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OxfordAQA International GCSE

Design and Technology: Product Design (9252)

Scheme of work (Optional foundation year)

For teaching from September 2023 onwards
For International GCSE exams in June 2025 onwards

Introduction

This outline scheme of work has been created for schools who choose to provide their students with a foundation year in Design and Technology: Product Design before they start their full Oxford AQA International GCSE in the subject. It is aimed at Year 9 students (or equivalent). The purpose of this outline scheme is to provide advice and guidance to teachers, not to prescribe and restrict their approach. It has been produced by a practicing subject teacher. There are obviously many other ways of organising the work, and there is absolutely no requirement to use this scheme.

Assumed coverage

This scheme of work is designed to be taught in a single academic year. It introduces Year 9 (or equivalent students to the key ideas contained OxfordAQA International Design and Technology: Product Design GCSE specification, and encourages them to apply these ideas to the type of project work that forms the basis for the NEA assessment in the full international GCSE qualification. Therefore, it is an ideal preparation for the full international GCSE.

A separate two year scheme of work to help teachers plan and implement the teaching of the full International GCSE specification aimed at Years 10 and 11 (or equivalent) can be found on the OxfordAQA website.

Contents

Term 1: Moving toy

The focus of this term (weeks 1-15) is a project involving the design and manufacture of a moving toy based on a given brief.

Week 1

Key ideas

- Material categories.
- Key names of materials and their properties.
- Students to record core technical principles for the External assessment – Section A.

Specification content

- 3.1.6 Materials and their working properties.

Teaching and learning activities

- Timbers
  - A range of products and material samples can be used to assess prior knowledge. What names and categories are already understood?
  - Build theory knowledge through note taking activities – research packs on hardwoods, softwoods, manufactured boards – used to collect and record information.
  - Discussion of properties and demonstration with the material samples of some of these properties.
  - Students look at moving toys made of a variety of timbers and identify which timber has been used and why.
  - Links made to sources and origins, finite/non-finite resources (3.1.1, 3.2.4).

- Metals
  - Discussion of the three main categories – their characteristics.
  - Metal samples and magnets on desks – student to categorise the samples in front of them into ferrous and non-ferrous.
  - Build theory knowledge through note taking activities – research packs on ferrous, non-ferrous and alloys – used to collect and record information.
  - Students look at moving toys and identify where metals have been used in their manufacture and why.
  - Links made to sources and origins, finite/non-finite resources (3.1.1, 3.2.4).

Week 2

Key ideas

- Material categories.
- Key names of materials and their properties.
- Students to record core technical principles for the External assessment – Section A.

Specification content

- 3.1.6 Materials and their working properties.

Teaching and learning activities

- Polymers
  - Discussion of when polymers replace other materials and why? This should link into the properties that these materials have.
  - Analysing common products that we use every day and discussing the specific type of polymers, names, types and properties.
  - Demonstration of heating and processing thermoforming polymers to understand plastic memory.
  - Note taking used to record information.
  - Students look at moving toys made of a variety of polymers and identify which polymer has been used and why.
  - Links made to sources and origins, finite/non-finite resources (3.1.1, 3.2.4).

- Papers and boards
  - Categorisation of papers and boards, examples shown and discussion of findings.
  - Information and samples of various paper and board types and categories spread out in classroom. Students work in pairs to collect information. Resource and revision material collated.
  - Products shown and identification of materials discussed based on their findings.
  - Students look at moving toys/pop up books made of a variety of papers and boards and identify which materials have been used and why.
  - Links made to sources and origins, finite/non-finite resources (3.1.1, 3.2.4).

Week 3

Key ideas

- Sketching
- Modelling

Specification content

- 3.3.3 Design strategies.

Teaching and learning activities

- Design brief for the design and manufacture of a moving toy given (3.3.1) and analysed.
- Use of mixed materials is discussed according to facilities and teacher direction.
- Students produce design solutions for a moving toy (autometer, pull along toy etc). A more guided approach taken with this outcome as it is the first project.
- Annotation used to justify all design decisions – theory of materials and mechanical devices used to assist.
- Sketching techniques discussed and practiced.
- Peer assess.
- Discussion of different ways designers develop ideas. Examples shown of methods of modelling and sketching to communicate ideas.
- Techniques explored and practiced to encourage students to work quickly and without worrying about making sketches and models perfect.

