

Curriculum overview: Product Design

Key Stage 2	
Key skills/content requirements at Product Design	
<p><u>Product Design content and understanding</u></p> <p>Topics students need to have a good understand of</p> <ol style="list-style-type: none"> 1. Woods 2. Metals 3. Timbers 4. SMART Materials and Modern Materials 5. Sustainability include energy generation 6. The work of others and influential companies <p>Students will need to know appropriate key terminology in order to describe and explain the design and manufacture concepts within each topic with appropriate academic depth.</p> <p>Students will need to know a range of case studies to help support their discussions of the topics covered. These case studies require a high level of content knowledge.</p> <p>Within each topic, good understanding of product design comes from understanding the processes that bring about change within the material including forming, deforming and addition. Within the human, moral and social topics, students will need to be able to understand the interrelationships between different aspects of designing, manufacturing employment and source of raw materials and economic, social and political factors.</p>	<p style="text-align: center;"><u>Product Design skills</u></p> <p>Enquiry skills</p> <ul style="list-style-type: none"> • How to select appropriate materials for the mechanical properties to fulfil range of needs • Gathering data using a range of methodologies • Choosing appropriate ways to present data from primary and secondary research • Interpreting data and carrying out statistical tests to evidence ergonomic and anthropometric data • Identification of anomalies within data • Drawing of conclusions referring to data • Evaluation of design and manufacturing leading to develops and commercial changes <p>Manufacturing skills</p> <ul style="list-style-type: none"> • Accurate marking out <ul style="list-style-type: none"> ○ Use a selection of marking about tools accurately ○ Descriptions of patterns, templates and formers with production volumes ○ Analysing of current market products for manufacturing processes including sustainability • Accurate prototyping <ul style="list-style-type: none"> ○ Use of a range of traditional tools ○ Use of scales of production ○ Understanding the use of computers within manufacturing and their moral/economic implications ○ How to working drawings ○ Ability to describe the characteristics of a range of different materials <p>Other Product Design skills</p> <ul style="list-style-type: none"> • Sketch and render design ideas • Interpretation of working drawings • Interpret cross sections and formal drawing styles including isometric, oblique and orthographic projection • Interpret tables of data and graphs <p>Product Design skills are assessed through paper which involves interpretation of pre-release and unseen materials and the use of mathematical skills..</p>
Curriculum Overview	
<p>Product design content and understanding: Each year students will learn about a range of human and physical product design topics to help develop their understanding of key content. This portable knowledge is what students are entitled to know.</p> <p>Product design skills: <i>For each year group specific skills delivered within topics are shown in italics, each year skill development will embed and build upon what was learnt in the previous year. Across all year group lessons with an enquiry focus have been integrated into schemes of work to guide students though the process of analysing data to draw conclusions about a particular investigation question in preparation for GCSE NEA.</i></p>	

	KS3 Rotation	KS3 Rotation	KS3 Rotation	Portable knowledge	Key terms
Year 7	<p>Design</p> <ul style="list-style-type: none"> Compare the use of non-verbal communication techniques, research and developed design criteria to inform the innovation of design, function, appeal of a prototype that is fit for purpose Evaluate how generating, developing, modelling and communicating their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design, will improve a prototype's outcome 	<p>Make</p> <ul style="list-style-type: none"> Set-up and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately Explain the importance of using a wider range of materials and components, including construction materials, according to their functional properties and aesthetic qualities 	<p>Evaluate</p> <ul style="list-style-type: none"> Explain how their ideas and prototypes meet a design criterion and how they consider the views of others to improve their work Recall how key events and individuals in design and technology have helped shape the world Communicate the difference between destructive and non-destructive testing and the importance of objective testing 	<p>Technical knowledge</p> <ul style="list-style-type: none"> Recall knowledge of how to strengthen, stiffen and reinforce more complex structures including traditional joints Explain mechanical forces in context [for example, compression, tension, shear, bending and torsion] Understand the importance of the timber sustainability cycle and its importance for environmental carbon neutrality Explain the mechanical properties structures Understand the importance of testing and evaluating prototypes to identify required changes 	<ul style="list-style-type: none"> Chamfer Aesthetics Interference Fit Butt Joint CAD CAM JIG Measurements Accuracy Assembly Modelling Testing Evaluation Sustainability GSM 3 Dimensional (3d) Rendering Modelling Core Shadow Anchor Shadow Aesthetics
Year 8	<p>Design</p> <ul style="list-style-type: none"> Compare the use of research and exploration, such as the study of different cultures, to identify and understand user needs Identify and solve their own design problems and understand how to reformulate problems given to them Understand the importance of CAD/CAM and the benefits to accuracy and material saving use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses 	<p>Make</p> <ul style="list-style-type: none"> 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, components considering their properties Compare the use of jigs and templates in manufacturing to increase accuracy and reduce manufacturing time 	<p>Evaluate</p> <ul style="list-style-type: none"> 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, considering 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 	<ul style="list-style-type: none"> 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] Explain mechanical systems in context [for example, gears, pulleys, cams, levers and linkages] 	<ul style="list-style-type: none"> Structure Rebate Joint Butt Joint Mitre Joint Finger Joint Plough groove Measurements Accuracy Fitting Assembly Modelling Testing Evaluation Sustainability CAM's Followers Excentric Velocity Ratio Mechanical Advantage

