Design Technology & Engineering Year 7

Our Subject Vision

Design and Technology is a subject which prepares pupils for work and life in the 21st century by allowing them to participate confidently and successfully in an increasingly technological world. Fast paced changes in the economy make predictions about future job market difficult. Giving students a range of transferable skills, up to date subject knowledge, and creative thinking will make them adaptable in the face of change.

Design and Technology can do this by empowering them to independently research, plan, implement and reflect and ensure they are equipped with the practical skills and technical knowledge to participate in modern society, giving them the option to pursue a career in STEM.

Design and technology programmes of study: key stage 3 National curriculum in England

Purpose of study

Design and technology are an inspiring, rigorous, and practical subject. Using creativity and imagination, pupils design and make products that solve real and relevant problems within a variety of contexts, considering their own and others' needs, wants and values. They acquire a broad range of subject knowledge and draw on disciplines such as mathematics, science, engineering, computing, and art. Pupils learn how to take risks, becoming resourceful, innovative, enterprising, and capable citizens. Through the evaluation of past and present design and technology, they develop a critical understanding of its impact on daily life and the wider world. High-quality design and technology education makes an essential contribution to the creativity, culture, wealth, and well-being of the nation.

Aims

The national curriculum for design and technology aims to ensure that all pupils:

- develop the creative, technical, and practical expertise needed to perform everyday tasks confidently and to participate successfully in an increasingly technological world
- build and apply a repertoire of knowledge, understanding and skills to design and make high-quality prototypes and products for a wide range of users
- critique, evaluate and test their ideas and products and the work of others

Attainment targets

By the end of key stage 3, pupils are expected to know, apply, and understand the matters, skills and processes specified in the programme of study. Schools are not required by law to teach the example content in [square brackets].

Design Technology & Engineering Year 7

Subject content Key stage 3

Through a variety of creative and practical activities, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making. They should work in a range of domestic and local contexts [for example, the home, health, leisure, and culture], and industrial contexts [for example, engineering, manufacturing, construction, energy].

When designing and making, pupils should be taught to:

Design

- use research and exploration, such as the study of diverse cultures, to identify and understand user needs
- identify and solve their own design problems and understand how to reformulate problems given to them
- develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations
- use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses
- develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools

Make

- select from and use specialist tools, techniques, processes, equipment, and machinery precisely, including computer-aided manufacture
- select from and use a wider, more complex range of materials and components, taking into account their properties

Evaluate

- analyse the work of past and present professionals and others to develop and broaden their understanding
- investigate new and emerging technologies
- test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups
- understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers, and technologists

Technical knowledge

- understand and use the properties of materials and the performance of structural elements to achieve functioning solutions
- understand how more advanced mechanical systems used in their products enable changes in movement and force
- understand how more advanced electrical and electronic systems can be powered and used in their products [for example, circuits with heat, light, sound and movement as inputs and outputs]
- apply computing and use electronics to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components [for example, microcontrollers]

Design Technology & Engineering Year 7

End Points – GCSE DT

EP1.To innovate and take risks, to be resourceful, to be an enterprising and capable citizen.
EP2.To be a participant in advances in manufacturing, to be able utilise CAD (Computer Aided Design) CAM.
EP3.To be able to conduct primary and secondary research relating - aesthetic, technical, cultural, social, economic, industrial, and environmental issues. To understand and apply findings to inform design decisions.
EP4.To Design products that solve real world and relevant problems within a variety of contexts, considering their own and other's needs, wants and values
EP5.To combine practical and technological skills with creative thinking and problem solving to make products and systems to meet human needs
EP6.To have and apply an understanding of a wide range of materials, being able to choose and justify their use in relation to their aesthetic, technical, economic, cultural, and physical properties.

End Points – OCR National Engineering Design

R038: Principles of engineering design - EP1 - Designing processes, EP2 - Designing requirements, EP3 - Communicating design outcomes, EP4 - Evaluating design ideas

R039: Communicating designs - EP5 - Manual production of freehand sketches, EP6 - Manual production of engineering drawings, EP7 - Use of Computer Aided Design (CAD)
R040: Design, evaluation, and modelling - EP8 - Product evaluation, EP9 - Modelling design ideas

Subject Domains of Knowledge – GCSE DT

- D1. Industry and enterprise
- D2. Critical evaluation and disruptive technologies
- D3. Investigation with primary and secondary data
- D4. Prototype development
- D5. Specialist tools and equipment
- D6. Materials and their properties