Week 4

Key ideas

- Types of motion.
- Names of common mechanisms.
- Students to record core technical principles for the External assessment – Section A.
- Names of common mechanisms and changing direction of force.

Specification content

- 3.1.5 Mechanical devices.

Teaching and learning activities

- Whiteboard activity – think of the main types of motion. Visual aids could be used as prompts (sewing machine, see saw, pendulum, wheel).
- Record key information.
- Discuss the use of mechanisms within products and machines, identify key mechanisms by name. Examples of products shown and analysed to understand the use of mechanisms.
- Record key information.
- Using card (templates) and split pins, model classes of levers, linkages and gear trains.
- Working examples of mechanisms produced to embed understanding.
- Links to maths for the external assessment possible. Looking at gear ratios, calculating angles in degrees, action of forces.

Week 5

Key ideas

- Sketching
- Modelling
- Selecting the correct tools and equipment for a range of materials.

Specification content

- 3.3.3 Design strategies.
- 3.3.8 Use appropriate marking out methods, data points and coordinates.
- 3.3.9 Specialist tools and equipment.

Teaching and learning activities

- Sketching and modelling
    - Students continue to produce design solutions for a moving toy (autometer, pull along toy etc). A more guided approach taken with this outcome as it is the first project.
    - Annotation used to justify all design decisions – theory of materials and mechanical devices used to assist.
    - Peer assess.

- Selecting the correct tools and equipment for a range of materials.
    - Use of whiteboards to name tools linked to the 4 material areas being looked at in this project.
    - Stations set up with instructions at each and sample materials. In pairs students use the machines/tools to mark out, cut and shape materials. All material areas included.
    - Samples could be photographed for revision booklets.

Week 6

Key ideas

- Sketching
- Modelling

Specification content

- 3.3.3 Design strategies.

Teaching and learning activities

- Post-it notes – assess the stability of the toy and materials within their design (using the theory work).
- Develop design ideas further taking all theory into account: materials, mechanisms, aesthetics etc.
- Evaluation of their work to improve outcomes.
- Justify all modifications made.

Week 7

Key ideas

- Testing

Specification content

- 3.3.3 Design strategies.

Teaching and learning activities

- Developing ideas through prototyping (3.3.6).
- Model part or the entire toy to scale (maths links – working to and working out the scale).
- Evaluation of their work to improve outcomes.

Week 8

Key ideas

- Appropriate techniques used to communicate design ideas.

Specification content

- 3.3.4 Communication of ideas.

Teaching and learning activities

- Demonstration of a specific technique used to communicate in 2D or 3D a chosen design idea. (isometric, perspective).
- Students watch and condense the information they are being shown into easy to remember stages – allowing for independent working.
- Completion of design drawing.
- All materials annotated and justified. Choice of mechanism explained and any reinforcement clearly shown.

Week 9 - 14

Key ideas

- Use of appropriate marking out methods to ensure quality.
- Select and use appropriate hand tools and machinery safely.

Specification content

- 3.3.8 – Use appropriate marking out methods, data points and coordinates.
- 3.3.9 Specialist tools and equipment.
- 3.2.5 Using and working with materials – how to shape and form using abrasion, cutting and addition.
- 3.3.10 Specialist techniques and processes – surface treatments and finishes (3.2.9).

Teaching and learning activities

- Use of appropriate marking out methods to ensure quality
    - Re-visit marking out on a variety of materials – quick whiteboard test to assess retention of knowledge.
    - Students begin to measure and mark out parts of their toys in their chosen material.
    - Peer assessment used as QC.

- Select and use appropriate hand tools and machinery safely
    - Test/re-visit knowledge of tools and techniques.
    - Students work independently to begin shaping parts of their toys.
    - Manufacture diaries could be used to plan out each activity and use of tools and equipment.
    - Demonstration of treatments and finishes used on a range of materials.
    - Samples carried out to test a range of treatments.
    - Students recall and apply knowledge as appropriate.

Week 15

Key idea

- Smart materials
- New materials

Specification content

- 3.1.3 Development in new materials.

Teaching and learning activities

- Give students the four categories of developing materials (smart, composites, new) and definitions to match up.
- Give students a list of materials and ask them categorise them (tests any prior knowledge) under the four headings – leads to a discussion.
- Demonstration of smart materials and new materials. In groups analyse the benefits of using smart/new materials in a range of products.
- Feedback findings.
- Using information on developments in materials, students are to re-design their toy to incorporate one or more of these to enhance the design.
- Self or peer assess outcomes.

