curriculum

The importance of design and technology to pupils' education is set out on page 15. The handbooks for primary and secondary teachers also set out in general terms how the National Curriculum can promote learning across the curriculum in a number of areas such as spiritual, moral, social and cultural development, key skills and thinking skills. The examples below indicate specific ways in which the teaching of design and technology can contribute to learning across the curriculum.

### Promoting pupils' spiritual, moral, social and cultural development through design and technology

For example, design and technology provides opportunities to promote:

- *spiritual development*, through helping pupils recognise their own creativity and the creativity of others in finding solutions to problems, and through recognising the tension between material and non-material needs
- *moral development*, through helping pupils to reflect on how technology affects the environment so they can make informed choices when designing and making and through discussing the moral dilemmas posed by introducing new technologies within different values systems and the advantages and disadvantages of new technology to local, national and global communities
- *social development*, through helping pupils recognise the need to consider the views of others when discussing design ideas
- *cultural development*, through exploring the contribution of products to the quality of life within different cultures, and through valuing and reflecting on the responses of people from other cultures to design solutions.

### Promoting key skills through design and technology

For example, design and technology provides opportunities for pupils to develop the key skills of:

- *communication*, through exchanging designing and making ideas with their teacher and peers, producing design proposals, and recording and evaluating their work
- *application of number*, through measuring and assembling materials and components, evaluating processes and products by collecting and recording data, and presenting findings [for example, to work out the effect of loads on structures]
- *IT*, through preparing, presenting, and reviewing information as they work on their design ideas, developing models that communicate these ideas, and making products using computer-aided manufacture (CAM)
- *working with others*, through drawing on other people's experiences to generate ideas, discussing their own and other people's designs, both in group projects and when seeking support for individual work, and through researching the needs and values of intended users of their products
- *improving own learning and performance*, through carrying out focused practical tasks that support their own approaches, following plans to meet negotiated targets, and through evaluating the whole designing and making process
- *problem solving*, through dealing with conflicting requirements when making and project planning, and through considering alternatives in designing when investigating and evaluating products.

## Promoting other aspects of the curriculum

For example, design and technology provides opportunities to promote:

- *thinking skills*, through pupils identifying relevant sources of information, and developing criteria for designs to guide their thinking
- *financial capability*, through taking account of the relative cost of materials and components, in relation to their working characteristics and properties when deciding if, when and how to use them
- *enterprise and entrepreneurial skills*, through identifying an opportunity to design something to meet a specific need, finding out about the work of professional designers and the manufacturing industry and then making and marketing the product, and evaluating the whole process
- *work-related learning*, through bringing a realistic industrial or commercial perspective to the development of a product in the classroom, visiting a workplace for hands-on experience related to designing and making, and providing the opportunity for visitors from business to act as product advisers or clients
- *education for sustainable development*, through developing knowledge and understanding of the principles of sustainable design and production systems, developing skills in creative problem solving and evaluation, and exploring values and ethics in relation to the application of design and technology.





# The programmes of study for design and technology



# A common structure and design for all subjects

## The programmes of study

The National Curriculum programmes of study have been given a common structure and a common design.

In each subject, at each key stage, the main column **1** contains the programme of study, which sets out two sorts of requirements:

- **Knowledge, skills and understanding** **2** – what has to be taught in the subject during the key stage
- **Breadth of study** **3** – the contexts, activities, areas of study and range of experiences through which the **Knowledge, skills and understanding** should be taught.

Schools are not required by law to teach the content in grey type. This includes the examples in the main column [printed inside square brackets], all text in the margins **4** and information and examples in the inclusion statement. In the programmes of study *italic type* is used to emphasise options, where schools and teachers can choose between requirements.

## The programmes of study for English, mathematics and science

The programmes of study for English and science contain sections that correspond directly to the attainment targets for each subject. In mathematics this one-to-one correspondence does not hold for all key stages – see the mathematics programme of study for more information. In English, the three sections of the programme of study each contain **Breadth of study** requirements. In mathematics and science there is a single, separate set of **Breadth of study** requirements for each key stage.

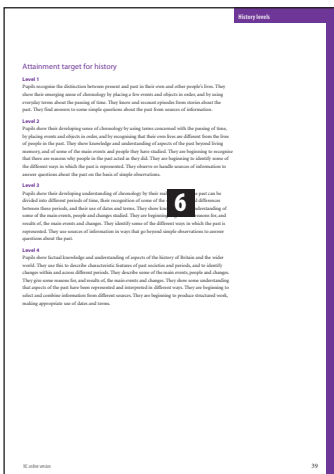
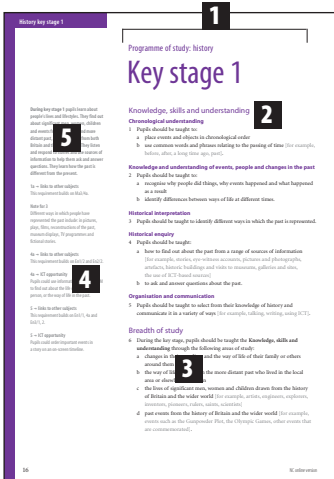
## The programmes of study in the non-core foundation subjects

In these subjects (except for citizenship) the programme of study simply contains two sets of requirements – **Knowledge, skills and understanding** and **Breadth of study**. The programmes of study for citizenship contain no **Breadth of study** requirements.

## Information in the margins

At the start of each key stage, the margin begins with a summary **5** of the main things that pupils will learn during the key stage. The margins also contain four other types of non-statutory information:

- notes giving key information that should be taken into account when teaching the subject
- notes giving definitions of words and phrases in the programmes of study
- suggested opportunities for pupils to use information and communication technology (ICT) as they learn the subject
- some key links with other subjects indicating connections between teaching requirements, and suggesting how a requirement in one subject can build on the requirements in another in the same key stage.



## The referencing system

References work as follows:

### A reference in ...

Physical education key stage 2

### ... reads ...

11a, 11b → links to other subjects  
These requirements build on Gg/2c.

### ... and means ...

Physical education key stage 2,  
requirements 11a and 11b build on  
geography (key stage 2), paragraph  
2, requirement c.