Subject Key Concepts GCSE DT

Industry and enterprise

- **C1. Organisation of the workplace**
- **C2. Business models**
- **C3. Automation**
- **C4. Scale of production**

Critical evaluation and disruptive technologies

- **C5. Global warming**

Subject Key Concepts OCR National Engineering Design

R038: Principles of engineering design

EP1 - Designing processes

Linear design, Iterative design, Inclusive design, User-centred design, Sustainable design, Ergonomic design, Analysis of the design brief, Methods of researching the product requirements,
Production of an engineering design specification, Generation of design ideas by sketching and modelling, The reasons for the use of modelling, Virtual modelling of the

Design Technology & Engineering Year 7

Subject Domains of Knowledge – OCR National Engineering Design

R038: Principles of engineering design -

EP1 - Designing processes
- The stages involved in design strategies
- Stages of the iterative design process, and the activities carried out within each stage of this cyclic approach

EP2 - Designing requirements
- Types of criteria included in an engineering design specification
- How manufacturing considerations affect design
- Influences on engineering product design

EP3 - communicating design outcomes
- Types of drawing used in engineering
- Working drawings
- Using CAD drawing software

EP4 - Evaluating design ideas
- Methods of evaluating design ideas
- Modelling methods
- Methods of evaluating a design outcome

R039: Communicating designs -

EP5 - Manual production of freehand sketches
- Sketches for a design idea

EP6 - Manual production of engineering drawings
- Drawings for a design idea

EP7 - Use of computer aided design (CAD)
- Produce a 3D CAD model of a design proposal to include compound 3D shapes

- **C6. Finite/non-finite**
- **C7. CAD/CAM**
- **C8. Planned obsolescence**
- **C9. Ethical considerations**

Investigation with primary and secondary data
- **C10. Primary and secondary data**
- **C11. Representation of data**
- **C12. Responding to data**
- **C.13 The work of others**

Prototype development
- **C.14 Design strategies**
- **C.15 Exploring design ideas**
- **C.16 Communicating design ideas**

Specialist tools and equipment
- **C.17 Marking out**
- **C.18 Addition process**
- **C19.Wasting processes**
- **C.20.Deforming processes**
- **C.21.Finishing processes**
- **C.22Commercial processes**

Materials and their properties
- **C.23 Sources and origin of plastic**
- **C.24 Thermoforming plastic**
- **C.25 Thermosetting plastic**

design idea, Physical modelling of the design idea, Manufacture, or modification of the prototype

EP2 - Designing requirements

Needs and wants, Quantitative and qualitative criteria, Reasons for the product criteria included in the design specification (ACCESS FM), Scale of manufacture, Material availability and form, Types of manufacturing processes, Production costs, Market pull and technology push, British and International Standards, Legislation, Planned obsolescence, Sustainable design (6Rs), Design for the circular economy

EP3 - Communicating design outcomes

Freehand sketching, Isometric, Oblique, Orthographic drawings, Exploded views, Assembly drawings, Block diagrams, Flowcharts, Circuit diagrams, Wiring diagrams

2D engineering drawings using third angle orthographic projection, Standard conventions,

Meaning of line types, Abbreviations, Representations of mechanical features, Advantages, and limitations of using CAD drawing software compared to manual drawing techniques

EP4 - Evaluating design ideas

Production of models, Qualitative comparison with the design brief and specification, Ranking matrices, Quality Function Deployment (QFD), Virtual (3D

Design Technology & Engineering Year 7

R040: Design, evaluation, and modelling - EP8 - Product evaluation • Product analysis • Carry out product disassembly EP9 - Modelling design ideas • Methods of modelling	• **C.26 Density** • **C.27 Conductivity** • **C.28 Strength** • **C.29 Hardness** • **C.30 Toughness** • **C.31 Malleability** • **C.32 Elasticity** • **C.33 Stock forms** • **C.34 Reinforcing**	CAD), Card, Block, Breadboarding, 3D printing, Methods of measuring the dimensions and functionality of the product, Quantitative comparison with the design brief and specification, User testing, Reasons for identifying potential modifications and improvements to the design, ***R039: Communicating designs*** ***EP5 - Manual production of freehand sketches*** 2D/3D sketches, Thick/thin lines, Texture, Tone Shading, Annotation, and labelling techniques, Produce an isometric sketch for a design proposal, ***EP6 - Manual production of engineering drawings*** Produce a 3rd angle orthographic projection drawing of a design proposal using standard conventions, Produce an assembly drawing for a design proposal. ***EP7 - Use of computer aided design (CAD)*** Produce a 3D CAD model of a design proposal to include compound 3D shapes, Produce 3D CAD assemblies of components ***R040: Design, evaluation, and modelling*** ***EP8 - Product evaluation*** Carry out product analysis using ACCESS FM, compare products using Ranking matrices, Quality Function Deployment