Term 2: Furniture modelling

The focus of this term (weeks 16-27) is a project involving furniture modelling based on a given design brief.

Week 16

Key ideas

- Use secondary data to understand the clients and/or user needs.
- Papers and boards.
- Use of Revision booklet to record information.

Specification content

- 3.3.1 Investigation primary and secondary data.
- 3.2.1 Selection of materials and components.
- 3.1.6.1 Material categories.
- 3.1.6.2 Material properties.
- 3.2.4 Sources and origins.
- 3.3.2 Environmental, social and economic challenge.
- 3.2.6 Stock forms, types and sizes.

Teaching and learning activities

- Use secondary data to understand the clients and/or user needs.
    - Group work used to investigate and analyse existing products (secondary data).
    - Students consider the functionality, aesthetics, availability, cost, social, cultural and ethical factors of these product.
    - Investigation work used as a source of inspiration and will allow students to design a successful product, based on their own analysis.
    - Key facts and research shared and presented.

- Papers, boards and use of revision booklet to record information.
    - Card sort the process of making paper – order of key stages to be decided.
    - Discussion to embed knowledge of the process and sources and origins of paper and board.
    - Samples used to explain the types of paper and board available and application. Properties of these looked at and applied to products.
    - Stock sizes to be explained and linked to practical application (used in printers etc).
    - Consideration into the environmental impact of using trees for paper – deforestation.

Week 17

Key ideas

- Types of forces.
- Ways to reinforce materials.
- Students to record core technical principles for the External assessment – Section A.
- Design a seating solution.
- Collaboration.

Specification content

- 3.2.2 Forces and stresses.
- 3.3.3 Design strategies.

Teaching and learning activities

- Types of forces, ways to reinforce materials, and recording core technical principles for the assessment.
    - Discussion of buildings that have failed under stresses and forces.
    - Information recorded on the types of forces that can act upon materials and structures.
    - Use art straws to model different structures and students experiment with ways to reinforce these – discussion around best solution under different stresses.
    - Lead on to understand how materials can be reinforced (lamination, webbing, and interfacing).
    - Use of reinforced materials to build structures - compare the results.
- Designing a seating solution and collaboration.
    - Post-it note/mindmap - revisit forces/stresses - how might this need to be considered when designing seating?
    - Group design work – initial sketches used to generate design ideas.
    - Feedback time to explain their sketches to others.

Week 18

Key ideas

- Freehand sketching
- Isometric
- 2D/3D drawing,
- Annotated drawings
- Cut materials efficiently to minimise waste

Specification content

- 3.3.3 Design strategies
- 3.3.4 Communication of ideas
- 3.3.8 Material management

Teaching and learning activities

- Freehand sketching, Isometric, 2D/3D drawing, and annotated drawings
    - Identify areas of success from the initial sketches.
    - Use these to produce design ideas for seating.

- Minimising waste
    - Use of Computer Aided Design (CAD) to introduce the idea of reducing waste when cutting/manufacturing parts of their seating (scaled), (maths link – working out the surface area needed for parts and the amount of wastage).
    - Exploration of shape, tessellation/nesting.
    - Links made to stock size, cost and wastage.
    - Students modify their seating designs in light of this information and draw out part/s using CAD to help them maximise material use.

Week 19

Key ideas

- Commercial processes
- Tolerance
- Quality Control (QC)
- Students to record information for revision purposes.

Specification content

- 3.2.8 Specialist techniques and processes (the use of production aids, tolerance, commercial processes and QC).

Teaching and learning activities

- Video clips looking at offset lithography printing and die cutting:
    - How offset printing works
    - Die cutting
    - Die cut process
- Discussion based around commercial methods used to manufacture with paper and boards.
- Identify ways of introducing QC and working to tolerance and question the importance of these.
- Diagrams of key processes drawn and labelled.

Week 19-20

Key ideas

- Prototype designs which:
  - demonstrate innovation
  - are functional
  - consider aesthetics
  - assess if prototypes are fit for purpose.
- Prototypes
- Batch
- Mass
- Continuous
- Use of Revision booklet to record information.

Specification content

- 3.3.5 Prototype development.
- 3.2.7 Scales of production.