Art and design key stage 1

4a → links to other subjects  
This requirement builds on  
Ma3/2a, 2c, 2d.

Art and design key stage 1,  
requirement 4a builds on  
mathematics (key stage 1),  
Ma3 Shape, space and measures,  
paragraph 2, requirements a, c and d.

Citizenship key stage 3

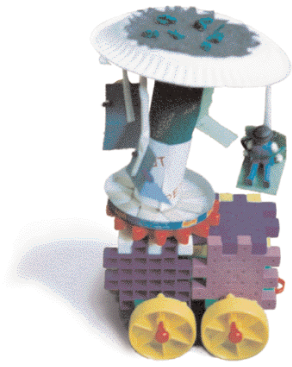
1a → links to other subjects  
This requirement builds on Hi/10, 13.

Citizenship key stage 3,  
requirement 1a builds on history  
(key stage 3) paragraphs 10 and 13.

## The attainment target

The attainment target **6** is at the end of this booklet.





The design of an object defines its meaning and ultimately its utility. The nature of the connection between technology and people is determined by the designer.

Jonathan Ive, Apple Computer

An understanding of the technical possibilities available, together with an interest in and sensitivity to use of language, gives you the confidence to express your design ideas.

Freda Sack, Type Designer and Typographer, The Foundry

‘Tell me and I forget – show me and I may remember – let me do it, and I learn.’ Learning through making works!

Prue Leith, Leith’s School of Food and Wine

Design and technology is about making things that people want and that work well. Creating these things is hugely exciting: it is an inventive, fun activity.

James Dyson, Chairman, Dyson Ltd



### **The importance of design and technology**

Design and technology prepares pupils to participate in tomorrow's rapidly changing technologies. They learn to think and intervene creatively to improve quality of life. The subject calls for pupils to become autonomous and creative problem solvers, as individuals and members of a team. They must look for needs, wants and opportunities and respond to them by developing a range of ideas and making products and systems. They combine practical skills with an understanding of aesthetics, social and environmental issues, function and industrial practices. As they do so, they reflect on and evaluate present and past design and technology, its uses and effects. Through design and technology, all pupils can become discriminating and informed users of products, and become innovators.



## Programme of study: design and technology

## Key stage 1

During key stage 1 pupils learn how to think imaginatively and talk about what they like and dislike when designing and making. They build on their early childhood experiences of investigating objects around them. They explore how familiar things work and talk about, draw and model their ideas. They learn how to design and make safely and could start to use ICT as part of their designing and making.

**Note**

The general teaching requirement for health and safety applies in this subject.

**1a, 1e → ICT opportunity**

Pupils could use word-processing or desktop publishing (DTP) software and a printer to plan and display their ideas.

**1c, 3a → links to other subjects**

These requirements build on En1/1, 3.

**2a → links to other subjects**

This requirement builds on Sc3/1a, 1c, 1d and A&D/2a, 2b.

**2c → links to other subjects**

This requirement builds on Ma3/4a–4c.

**2e → ICT opportunity**

Pupils could use 'paint' software and a colour printer to produce a pattern for finishing a product.

**4b → links to other subjects**

This requirement builds on Sc4/2a.

**Knowledge, skills and understanding**

Teaching should ensure that **knowledge and understanding** are applied when **developing ideas, planning, making products and evaluating them**.

**Developing, planning and communicating ideas**

- 1 Pupils should be taught to:
  - a generate ideas by drawing on their own and other people's experiences
  - b develop ideas by shaping materials and putting together components
  - c talk about their ideas
  - d plan by suggesting what to do next as their ideas develop
  - e communicate their ideas using a variety of methods, including drawing and making models.

**Working with tools, equipment, materials and components to make quality products**

- 2 Pupils should be taught to:
  - a select tools, techniques and materials for making their product from a range suggested by the teacher
  - b explore the sensory qualities of materials
  - c measure, mark out, cut and shape a range of materials
  - d assemble, join and combine materials and components
  - e use simple finishing techniques to improve the appearance of their product, using a range of equipment
  - f follow safe procedures for food safety and hygiene.

**Evaluating processes and products**

- 3 Pupils should be taught to:
  - a talk about their ideas, saying what they like and dislike
  - b identify what they could have done differently or how they could improve their work in the future.

**Knowledge and understanding of materials and components**

- 4 Pupils should be taught:
  - a about the working characteristics of materials [for example, folding paper to make it stiffer, plaiting yarn to make it stronger]
  - b how mechanisms can be used in different ways [for example, wheels and axles, joints that allow movement].

## Breadth of study

- 5 During the key stage, pupils should be taught the **Knowledge, skills and understanding** through:
- a investigating and evaluating a range of familiar products [for example, talking about how they work, and whether they do what they are supposed to do]
  - b focused practical tasks that develop a range of techniques, skills, processes and knowledge
  - c design and make assignments using a range of materials, including food, items that can be put together to make products, and textiles.

## Programme of study: design and technology

## Key stage 2

During key stage 2 pupils work on their own and as part of a team on a range of designing and making activities. They think about what products are used for and the needs of the people who use them. They plan what has to be done and identify what works well and what could be improved in their own and other people's designs. They draw on knowledge and understanding from other areas of the curriculum and use computers in a range of ways.

**Note**

The general teaching requirement for health and safety applies in this subject.

**1a → links to other subjects**

This requirement builds on En2/3a–3e and ICT/1a.

**1b–1d → ICT opportunity**

Pupils could use desktop publishing (DTP) software and a colour printer to develop and communicate their design ideas.

**2c → links to other subjects**

This requirement builds on Sc3/1a and A&D/2a.

**2d → links to other subjects**

This requirement builds on Ma3/4a–4c.

**Knowledge, skills and understanding**

Teaching should ensure that **knowledge and understanding** are applied when **developing ideas, planning, making products and evaluating them**.

**Developing, planning and communicating ideas**

- 1 Pupils should be taught to:
  - a generate ideas for products after thinking about who will use them and what they will be used for, using information from a number of sources, including ICT-based sources
  - b develop ideas and explain them clearly, putting together a list of what they want their design to achieve
  - c plan what they have to do, suggesting a sequence of actions and alternatives, if needed
  - d communicate design ideas in different ways as these develop, bearing in mind aesthetic qualities, and the uses and purposes for which the product is intended.