	<ul style="list-style-type: none"> develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools 																												
	Term 1	Term 2	Term 3	Portable knowledge																									
Year 9 Transition Year	<ul style="list-style-type: none"> Describe how the critical evaluation of new and emerging technologies informs design decisions The impact of new and emerging technologies Recall the functions of mechanical devices and their importance in improving mechanical advantage. Understand the importance of the timber sustainability cycle for continued provision of non-finite resources Develop understanding of the sustainability of timber as a non-finite resource Conceptual understanding of the types, properties and structure of hardwood, softwood and manufactured boards Explain how to achieve accuracy and precision through the use of traditional hand tools and automated machinery 	<ul style="list-style-type: none"> Describe how manufacturing volumes influence employment and employer skill. Conceptual understanding of the types, properties and structure of ferrous and non-ferrous metals Explain how to achieve accuracy and precision through the use of metal working tools such as marking blue; scribes; centre punch, hacksaw; files; case hardening; riveting. Explain how electronic systems provide functionality to products and processes through input and output devices Conceptual understanding of the types, properties and structure of polymers Conceptual understanding of the types, properties and structure of paper and boards 	<ul style="list-style-type: none"> Describe the categorisation of the types, properties and structure of papers and boards Describe the categorisation of the types, properties and structure of thermoforming and thermosetting polymers Explain environmental, social and economic challenges 	<ul style="list-style-type: none"> Describe how electronics can be used to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components [for example, microcontrollers]. Label and explain the use of electrical generation through the use of fossil and alternative energy supplies Label and explain systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors] Understand the impact of production volumes has on the workforce Explain the chemical structure of thermoset and thermos-softening plastics Label and explain the fractional distillation process for extraction polymers Describe how the disposal of polymers is having global impact on the world health 	<table border="1"> <tr><td>Extruded</td></tr> <tr><td>Environmental impact</td></tr> <tr><td>Fixed scale</td></tr> <tr><td>Fabrication</td></tr> <tr><td>Laminating</td></tr> <tr><td>jig</td></tr> <tr><td>One-off production</td></tr> <tr><td>Performance requirements</td></tr> <tr><td>SMA</td></tr> <tr><td>Smart materials</td></tr> <tr><td>Scale</td></tr> <tr><td>Recycling</td></tr> <tr><td>Reduce</td></tr> <tr><td>Reforming</td></tr> <tr><td>Tempering</td></tr> <tr><td>Tensile strength</td></tr> <tr><td>Tension force</td></tr> <tr><td>Wastage</td></tr> <tr><td>Carbon Neutral</td></tr> <tr><td>Finite</td></tr> <tr><td>Adaptives</td></tr> <tr><td>Annealing</td></tr> <tr><td>Solvents</td></tr> <tr><td>Fibrous</td></tr> </table>	Extruded	Environmental impact	Fixed scale	Fabrication	Laminating	jig	One-off production	Performance requirements	SMA	Smart materials	Scale	Recycling	Reduce	Reforming	Tempering	Tensile strength	Tension force	Wastage	Carbon Neutral	Finite	Adaptives	Annealing	Solvents	Fibrous
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Year 10	<ul style="list-style-type: none"> NEA Style Metals Project- Use of all three main material groups: Metals 	<ul style="list-style-type: none"> Conceptual understanding of the types, properties and structure of technical 	<ul style="list-style-type: none"> Explain using given design brief headings, User issues, Analysing the design context, 	June 1st NEA	<table border="1"> <tr><td>Abrasive</td></tr> <tr><td>Composite</td></tr> <tr><td>Accuracy</td></tr> </table>	Abrasive	Composite	Accuracy																					
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	<p>supported by timber & plastic.</p> <ul style="list-style-type: none"> 2D Design- Google Sketch up design - Developing CAD skills and 3D Modelling and 2D design for automated production 	<p>textiles</p> <ul style="list-style-type: none"> Understand the influence on creative design with the introduction to main design eras of the last 150 years. Researching and selection of design eras and designing a product based on one of them. Developing knowledge and skills in areas of: research; design; development; modelling; evaluation; making; adhesives; finishes and materials. Researching and selection of design eras and designing a product based on one of them. Developing knowledge and skills in areas of: research; design; development; modelling; evaluation; making; adhesives; finishes and materials. Evaluation and testing, Y10 Exam preparation based on specification requirements 	<p>Researching and analysing skills, Creating design criteria's, Idea generations Development modelling through a variety of practical tasks Quality assurance issues,</p> <ul style="list-style-type: none"> Consider the importance of historic design and the influence of a range of designer's both past and present 	<p>Portable knowledge is used in the completion of the 35-hour NEA</p>	<table border="1"> <tr><td>Aesthetics</td></tr> <tr><td>Compressive strength</td></tr> <tr><td>Alloys</td></tr> <tr><td>Analysis</td></tr> <tr><td>Annealing</td></tr> <tr><td>Draft angle</td></tr> <tr><td>Anthropometric data</td></tr> <tr><td>Axis</td></tr> <tr><td>Opaque</td></tr> <tr><td>Orthographic drawing</td></tr> <tr><td>Outcome</td></tr> <tr><td>Pilot hole</td></tr> <tr><td>Planishing</td></tr> <tr><td>Plastic memory</td></tr> <tr><td>Rapid prototyping</td></tr> <tr><td>Torque</td></tr> <tr><td>Torsion</td></tr> <tr><td>Toughness</td></tr> <tr><td>Toxic</td></tr> <tr><td>Triangulation</td></tr> <tr><td>Wastage</td></tr> <tr><td>Work hardening</td></tr> </table>	Aesthetics	Compressive strength	Alloys	Analysis	Annealing	Draft angle	Anthropometric data	Axis	Opaque	Orthographic drawing	Outcome	Pilot hole	Planishing	Plastic memory	Rapid prototyping	Torque	Torsion	Toughness	Toxic	Triangulation	Wastage	Work hardening
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<p>Year 11</p>	<p>NEA</p> <p>Using given design brief identify Key skills, User issues, Analysing the design context, Researching and analysing skills, creating design criteria's, Idea generations Development modelling through a variety of practical tasks Quality assurance issues, Evaluation and testing, Y10 Exam preparation based on specification requirements</p>	<p>Exam Preparation</p>	<p>Exam Preparation</p>	<p>Interleaved through exam style questions, quiz's, micro-projects to enable a recap of Y9 (foundation year) and extensive knowledge gained in Y10.</p>	<p>All of the Above</p>																						