Teaching and learning activities

- Prototype development
  - Continued use of CAD to develop scaled seating solutions.
  - Be functional considering forces and stresses.
  - Minimise wastage when cut.

- Scales of production
  - As an introduction to scales of production - identify from a range of products which would be needed most frequently, which may be lower/higher in cost and which are hand/ machine made.
  - Definitions discussed and products/production scales clarified.

Week 21 - 24

Key ideas

- Use of automation in the workplace.

Specification content

- 3.1.1 Industry, robotics.

Teaching and learning activities

- Video clip – automation:
    - Oddly satisfying automated factories
- Use of robotics to manufacture in batch/mass/continuous production. Looking into the design and organisation of the workplace to manufacture.
- Group work – discussion of advantages and disadvantages of the use of robotics to manufacture in quantity.

Week 25

Key ideas

- Society

Specification content

- 3.3.5 Prototype development.
- 3.3.9 Specialist tools and equipment.
- 3.3.6 selection of materials.
- 3.3.10 Specialist techniques and processes.
- 3.1.1 Production techniques and systems, use of Computer Aided Design (CAD).
- 3.1.1 New and emerging technologies.

Teaching and learning activities

- Prototype development
    - Continue to develop the prototype of a scaled piece of seating.
    - Consider the materials they are selecting for their prototype and also if they were to commercially manufacture their product.
    - Use of CAD to modify ideas quickly and respond to feedback.
    - Development to focus on the design style, functional solution (forces/stresses), ability to nest the parts to minimise waste.
    - Ideas to be laser cut and evaluated in terms of the above.
    - Materials can be explored to improve design.

- New and emerging technologies
    - Video clip: Trevor Baylis
    - Identify groups of people that have particular needs.
    - In groups look at a particular audience and research their needs further and problems they encounter.
    - Re-issue the design brief - to design seating for their given audience with a specific problem outlined.

Week 26

Key ideas

- Society
- User-centred design

Specification content

- 3.1.1 New and emerging technologies.
- 3.3.3 Design strategies.
- 3.3.6 Selection of materials and components.
- 3.3.5 Prototype development.

Teaching and learning activities

- Building on learnt skills, students work collaboratively to produce a seating design to meet their given brief.
- Continue to consider the materials they are selecting for their prototype and also if they were to commercially manufacture their product.
- Using CAD, sketching, modelling – ideas are trialed and tested.

Week 27

Key idea

- Society
- User-centred design

Specification content

- 3.1.1 New and emerging technologies.
- 3.3.3 Design strategies.
- 3.3.4 Communication of design ideas.
- 3.3.5 Prototype development.

Teaching and learning activities

- Prototype development
    - Building on learnt skills, students work collaboratively to produce a seating design to meet their given brief.
    - Using CAD, sketching, modelling – ideas are trialed and tested.

- Communication of design ideas
    - Presentation of design ideas and models.
    - Explanation of idea and how their audience's needs have been met.
    - Functionality, aesthetics, materials management also explained.

Term 3: Environmental clock

The focus of this term (weeks 28-40) is a project involving the production of an environmentally friendly clock based on a given design brief.

Week 28

Key ideas

- Enterprise
- Design ideas and sketches
- Using data to understand needs
- Fossil fuels
- Nuclear power
- Renewable energy
- Energy storage
- Students to record information for revision purposes.

Specification content

- 3.1.1 New and emerging technologies.
- 3.3.3 Design strategies.
- 3.3.1 Investigation, primary and secondary data.
- 3.1.2 Energy generation and storage.

Teaching and learning activities

- New and emerging technologies and design strategies
    - Key terms given and definitions discussed (enterprise, crowd funding, virtual marketing, co-operatives, fair trade).
    - Design brief analysed and the idea of being an enterprise put into context.
    - Design ideas produced to begin to answer the brief.
    - Questions that have been highlighted during the designing are to be discussed further (how could the clock be powered? What materials are environmentally friendly?).
- Investigation, primary and secondary data, and energy generation and storage
    - Data given to be analysed. Data based around energy sources and importance of sustainability from the prospective client's view point.
    - Demonstrate clock that is powered by potato/lemon - begin to think about energy sources that can be used.
    - Card match-up activity to energy types and impacts/advantages.
    - Group research activity into ways of storing energy.

Week 29

Key idea

- Systems
- Iteration

Specification content

- 3.1.4 Systems approach to designing.
- 3.3.3 Design strategies.