**Working with tools, equipment, materials and components to make quality products**

- 2 Pupils should be taught to:
  - a select appropriate tools and techniques for making their product
  - b suggest alternative ways of making their product, if first attempts fail
  - c explore the sensory qualities of materials and how to use materials and processes
  - d measure, mark out, cut and shape a range of materials, and assemble, join and combine components and materials accurately
  - e use finishing techniques to strengthen and improve the appearance of their product, using a range of equipment including ICT [for example, 'drawing' software or computer-aided design (CAD) software and a printer]
  - f follow safe procedures for food safety and hygiene.

**Evaluating processes and products**

- 3 Pupils should be taught to:
  - a reflect on the progress of their work as they design and make, identifying ways they could improve their products
  - b carry out appropriate tests before making any improvements
  - c recognise that the quality of a product depends on how well it is made and how well it meets its intended purpose [for example, how well products meet social, economic and environmental considerations].

### Knowledge and understanding of materials and components

- 4 Pupils should be taught:
- how the working characteristics of materials affect the ways they are used
  - how materials can be combined and mixed to create more useful properties [for example, using cardboard triangles on the corners of a wooden framework to strengthen it]
  - how mechanisms can be used to make things move in different ways, using a range of equipment including an ICT control program
  - how electrical circuits, including those with simple switches, can be used to achieve results that work.

4c → links to other subjects

This requirement builds on Sc4/2c, 2d and ICT/2b.

4d → links to other subjects

This requirement builds on Sc4/1.

### Breadth of study

- 5 During the key stage, pupils should be taught the **Knowledge, skills and understanding** through:
- investigating and evaluating a range of familiar products, thinking about how they work, how they are used and the views of the people who use them
  - focused practical tasks that develop a range of techniques, skills, processes and knowledge
  - design and make assignments using a range of materials, including electrical and mechanical components, food, mouldable materials, stiff and flexible sheet materials, and textiles.

## Programme of study: design and technology

## Key stage 3

During key stage 3 pupils use a wide range of materials to design and make products. They work out their ideas with some precision, taking into account how products will be used, who will use them, how much they cost and their appearance. They develop their understanding of designing and making by investigating products and finding out about the work of professional designers and manufacturing industry. They use computers, including computer-aided design and manufacture (CAD/CAM) and control software, as an integral part of designing and making. They draw on knowledge and understanding from other areas of the curriculum.

**Note**

The general teaching requirement for health and safety applies in this subject.

**1a → links to other subjects**

This requirement builds on En2/4a–4c and ICT/1b.

**1f → links to other subjects**

This requirement builds on En3/10.

**1g → ICT opportunity**

Pupils could use spreadsheets to model time and costs.

**1h → links to other subjects**

This requirement builds on ICT/3a.

**2b → links to other subjects**

This requirement builds on A&D/2a.

**Knowledge, skills and understanding**

Teaching should ensure that **knowledge and understanding** are applied when **developing ideas, planning, producing products and evaluating them**.

**Developing, planning and communicating ideas**

- 1 Pupils should be taught to:
  - a identify relevant sources of information, using a range of resources including ICT
  - b respond to design briefs and produce their own design specifications for products
  - c develop criteria for their designs to guide their thinking and to form a basis for evaluation
  - d generate design proposals that match the criteria
  - e consider aesthetics and other issues that influence their planning [for example, the needs and values of intended users, function, hygiene, safety, reliability, cost]
  - f suggest outline plans for designing and making, and change them if necessary
  - g prioritise actions and reconcile decisions as a project develops, taking into account the use of time and costs when selecting materials, components, tools, equipment and production methods
  - h use graphic techniques and ICT, including computer-aided design (CAD), to explore, develop, model and communicate design proposals [for example, using CAD software or clip-art libraries, CD-ROM and internet-based resources, or scanners and digital cameras].

**Working with tools, equipment, materials and components to produce quality products**

- 2 Pupils should be taught:
  - a to select and use tools, equipment and processes, including computer-aided design and manufacture (CAD/CAM), to shape and form materials safely and accurately and finish them appropriately [for example, using CAM software linked to a cutter/plotter, lathe, milling machine or sewing machine]
  - b to take account of the working characteristics and properties of materials and components when deciding how and when to use them
  - c to join and combine materials and ready-made components accurately to achieve functional results
  - d to make single products and products in quantity, using a range of techniques, including CAD/CAM to ensure consistency and accuracy
  - e about the working characteristics and applications of a range of modern materials, including smart materials.

### Evaluating processes and products

- 3 Pupils should be taught to:
- evaluate their design ideas as these develop, and modify their proposals to ensure that their product meets the design specification
  - test how well their products work, then evaluate them
  - identify and use criteria to judge the quality of other people's products, including the extent to which they meet a clear need, their fitness for purpose, whether resources have been used appropriately, and their impact beyond the purpose for which they were designed [for example, the global, environmental impact of products and assessment for sustainability].

### Knowledge and understanding of materials and components

- 4 Pupils should be taught:
- to consider physical and chemical properties and working characteristics of a range of common and modern materials
  - that materials and components can be classified according to their properties and working characteristics
  - that materials and components can be combined, processed and finished to create more useful properties and particular aesthetic effects [for example, combining different ingredients to create products with different sensory characteristics]
  - how multiple copies can be made of the same product.

### Knowledge and understanding of systems and control

- 5 Pupils should be taught:
- to recognise inputs, processes and outputs in their own and existing products
  - that complex systems can be broken down into sub-systems to make it easier to analyse them, and that each sub-system also has inputs, processes and outputs
  - the importance of feedback in control systems
  - about mechanical, electrical, electronic and pneumatic control systems, including the use of switches in electrical systems, sensors in electronic switching circuits, and how mechanical systems can be joined together to create different kinds of movement
  - how different types of systems and sub-systems can be interconnected to achieve a particular function
  - how to use electronics, microprocessors and computers to control systems, including the use of feedback
  - how to use ICT to design sub-systems and systems.