		(QFD), Use of manufacturers manuals or other published sources, use appropriate tools and instruments, Analyse the disassembled product ***EP9 - Modelling design ideas*** Virtual CAD 3D, Physical modelling,

Year 7: Design Technology

Units	Unit 1 An introduction to DT (4 lessons / part 1 and part 2)	Unit 2 Phone holder (4 lessons)	Unit 3 Mini Light (10 lessons)
Unit Overview	In this unit students are introduced to ACCESSFM and product analysis. The purpose of this unit is to familiarise them with the design process and influences on the customer and designer using familiar products. They will then go on to look at the ethical implications of sourcing responsible materials with a case study on Coltan.	In this project students create a Phoner holder using Thermoformed Acrylic. The purpose of this project is to familiarise them with basic workshop skills, equipment, health, and safety, and introduce them to polymers.	In this project students create a Mini light using MDF (Medium Density Fibreboard) and HIPs, and 3D printing a second version. The purpose of this project is to familiarise them with basic workshop skills, equipment, health, and safety, and introduce them to polymers and manufactured boards.
Lesson Sequence	1. Introduction to Design Technology 2. Product Analysis and Annotation	1. Marking Up 2. Finishing Acrylic, and Drilling Acrylic	1. Properties of polymers – groups 2. Design Mini Light -

Design Technology & Engineering Year 7

	3. Sustainability (MESS) Ethical Issues in Product Design 4. Sustainability – extended writing	3. Line Bending 4 Peer assessment and Evaluation	3. Make Mini Light - Cutting MDF 4. Make Mini Light 5. Vacuum form Mould 6. Mini Light Assembly 7. Mini Light Assembly 8. TinkerCAD 9. TinkerCAD Ultimaker Cura 10. Mini Light 2 Assembly and Evaluation
Key Domains taught in this Unit	D2. Critical evaluation and disruptive technologies D3. Investigation with primary and secondary data D4. Prototype development D6. Materials and their properties	D4. Prototype development D5. Specialist tools and equipment D6. Materials and their properties	D2. Critical evaluation and disruptive technologies D4. Prototype development D5. Specialist tools and equipment D6. Materials and their properties
Key Concepts taught in this Unit	Ethical considerations Responding to data The work of others Exploring design ideas Communicating design ideas Sources and origin of materials	Exploring design ideas Marking out Finishing processes Deforming processes Manufacturing processes Health and safety Thermoforming plastic	Introduction to CAD – TinkerCad Communicating design ideas Marking out Finishing processes Manufacturing processes Wasting Processes Health and safety Sources and origin of materials Thermoforming plastic

Design Technology & Engineering Year 7

KS4 End Points	EP2.To be a participant in advances in manufacturing, to be able utilise CAD (Computer Aided Design) CAM. EP3.To be able to conduct primary and secondary research relating - aesthetic, technical, cultural, social, economic, industrial, and environmental issues. To understand and apply findings to inform design decisions. EP4.To Design products that solve real world and relevant problems within a variety of contexts, considering their own and other's needs, wants and values EP6.To have and apply an understanding of a wide range of materials, being able to choose and justify their use in relation to their aesthetic, technical, economic, cultural, and physical properties.	EP4.To Design products that solve real world and relevant problems within a variety of contexts, considering their own and other's needs, wants and values EP5.To combine practical and technological skills with creative thinking and problem solving to make products and systems to meet human needs EP6.To have and apply an understanding of a wide range of materials, being able to choose and justify their use in relation to their aesthetic, technical, economic, cultural, and physical properties.	EP2.To be a participant in advances in manufacturing, to be able utilise CAD (Computer Aided Design) CAM. EP4.To Design products that solve real world and relevant problems within a variety of contexts, considering their own and other's needs, wants and values EP5.To combine practical and technological skills with creative thinking and problem solving to make products and systems to meet human needs EP6.To have and apply an understanding of a wide range of materials, being able to choose and justify their use in relation to their aesthetic, technical, economic, cultural, and physical properties.
Declarative Knowledge (Students should know)	To know the parts of ACCESSFM and how they can be applied in the design process. To understand that materials are sourced from material environment to know the original source of natural fabrics, timber, papers, metals, and plastics. This includes the environmental and ethical impact.	To know how a product is manufactured with traditional skills (thermoforming with a strip heater) To understand that materials are sourced from material environment to know the original source of plastics (polymers come from crude oil) To be able to name a range of common workshop tools and explain their functions To know how to draw in 3D by hand	To know how a product is manufactured with traditional skills To understand that materials are sourced from material environment To know the original source of timber and plastics To be able to name a range of common workshop tools and explain their functions To know how to draw in 3D by hand and with relevant software