Teaching and learning activities

- Systems
    - Identify inputs, processes and outputs in a system.
    - Link to alarm clocks.
    - Draw out a simple system diagram to understand the inputs, process and outputs of this product.
    - Make notes on the other inputs, process and outputs and link these to everyday products.
- Iteration
    - Post-it notes/white boards - key findings from previous sessions?
    - Take initial idea/s - develop these using the information regarding energy usage and storage.

Week 30

Key idea

- Environment - pollution, global warming.
- Sustainability - finite/non-finite.
- Students to record information for revision purposes.
- Product analysis and evaluation.
- The six Rs (reduce, refuse, re-use, repair, recycle and rethink).
- Students to record information for revision purposes.

Specification content

- 3.1.1 New and emerging technologies.
- 3.3.1 Investigation, primary and secondary data.
- 3.2.3 Ecological and social footprint.

Teaching and learning activities

- New and emerging technologies
    - Look at a range of products from a variety of material areas – how will they impact on the environment (obsolescence, life cycle).
    - Discussion around finite/non-finite resources – carry out a life cycle assessment for their design idea so far.
    - Links to science (2a).
    - What improvements could they make?

- Investigation, primary and secondary data, and ecological and social footprint.
    - Investigate similar products that have been designed with the environment in mind.
    - Find inspiration in products that have considered the six Rs.

Week 31

Key ideas

- Modelling – using card
- Iteration

Specification content

- 3.3.4 Communication of design ideas
- 3.3.3 Design strategies

Teaching and learning activities

- Make further modifications to design ideas and begin to produce 3D models of these.
- Models could be scaled. Links to maths (1b).

Week 32

Key ideas

- Critical emerging technologies:
  - obsolescence
  - design for maintenance
  - ethics
  - environment.
- Commercial processes.
- Students to record information for revision purposes.

Specification content

- 3.1.1 New and emerging technologies.
- 3.2.8 Specialist techniques and processes.

Teaching and learning activities

- New and emerging technologies.
  - Introduce the four key terms and give definitions.
  - Given specific amounts of time, students make a change to their design based around one of the four key headings. After each modification is made it is discussed to evaluate the improvement to the design.
  - Original design is compared to the fourth modification.

- Specialist techniques and processes.
  - Use of questioning and whiteboards to test /re-visit commercial processes used with paper and card.
  - For another or several material areas use video clips to understand commercial processes.
  - Plastic injection molding
  - Discussion of products manufactured in this way. Highlight any environmental advantages and disadvantages to the processes.
  - Diagrams used to record processes.

Week 33

Key idea

- Linking to manufacture - ecological issues, life cycle of products.

Specification content

- 3.2.3 Ecological and social footprint.

Teaching and learning activities

- Choose a commercial process - draw and label it.
- Build on this information to understand the concept of social and ecological footprints. Record the definitions.
- Have scenario cards - in pairs decide which would be considered a social impact or an ecological impact.
- Take one product and as a class identify all of the ways from extraction to disposal that it impacts on the environment and society. Produce a class analysis diagram.

Week 33 - 35

Key ideas

- Further development
- Sketching, 2D, 3D drawing

Specification content

- 3.3.4 Communication of design ideas.

Teaching and learning activities

- Whiteboard activity:
  Make a list of all the key considerations covered so far – what do they need to consider before they develop their product again?
  - energy sources
  - six Rs
  - social/ecological footprint
  - sustainability
  - obsolescence
  - maintenance
  - commercial production and impact.
- Use sketches to develop ideas further.
- Justify modifications made against the consideration list.

Week 35 - 39

Key ideas

- Select and use specialist techniques and processes.
- Consider accuracy.
- Shape, fabricate and construct a high quality prototype.

Specification content

- 3.3.5 Prototype development.
- 3.3.7 Tolerances.
- 3.3.9 Specialist tools and equipment.
- 3.3.10 Specialist techniques and processes.

Teaching and learning activities

- Produce a prototype of their developed idea.
- Re-visit knowledge and experience from previous two projects.
- Work to tolerance given as they manufacture their prototype to ensure accuracy.

Week 40

Key idea

- Surface treatments and finishes

Specification content

- 3.3.10 Specialist techniques and processes

Teaching and learning activities

- Finish the end product using treatments and finishes. Demonstrations used to ensure understanding of appropriate methods.