#### Note for 2e

Modern materials are those that are continually being developed through the invention of new or improved processes (for example, Teflon, optical fibres, neoprene, modified enzymes, antioxidants, genetically engineered foods, synthetic flavours, synthetic microfibres, Lycra blends, polartec, composite materials, cellular materials, carbon or Kevlar fibre).

Smart materials respond to differences in temperature or light and change in some way. They are called 'smart' because they sense conditions in their environment and respond to them. Some examples are:

- shape memory alloy (such as nitinol), which can be used to give mechanical movement when a set temperature is reached (such as to trigger a sprinkler system)
- liquid crystals in coated fabrics or thermochromic dyes, used to produce clothing that changes colour with light or temperature (such as colour change to warn of hypothermia possibility or excessive UV exposure)
- modified starches, such as starches that are chemically modified to set at high temperature and then become fluid again at low temperatures.

#### 4a → links to other subjects

This requirement builds on Sc3/1a, 1d, 1g.

#### 4b → ICT opportunity

Pupils could analyse materials and their properties using data-handling software.

6b → links to other subjects

This requirement builds on Ma2/1b–1d.

**Note for 7c**

'Compliant materials' is a broad term used to describe plastics and the full range of textiles, including some composites.

### Knowledge and understanding of structures

- 6 Pupils should be taught:
- a to recognise and use structures and how to support and reinforce them
  - b simple tests and appropriate calculations to work out the effect of loads
  - c that forces of compression, tension, torsion and shear produce different effects.

### Breadth of study

- 7 During the key stage, pupils should be taught the **Knowledge, skills and understanding** through:
- a product analysis
  - b focused practical tasks that develop a range of techniques, skills, processes and knowledge
  - c design and make assignments in different contexts. The assignments should include control systems, and work using a range of contrasting materials, including resistant materials, *compliant materials and/or food* .

## Programme of study: design and technology

# Key stage 4

### Knowledge, skills and understanding

Teaching should ensure that **knowledge and understanding** are applied when **developing ideas, planning, producing products and evaluating them**.

#### Developing, planning and communicating ideas

- 1 Pupils should be taught to:
  - a develop and use design briefs, detailed specifications and criteria
  - b consider issues that affect their planning [for example, the needs and values of a range of users; moral, economic, social, cultural and environmental considerations; product maintenance; safety; the degree of accuracy needed in production]
  - c design for manufacturing in quantity
  - d produce and use detailed working schedules, setting realistic deadlines and identifying critical points
  - e match materials and components with tools, equipment and processes, taking account of critical dimensions and tolerances when deciding how to manufacture the product
  - f be flexible and adaptable in responding to changing circumstances and new opportunities
  - g use graphic techniques and ICT, including computer-aided design (CAD), to generate, develop, model and communicate design proposals [for example, using CAD software to generate accurate drawings and part drawings to help with manufacturing].

#### Working with tools, equipment, materials and components to produce quality products

- 2 Pupils should be taught to:
  - a select and use tools, equipment and processes effectively and safely to make products that match a specification
  - b use a range of industrial applications when working with familiar materials and processes
  - c manufacture single products and products in quantity, applying quality assurance techniques
  - d use computer-aided manufacture (CAM) in single item production and in batch or volume production [for example, using vinyl cutters, embroiderers, knitting machines, engravers, milling machines, lathes]
  - e simulate production and assembly lines, including the use of ICT.

During key stage 4 pupils take part in design and make projects that are linked to their own interests, industrial practice and the community. Projects may involve an enterprise activity, where pupils identify an opportunity, design to meet a need, manufacture products and evaluate the whole design and make process. Pupils use ICT to help with their work, including computer-aided design and manufacture (CAD/CAM) software, control programs and ICT-based sources for research. They consider how technology affects society and their own lives, and learn that new technologies have both advantages and disadvantages.

#### Note

The general teaching requirement for health and safety applies in this subject.

#### 1d → ICT opportunity

Pupils could use spreadsheets to model schedules.

### 4b → ICT opportunity

Pupils could research industrial applications on the internet.

### Evaluating processes and products

- 3 Pupils should be taught to:
  - a check design proposals against design criteria, and review and modify them if necessary as they develop their product
  - b devise and apply tests to check the quality of their work at critical points during development
  - c ensure that their products are of a suitable quality for intended users [for example, how well products meet a range of considerations such as moral, cultural and environmental] and suggest modifications that would improve their performance if necessary
  - d recognise the difference between quality of design and quality of manufacture, and use essential criteria to judge the quality of other people's products.

### Knowledge and understanding of materials and components

- 4 Pupils should be taught:
  - a how materials are cut, shaped and formed to specified tolerances
  - b how materials can be combined and processed to create more useful properties, and how these changed materials are used in industry
  - c how materials are prepared for manufacture and how pre-manufactured standard components are used
  - d about a variety of finishing processes, and why they are important for aesthetic and functional reasons
  - e that to achieve the optimum use of materials and components, they need to take into account the relationships between material, form and intended manufacturing processes.

### Knowledge and understanding of systems and control

- 5 Pupils should be taught:
  - a the concepts of input, process and output, and the importance of feedback in controlling systems, including:
    - i how control systems and sub-systems can be designed, used and connected to achieve different purposes
    - ii how feedback is incorporated into systems
    - iii how to analyse the performance of systems.

## Breadth of study

- 6 During the key stage, pupils should be taught the **Knowledge, skills and understanding** through:
  - a product analysis
  - b focused practical tasks that develop a range of techniques, skills, processes and knowledge
  - c design and make assignments, which include activities related to industrial practices and the application of systems and control.



# General teaching requirements



# Inclusion: providing effective learning opportunities for all pupils

Schools have a responsibility to provide a broad and balanced curriculum for all pupils. The National Curriculum is the starting point for planning a school curriculum that meets the specific needs of individuals and groups of pupils. This statutory inclusion statement on providing effective learning opportunities for all pupils outlines how teachers can modify, as necessary, the National Curriculum programmes of study to provide all pupils with relevant and appropriately challenging work at each key stage. It sets out three principles that are essential to developing a more inclusive curriculum:

- A Setting suitable learning challenges
- B Responding to pupils' diverse learning needs
- C Overcoming potential barriers to learning and assessment for individuals and groups of pupils.