GCSE external assessment:

Product Design uses the GCSE 1-9 grading system, where 9 is the best grade. All examinations are terminal (at the end of Year 11). The assessments are comprised of the following components:

- Paper 1: 50%
- NEA: Contextual challenge 50%

SMSC in product design

The study of product design includes many topics and activities that support the spiritual, moral, social and cultural development of students. The product design curriculum offers opportunities to consider a range of topics such as development and globalisation, managing environments, disasters, urban change and the choice between the productions of food or biomass energy. Within each topic, students are encouraged to reflect on how people affect places and how places affect people. Students are encouraged to consider what could or should be done and who benefits and suffers from changes whilst undertaking a variety of individual, pair and group work tasks.

Spiritual development in product design

Students have many opportunities to reflect on their beliefs and life perspectives whilst learning about production in other parts of the world. They are encouraged to consider the feelings and values of others whilst debating topics such as fair trade and to show respect for others whilst taking part in role-plays about issues such as quarrying. Students are given opportunities to use their imagination and creativity through extended tasks and regularly reflect on their experiences both verbally and in writing. The accuracy and reliability of methods and the accuracy of data is considered and thinking skills are developed through tasks such as giving Aid and types of Aid. The study of product design supports students in their quest to find out more about themselves, others and the world around them.

Moral development in product design

Whilst studying product design, students are encouraged to share and justify their views about moral and ethical issues such as when studying material sourcing, extraction and poverty in less developed countries. During lessons students are given opportunities to listen and appreciate the ideas of others and to consider the implications of decision making. Decision making exercises about issues such as open cast quarrying support moral development through product design as students consider right and wrong, respect for laws and the consequences of decisions and behaviour.

Social development in product design

In product design, students work with others from different backgrounds and this is encouraged, through the use of a seating plan and a variety of team work and group tasks. Research opportunities require students to cooperate and show mutual respect whilst working in groups carrying out a range of tasks. Leadership qualities, speaking and listening skills, organisational ability and conflict resolution are developed whilst in the field but also whilst undertaking activities such as research and presentation group tasks. Self and peer assessment take place regularly in product design and encourages students to reflect on their progress.

Cultural development in product design

Many topics in product design allow students to develop their understanding of cultures and heritage at local, regional, national and international production. Through learning about case studies, design movements and influential companies it is important when considering topics such as extraction of raw materials and developing through investment.