	To be able to recognise the difference between products and the positives and negatives involved		To understand basic functions of a 3D printer
Procedural Knowledge (Students should be able to do)	To be able to say the good and bad things about a range of similar existing products To be able to redesign a familiar product given a set scenario To be able to discuss the pros / cons of their own work and compare it to those of other people To be able to consider the implications of material choices and the environmental / and ethical impact on the real world.	To be able to identify workshop hazards To be able to follow workshop safety rules To be able name and create a template To be able to measure accurately To be able to use wet and dry paper To be able to name a range of common workshop tools, machinery and explain their functions To be able to draw in 3D by hand	To be able to identify workshop hazards To be able to follow workshop safety rules To be able name and use a template To be able to measure accurately To be able to use wet and dry paper To be able to name a range of common workshop tools and explain their functions To be able to draw in 3D by hand and with relevant software
Developing T3 Literacy and Numeracy	Product designer, engineer, architect, inventor, electrical engineer, Aesthetic, customer, cost, ergonomics/ environment, size, safety, function, materials, annotation, Mining, minerals, poverty, exploitation, hazardous, economic issues, ethical issues. 6Rs Reuse, recycle, rethink, repair, reduce, refuse, renewable, non-renewable, carbon footprint, global warming, climate change	Try square, steel rule, permanent marker, Twist drill bit, clamp, saw marks, cross file, draw file, abrade, wet and dry paper, smooth, shiny, Buffer, Polish, Line bender, strip heater, align, measure, soften, form, cool, Inaccurate/ accurate, asymmetrical/ symmetrical, weak/ strong, unattractive/ attractive, improve, modify, change	Crude oil, fractioning tower, polymerisation, durable, plasticity, waterproof, flexible, brittle, transparent, opaque, self-finishing Template, draw, pencil, adapt, modify, change, improve, Tenon saw, dovetail saw, coping saw, fret saw/scroll saw, accurate, inaccurate, MDF, card, glue stick, scissors, coping saw, scroll saw, disc sander, abrasive paper. Vacuum former, Protect, Inform, Contain, Preserve, Display, logo, brand identity, barcode, recycling symbols, Battery, cell, Fixed resistor, 330 ohms, Push switch, wires, Positive, negative,

			cathode, anode, Import, Export, Box- cube, Cylinder, Roof – prism, cone, Text, Polygon, extrude, Inaccurate/ accurate, asymmetrical/ symmetrical, weak/ strong, unattractive/ attractive, improve, modify, change
Assessment (Summative and Formative)	Brief analysis task to outline understanding of topic. Extended piece of writing on the (Ep3) cultural, social, economic, industrial, and environmental issues) caused by the mining of Coltan.	Summative assessment of practical outcome with written self-reflection evaluation, followed by formative feedback from the teacher.	Summative assessment of practical outcome with written self-reflection evaluation, followed by formative feedback from the teacher. Summative test with focus on gained knowledge / End of unit 3 assessment
Links to Prior Learning	None Guaranteed as it is the first piece of work in y7.	Application of knowledge on the source of polymers (from unit 1)	Building upon unit 1 and 2, further developing the revisited knowledge on Polymers
Next steps in learning	To apply their analysing skills in unit 2/3.	To apply their analysing skills in unit 3.	To apply their analysing skills in unit 2 in year 8.
Common Barriers to learning in this unit	Lack of prior knowledge base from Primary – misconceptions of key concepts.	Lack of prior knowledge base from Primary – misconceptions of key concepts and lack of opportunity for practical experience and handling of tools and equipment	Lack of prior knowledge base from Primary – misconceptions of key concepts and lack of opportunity for practical experience and handling of tools and equipment Timetabling constraints on the subject – limited to 18 hrs per year – restricting the review and reflection practice