Applying these principles should keep to a minimum the need for aspects of the National Curriculum to be disapplied for a pupil.

Schools are able to provide other curricular opportunities outside the National Curriculum to meet the needs of individuals or groups of pupils such as speech and language therapy and mobility training.

## Three principles for inclusion

In planning and teaching the National Curriculum, teachers are required to have due regard to the following principles.

### A Setting suitable learning challenges

- 1 Teachers should aim to give every pupil the opportunity to experience success in learning and to achieve as high a standard as possible. The National Curriculum programmes of study set out what most pupils should be taught at each key stage – but teachers should teach the knowledge, skills and understanding in ways that suit their pupils' abilities. This may mean choosing knowledge, skills and understanding from earlier or later key stages so that individual pupils can make progress and show what they can achieve. Where it is appropriate for pupils to make extensive use of content from an earlier key stage, there may not be time to teach all aspects of the age-related programmes of study. A similarly flexible approach will be needed to take account of any gaps in pupils' learning resulting from missed or interrupted schooling [for example, that may be experienced by travellers, refugees, those in care or those with long-term medical conditions, including pupils with neurological problems, such as head injuries, and those with degenerative conditions].

- 2 For pupils whose attainments fall significantly below the expected levels at a particular key stage, a much greater degree of differentiation will be necessary. In these circumstances, teachers may need to use the content of the programmes of study as a resource or to provide a context, in planning learning appropriate to the age and requirements of their pupils.<sup>1</sup>
- 3 For pupils whose attainments significantly exceed the expected level of attainment within one or more subjects during a particular key stage, teachers will need to plan suitably challenging work. As well as drawing on materials from later key stages or higher levels of study, teachers may plan further differentiation by extending the breadth and depth of study within individual subjects or by planning work which draws on the content of different subjects.<sup>2</sup>

## B Responding to pupils' diverse learning needs

- 1 When planning, teachers should set high expectations and provide opportunities for all pupils to achieve, including boys and girls, pupils with special educational needs, pupils with disabilities, pupils from all social and cultural backgrounds, pupils of different ethnic groups including travellers, refugees and asylum seekers, and those from diverse linguistic backgrounds. Teachers need to be aware that pupils bring to school different experiences, interests and strengths which will influence the way in which they learn. Teachers should plan their approaches to teaching and learning so that all pupils can take part in lessons fully and effectively.
- 2 To ensure that they meet the full range of pupils' needs, teachers should be aware of the requirements of the equal opportunities legislation that covers race, gender and disability.<sup>3</sup>
- 3 Teachers should take specific action to respond to pupils' diverse needs by:
  - a creating effective learning environments
  - b securing their motivation and concentration
  - c providing equality of opportunity through teaching approaches
  - d using appropriate assessment approaches
  - e setting targets for learning.

### Examples for B/3a – creating effective learning environments

Teachers create effective learning environments in which:

- the contribution of all pupils is valued
- all pupils can feel secure and are able to contribute appropriately
- stereotypical views are challenged and pupils learn to appreciate and view positively differences in others, whether arising from race, gender, ability or disability

<sup>1</sup> Teachers may find QCA's guidance on planning work for pupils with learning difficulties a helpful companion to the programmes of study.

<sup>2</sup> Teachers may find QCA's guidance on meeting the requirements of gifted and talented pupils a helpful companion to the programmes of study.

<sup>3</sup> The Sex Discrimination Act 1975, the Race Relations Act 1976, the Disability Discrimination Act 1995.

- pupils learn to take responsibility for their actions and behaviours both in school and in the wider community
- all forms of bullying and harassment, including racial harassment, are challenged
- pupils are enabled to participate safely in clothing appropriate to their religious beliefs, particularly in subjects such as science, design and technology and physical education.

#### **Examples for B/3b – securing motivation and concentration**

Teachers secure pupils' motivation and concentration by:

- using teaching approaches appropriate to different learning styles
- using, where appropriate, a range of organisational approaches, such as setting, grouping or individual work, to ensure that learning needs are properly addressed
- varying subject content and presentation so that this matches their learning needs
- planning work which builds on their interests and cultural experiences
- planning appropriately challenging work for those whose ability and understanding are in advance of their language skills
- using materials which reflect social and cultural diversity and provide positive images of race, gender and disability
- planning and monitoring the pace of work so that they all have a chance to learn effectively and achieve success
- taking action to maintain interest and continuity of learning for pupils who may be absent for extended periods of time.

#### **Examples for B/3c – providing equality of opportunity**

Teaching approaches that provide equality of opportunity include:

- ensuring that boys and girls are able to participate in the same curriculum, particularly in science, design and technology and physical education
- taking account of the interests and concerns of boys and girls by using a range of activities and contexts for work and allowing a variety of interpretations and outcomes, particularly in English, science, design and technology, ICT, art and design, music and physical education
- avoiding gender stereotyping when organising pupils into groups, assigning them to activities or arranging access to equipment, particularly in science, design and technology, ICT, music and physical education
- taking account of pupils' specific religious or cultural beliefs relating to the representation of ideas or experiences or to the use of particular types of equipment, particularly in science, design and technology, ICT and art and design
- enabling the fullest possible participation of pupils with disabilities or particular medical needs in all subjects, offering positive role models and making provision, where necessary, to facilitate access to activities with appropriate support, aids or adaptations. (See **Overcoming potential barriers to learning and assessment for individuals and groups of pupils.**)

**Examples for B/3d – using appropriate assessment approaches**

Teachers use appropriate assessment approaches that:

- allow for different learning styles and ensure that pupils are given the chance and encouragement to demonstrate their competence and attainment through appropriate means
- are familiar to the pupils and for which they have been adequately prepared
- use materials which are free from discrimination and stereotyping in any form
- provide clear and unambiguous feedback to pupils to aid further learning.

**Examples for B/3e – setting targets for learning**

Teachers set targets for learning that:

- build on pupils' knowledge, experiences, interests and strengths to improve areas of weakness and demonstrate progression over time
- are attainable and yet challenging and help pupils to develop their self-esteem and confidence in their ability to learn.

## **C Overcoming potential barriers to learning and assessment for individuals and groups of pupils**

A minority of pupils will have particular learning and assessment requirements which go beyond the provisions described in sections A and B and, if not addressed, could create barriers to learning. These requirements are likely to arise as a consequence of a pupil having a special educational need or disability or may be linked to a pupil's progress in learning English as an additional language.

- 1 Teachers must take account of these requirements and make provision, where necessary, to support individuals or groups of pupils to enable them to participate effectively in the curriculum and assessment activities. During end of key stage assessments, teachers should bear in mind that special arrangements are available to support individual pupils.

### **Pupils with special educational needs**

- 2 Curriculum planning and assessment for pupils with special educational needs must take account of the type and extent of the difficulty experienced by the pupil. Teachers will encounter a wide range of pupils with special educational needs, some of whom will also have disabilities (see paragraphs C/4 and C/5). In many cases, the action necessary to respond to an individual's requirements for curriculum access will be met through greater differentiation of tasks and materials, consistent with school-based intervention as set out in the SEN Code of Practice. A smaller number of pupils may need access to specialist equipment and approaches or to alternative or adapted activities, consistent with school-based intervention augmented by advice and support from external specialists as described in the SEN Code of Practice, or, in exceptional circumstances, with a statement of special educational need.



Teachers should, where appropriate, work closely with representatives of other agencies who may be supporting the pupil.

- 3 Teachers should take specific action to provide access to learning for pupils with special educational needs by:
  - a providing for pupils who need help with communication, language and literacy
  - b planning, where necessary, to develop pupils' understanding through the use of all available senses and experiences
  - c planning for pupils' full participation in learning and in physical and practical activities
  - d helping pupils to manage their behaviour, to take part in learning effectively and safely, and, at key stage 4, to prepare for work
  - e helping individuals to manage their emotions, particularly trauma or stress, and to take part in learning.

**Examples for C/3a – helping with communication, language and literacy**

Teachers provide for pupils who need help with communication, language and literacy through:

- using texts that pupils can read and understand
- using visual and written materials in different formats, including large print, symbol text and Braille
- using ICT, other technological aids and taped materials
- using alternative and augmentative communication, including signs and symbols
- using translators, communicators and amanuenses.

**Examples for C/3b – developing understanding**

Teachers develop pupils' understanding through the use of all available senses and experiences, by:

- using materials and resources that pupils can access through sight, touch, sound, taste or smell
- using word descriptions and other stimuli to make up for a lack of first-hand experiences
- using ICT, visual and other materials to increase pupils' knowledge of the wider world
- encouraging pupils to take part in everyday activities such as play, drama, class visits and exploring the environment.

**Examples for C/3c – planning for full participation**

Teachers plan for pupils' full participation in learning and in physical and practical activities through:

- using specialist aids and equipment
- providing support from adults or peers when needed
- adapting tasks or environments
- providing alternative activities, where necessary.

**Examples for C/3d – managing behaviour**

Teachers help pupils to manage their behaviour, take part in learning effectively and safely, and, at key stage 4, prepare for work by:

- setting realistic demands and stating them explicitly
- using positive behaviour management, including a clear structure of rewards and sanctions
- giving pupils every chance and encouragement to develop the skills they need to work well with a partner or a group
- teaching pupils to value and respect the contribution of others
- encouraging and teaching independent working skills
- teaching essential safety rules.

**Examples for C/3e – managing emotions**

Teachers help individuals manage their emotions and take part in learning through:

- identifying aspects of learning in which the pupil will engage and plan short-term, easily achievable goals in selected activities
- providing positive feedback to reinforce and encourage learning and build self-esteem
- selecting tasks and materials sensitively to avoid unnecessary stress for the pupil
- creating a supportive learning environment in which the pupil feels safe and is able to engage with learning
- allowing time for the pupil to engage with learning and gradually increasing the range of activities and demands.

**Pupils with disabilities**

- 4 Not all pupils with disabilities will necessarily have special educational needs. Many pupils with disabilities learn alongside their peers with little need for additional resources beyond the aids which they use as part of their daily life, such as a wheelchair, a hearing aid or equipment to aid vision. Teachers must take action, however, in their planning to ensure that these pupils are enabled to participate as fully and effectively as possible within the National Curriculum and the statutory assessment arrangements. Potential areas of difficulty should be identified and addressed at the outset of work, without recourse to the formal provisions for disapplication.
- 5 Teachers should take specific action to enable the effective participation of pupils with disabilities by:
  - a planning appropriate amounts of time to allow for the satisfactory completion of tasks
  - b planning opportunities, where necessary, for the development of skills in practical aspects of the curriculum
  - c identifying aspects of programmes of study and attainment targets that may present specific difficulties for individuals.



**Examples for C/5a – planning to complete tasks**

Teachers plan appropriate amounts of time to allow pupils to complete tasks satisfactorily through:

- taking account of the very slow pace at which some pupils will be able to record work, either manually or with specialist equipment, and of the physical effort required
- being aware of the high levels of concentration necessary for some pupils when following or interpreting text or graphics, particularly when using vision aids or tactile methods, and of the tiredness which may result
- allocating sufficient time, opportunity and access to equipment for pupils to gain information through experimental work and detailed observation, including the use of microscopes
- being aware of the effort required by some pupils to follow oral work, whether through use of residual hearing, lip reading or a signer, and of the tiredness or loss of concentration which may occur.

**Examples for C/5b – developing skills in practical aspects**

Teachers create opportunities for the development of skills in practical aspects of the curriculum through:

- providing adapted, modified or alternative activities or approaches to learning in physical education and ensuring that these have integrity and equivalence to the National Curriculum and enable pupils to make appropriate progress
- providing alternative or adapted activities in science, art and design and design and technology for pupils who are unable to manipulate tools, equipment or materials or who may be allergic to certain types of materials
- ensuring that all pupils can be included and participate safely in geography fieldwork, local studies and visits to museums, historic buildings and sites.

**Examples for C/5c – overcoming specific difficulties**

Teachers overcome specific difficulties for individuals presented by aspects of the programmes of study and attainment targets through:

- using approaches to enable hearing impaired pupils to learn about sound in science and music
- helping visually impaired pupils to learn about light in science, to access maps and visual resources in geography and to evaluate different products in design and technology and images in art and design
- providing opportunities for pupils to develop strength in depth where they cannot meet the particular requirements of a subject, such as the visual requirements in art and design and the singing requirements in music
- discounting these aspects in appropriate individual cases when required to make a judgement against level descriptions.

### Pupils who are learning English as an additional language

- 6 Pupils for whom English is an additional language have diverse needs in terms of support necessary in English language learning. Planning should take account of such factors as the pupil's age, length of time in this country, previous educational experience and skills in other languages. Careful monitoring of each pupil's progress in the acquisition of English language skills and of subject knowledge and understanding will be necessary to confirm that no learning difficulties are present.
- 7 The ability of pupils for whom English is an additional language to take part in the National Curriculum may be ahead of their communication skills in English. Teachers should plan learning opportunities to help pupils develop their English and should aim to provide the support pupils need to take part in all subject areas.
- 8 Teachers should take specific action to help pupils who are learning English as an additional language by:
  - a developing their spoken and written English
  - b ensuring access to the curriculum and to assessment.

#### Examples for C/8a – developing spoken and written English

Teachers develop pupils' spoken and written English through:

- ensuring that vocabulary work covers both the technical and everyday meaning of key words, metaphors and idioms
- explaining clearly how speaking and writing in English are structured to achieve different purposes, across a range of subjects
- providing a variety of reading material [for example, pupils' own work, the media, ICT, literature, reference books] that highlight the different ways English is used, especially those that help pupils to understand society and culture
- ensuring that there are effective opportunities for talk and that talk is used to support writing in all subjects
- where appropriate, encouraging pupils to transfer their knowledge, skills and understanding of one language to another, pointing out similarities and differences between languages
- building on pupils' experiences of language at home and in the wider community, so that their developing uses of English and other languages support one another.

#### Examples for C/8b – ensuring access

Teachers make sure pupils have access to the curriculum and to assessment through:

- using accessible texts and materials that suit pupils' ages and levels of learning
- providing support by using ICT or video or audio materials, dictionaries and translators, readers and amanuenses
- using home or first language, where appropriate.



## Additional information for design and technology

Teachers may find the following additional information helpful when implementing the statutory inclusion statement: **Providing effective learning opportunities for all pupils.** Teachers need to consider the full requirements of the inclusion statement when planning for individuals or groups of pupils. There are specific references to design and technology in the examples for B/3a, B/3c, C/5b and C/5c.

To overcome any potential barriers to learning in design and technology, some pupils may require:

- alternative tasks to overcome any difficulties arising from specific religious beliefs they may hold in relation to the ideas or experiences they are expected to represent
- alternative or adapted activities to overcome difficulties with manipulating tools, equipment or materials [for example, the use of computer-aided design and manufacture (CAD/CAM) to produce quality products or the assistance of others to carry out activities according to the instructions of the pupil]
- specific support to enable them to engage in certain practical activities [for example, technological aids such as talking weighing scales, jigs to aid cutting, kettle tipping devices, or specialist ICT software to help with sequencing and following instructions]
- opportunities to communicate through means other than writing or drawing and help to record or translate their design ideas into a drawing
- opportunities to work in ways that avoid contact with materials to which they may be allergic
- time and opportunity to use non-visual means to gain understanding about, and to evaluate, different products and to use this information to generate ideas
- more time than others to complete the range of work indicated in Breadth of study [for example, by doing shorter assignments, by combining experience in more than one material in an assignment].

In assessment:

- pupils who are unable to use tools will be unable to achieve certain aspects of the attainment target. When a judgement against level descriptions is required, assessment of progress should either discount aspects that relate to the use of tools or indicate the levels of support that were necessary to complete this work.

# Use of language across the curriculum

- 1 Pupils should be taught in all subjects to express themselves correctly and appropriately and to read accurately and with understanding. Since standard English, spoken and written, is the predominant language in which knowledge and skills are taught and learned, pupils should be taught to recognise and use standard English.

## Writing

- 2 In writing, pupils should be taught to use correct spelling and punctuation and follow grammatical conventions. They should also be taught to organise their writing in logical and coherent forms.

## Speaking

- 3 In speaking, pupils should be taught to use language precisely and cogently.

## Listening

- 4 Pupils should be taught to listen to others, and to respond and build on their ideas and views constructively.

## Reading

- 5 In reading, pupils should be taught strategies to help them read with understanding, to locate and use information, to follow a process or argument and summarise, and to synthesise and adapt what they learn from their reading.
- 6 Pupils should be taught the technical and specialist vocabulary of subjects and how to use and spell these words. They should also be taught to use the patterns of language vital to understanding and expression in different subjects. These include the construction of sentences, paragraphs and texts that are often used in a subject [for example, language to express causality, chronology, logic, exploration, hypothesis, comparison, and how to ask questions and develop arguments].



# Use of information and communication technology across the curriculum

- 1 Pupils should be given opportunities<sup>1</sup> to apply and develop their ICT capability through the use of ICT tools to support their learning in all subjects (with the exception of physical education at key stages 1 and 2).
- 2 Pupils should be given opportunities to support their work by being taught to:
  - a find things out from a variety of sources, selecting and synthesising the information to meet their needs and developing an ability to question its accuracy, bias and plausibility
  - b develop their ideas using ICT tools to amend and refine their work and enhance its quality and accuracy
  - c exchange and share information, both directly and through electronic media
  - d review, modify and evaluate their work, reflecting critically on its quality, as it progresses.

<sup>1</sup> At key stage 1, there are no statutory requirements to teach the use of ICT in the programmes of study for the non-core foundation subjects. Teachers should use their judgement to decide where it is appropriate to teach the use of ICT across these subjects at key stage 1. At other key stages, there are statutory requirements to use ICT in all subjects, except physical education.

# Health and safety

- 1 This statement applies to science, design and technology, information and communication technology, art and design, and physical education.
- 2 When working with tools, equipment and materials, in practical activities and in different environments, including those that are unfamiliar, pupils should be taught:
  - a about hazards, risks and risk control
  - b to recognise hazards, assess consequent risks and take steps to control the risks to themselves and others
  - c to use information to assess the immediate and cumulative risks
  - d to manage their environment to ensure the health and safety of themselves and others
  - e to explain the steps they take to control risks.





# The attainment target for design and technology



# About the attainment target

An attainment target sets out the ‘knowledge, skills and understanding that pupils of different abilities and maturities are expected to have by the end of each key stage’<sup>1</sup>. Except in the case of citizenship<sup>2</sup>, attainment targets consist of eight level descriptions of increasing difficulty, plus a description for exceptional performance above level 8. Each level description describes the types and range of performance that pupils working at that level should characteristically demonstrate.

The level descriptions provide the basis for making judgements about pupils’ performance at the end of key stages 1, 2 and 3. At key stage 4, national qualifications are the main means of assessing attainment in design and technology.

Range of levels within which the great majority of pupils are expected to work		Expected attainment for the majority of pupils at the end of the key stage	
Key stage 1	<b>1–3</b>	at age 7	<b>2</b>
Key stage 2	<b>2–5</b>	at age 11	<b>4</b>
Key stage 3	<b>3–7</b>	at age 14	<b>5/6<sup>3</sup></b>

## Assessing attainment at the end of a key stage

In deciding on a pupil’s level of attainment at the end of a key stage, teachers should judge which description best fits the pupil’s performance. When doing so, each description should be considered alongside descriptions for adjacent levels.

Arrangements for statutory assessment at the end of each key stage are set out in detail in QCA’s annual booklets about assessment and reporting arrangements.

<sup>1</sup> As defined by the Education Act 1996, section 353a.

<sup>2</sup> In citizenship, expected performance for the majority of pupils at the end of key stages 3 and 4 is set out in end of key stage descriptions.

<sup>3</sup> Including modern foreign languages.

## Attainment target for design and technology

### Level 1

Pupils generate ideas and recognise characteristics of familiar products. Their plans show that, with help, they can put their ideas into practice. They use pictures and words to describe what they want to do. They explain what they are making and which tools they are using. They use tools and materials with help, where needed. They talk about their own and other people's work in simple terms and describe how a product works.

### Level 2

Pupils generate ideas and plan what to do next, based on their experience of working with materials and components. They use models, pictures and words to describe their designs. They select appropriate tools, techniques and materials, explaining their choices. They use tools and assemble, join and combine materials and components in a variety of ways. They recognise what they have done well as their work progresses, and suggest things they could do better in the future.

### Level 3

Pupils generate ideas and recognise that their designs have to meet a range of different needs. They make realistic plans for achieving their aims. They clarify ideas when asked and use words, labelled sketches and models to communicate the details of their designs. They think ahead about the order of their work, choosing appropriate tools, equipment, materials, components and techniques. They use tools and equipment with some accuracy to cut and shape materials and to put together components. They identify where evaluation of the design and make process and their products has led to improvements.

### Level 4

Pupils generate ideas by collecting and using information. They take users' views into account and produce step-by-step plans. They communicate alternative ideas using words, labelled sketches and models, showing that they are aware of constraints. They work with a variety of materials and components with some accuracy, paying attention to quality of finish and to function. They select and work with a range of tools and equipment. They reflect on their designs as they develop, bearing in mind the way the product will be used. They identify what is working well and what could be improved.

**Level 5**

Pupils draw on and use various sources of information. They clarify their ideas through discussion, drawing and modelling. They use their understanding of the characteristics of familiar products when developing and communicating their own ideas. They work from their own detailed plans, modifying them where appropriate. They work with a range of tools, materials, equipment, components and processes with some precision. They check their work as it develops and modify their approach in the light of progress. They test and evaluate their products, showing that they understand the situations in which their designs will have to function and are aware of resources as a constraint. They evaluate their products and their use of information sources.

**Level 6**

Pupils draw on and use a range of sources of information, and show that they understand the form and function of familiar products. They make models and drawings to explore and test their design thinking, discussing their ideas with users. They produce plans that outline alternative methods of progressing and develop detailed criteria for their designs and use these to explore design proposals. They work with a range of tools, materials, equipment, components and processes and show that they understand their characteristics. They check their work as it develops and modify their approach in the light of progress. They evaluate how effectively they have used information sources, using the results of their research to inform their judgements when designing and making. They evaluate their products as they are being used, and identify ways of improving them.

**Level 7**

Pupils use a wide range of appropriate sources of information to develop ideas. They investigate form, function and production processes before communicating ideas, using a variety of media. They recognise the different needs of a range of users and develop fully realistic designs. They produce plans that predict the time needed to carry out the main stages of making products. They work with a range of tools, materials, equipment, components and processes, taking full account of their characteristics. They adapt their methods of manufacture to changing circumstances, providing a sound explanation for any change from the design proposal. They select appropriate techniques to evaluate how their products would perform when used and modify their products in the light of the evaluation to improve their performance.

**Level 8**

Pupils use a range of strategies to develop appropriate ideas, responding to information they have identified. When planning, they make decisions on materials and techniques based on their understanding of the physical properties and working characteristics of materials. They identify conflicting demands on their design, explain how their ideas address these demands and use this analysis to produce proposals. They organise their work so that they can carry out processes accurately and consistently, and use tools, equipment, materials and components with precision. They identify a broad range of criteria for evaluating their products, clearly relating their findings to the purpose for which the products were designed and the appropriate use of resources.

**Exceptional performance**

Pupils seek out information to help their design thinking, and recognise the needs of a variety of client groups. They are discriminating in their selection and use of information sources to support their work. They work from formal plans that make the best use of time and resources. They work with tools, equipment, materials and components to a high degree of precision. They make products that are reliable and robust and that fully meet the quality requirements given in the design proposal.

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Excellence  
in schools

This booklet:

- sets out the legal requirements of the National Curriculum in England for design and technology
- provides information to help teachers implement design and technology in their schools.

It has been written for coordinators, subject leaders and those who teach design and technology, and is one of a series of separate booklets for each National Curriculum subject.

The National Curriculum for pupils aged five to 11 is set out in the handbook for primary teachers. The National Curriculum for pupils aged 11 to 16 is set out in the handbook for secondary teachers.

All these publications, and materials that support the teaching, learning and assessment of design and technology, can be found on the National Curriculum web site at [www.nc.uk.net](http://www.nc.uk.net).