

# GCSE Product Design - Exam Content

The content that you need to revise for the exam can be separated into 3 main sections

- **Materials and Components**
- **Design and Market Influences**
- **Processes and Manufacture**

## Materials and Components

### Paper/card

- Properties and uses of common papers: layout, cartridge, tracing, grid, card, corrugated card, duplex board, solid white board, foam core board;
- Common components used with card to fasten, seal, hang, pour, join, bind, index;
- Laminating: Layering up card with other to create different properties for specific purposes e.g. foil-backed for food packaging;
- Stock forms for paper/card materials i.e. size, thickness, weight and colour;
- Basic understanding of the source of pulp and the processes involved in making paper and card
- Printing methods: Offset Lithography, Flexography, Screen Printing, Block Printing, Dye Sublimation, Embossing, Laminating
- Cutting dies

  
  
  
  
  
  

### Timber based materials

- Identify common timbers such as pine, mahogany, teak, ash, beech used in the manufacture of products
- Identify common manufactured boards i.e. MDF, plywood, chipboard, blockboard, hardboard;
- Properties and uses of such materials within commercial products; and how they can be changed to suit a specific job.
- Stock forms for timber based materials i.e. rough sawn, PSE, sheet sizes and mouldings;
- Basic understanding of the source of timber and the processes involved in conversion to workable materials.
- Jigs & Templates

  
  
  
  
  

### Ferrous and non-ferrous metals

- Identify common metals i.e. silver, stainless steel, mild steel, cast iron, brass, copper, zinc, aluminium, pewter;
- Properties and uses of these within engineering and domestic products;
- understand how alloys or coated finishes can be changed to suit a specific job.
- Understand that the properties of metal can be changed by heat treatment;
- Stock forms for metals i.e. sheet, rod, bar, tube;
- Basic understanding of the source of metals and the processes involved in conversion to workable materials.

  
  
  
  
  

### Plastics

- Identify common thermoplastics i.e. HIPS, expanded polystyrene, acrylic, acetate, HDPE, PVC, PET;
- Identify common thermosetting plastics i.e. GRP, Epoxy resin, UF, MF;
- Understand the difference between thermoplastics and thermosetting plastics;
- Understand the ways in which plastics can be formed: vacuum forming, injection moulding, blow moulding, line bending, compression moulding, extrusion; (especially with regard to consumer products)
- Understand that the properties of plastics can be changed to suit a specific job e.g. increase rigidity, reduce weight, insulation etc
- Stock forms for plastic materials i.e. sheet, rod, powder, granules, foam;
- Basic understanding of the source of plastics and the processes involved in conversion to workable materials.

  
  
  
  
  
  

### Manipulating and Combining Materials

- How materials can be combined and processed in order to create more useful, or desirable, properties;
- How these materials are used in industry;
- How materials are prepared for manufacture,
- Finishes: self-finishing and applied-finishing processes, and their importance for aesthetics and function
- Pre-manufactured standard components

  
  
  
  

### New materials

- Knowledge and understanding that the development of new and smart materials to meet a variety of user needs in new and exciting ways e.g.
  - Precious Metal Clays (PMC) used in jewellery manufacture,
  - Corn starch polymers used in packaging,
  - Thermochromic pigments used for thermal warning patches
  - Shape memory alloys
  - Quantum Tunnelling Composite (QTC) used to incorporate electronics into textiles,
  - Nanomaterials and integrated electronics in the area of Design and Technology.

# Design and Market Influences

This is about understanding the “Designed world” and how Product Design affects us all.

## Evolution of Product Design

- Product EVOLUTION: The way products evolve over time because of developments in ideas, materials, manufacturing processes and technologies as well as because of social, political, cultural and environmental changes;
- Design movements: Arts & Crafts, Art Nouveau, Art Deco, Bauhaus, Modernism, De Stijl, Memphis, Post Modernism; and their influence *today*
- Manufacturing industries are involved in continuous improvement (CI) and this influences product evolution;
- New products are developed because of **marketing pull** and sometimes because of **technological push**.

## Product development

- Design Briefs: How to respond creatively, produce Design Specifications and develop your own ideas,
- Research and analysis of data, to support the design and manufacture of products;
- Factors involved in manufacturing a product in quantity (batch or mass production)
- End users: Who could you design for. *Inclusive Design*;
- Accuracy: Dimensions and tolerances
- CAD (and other ICT) and how it can be used to *model* design proposals and help decision making;
- Intellectual Property and the law: copyright, patents and registered designs.

## Communication and representation of ideas

- Graphical techniques: annotated sketches (practice!), formal drawing conventions, CAD
- Presentation techniques (to show materials/texture/finish): mood boards, presentation drawings, photos, CAD;
- Tone and Rendering: pencils, markers, CAD
- Layout grids and guidelines (to aid planning and presentation of drawings and information;
- Prototyping and modelling: Card, expanded polystyrene, etc. (to explore design alternatives, communicate and evaluate proposals

## Design Methodology

- Linear & non-linear Design: (The traditional design process is just one of many methods for successful design)
- Design approaches: problem solving, systems approach and intuitive designing.
- Starting points for designing and making: 
  - Natural form, pattern and structure
  - Geometry and mathematics
  - the work of well known artists, designers, craftsmen and technologists
  - Product analysis
  - Religious and cultural influences.

## Packaging

- Materials and processes used to package products and the impact of packaging materials on the environment: social responsibility, sustainability;
- Functions of packaging such as protect, inform, contain, transport, preserve and display;
- Product labelling and the common symbols used to indicated hazards, storage and handling, maintenance, disposal and design protection.

## Product marketing

- branding and advertising and the effect that they have upon different consumer groups;
- Product promotion techniques: leaflets, flyers, point of sale, packaging and digital media.

## Design in the Human Context

- Human factors that need to be understood for design to be effective and *inclusive*: e.g.access, cultural values
- Ergonomics and Anthropometrics (the needs of the 5th–95th percentile)
- The effect of colour to indicate message such as: danger, hot, cold, stop, go etc.
- The needs of social, economic and ethnic groups: disabled, elderly, religious groups
- Ergonomics: the layout of materials, equipment and controls, such as working triangles in the kitchen, production lines, assembly lines and how it can increase efficiency

## Safety

- The relevance of safety for you, the manufacturer and the product user;
- Designers and manufacturers have both a moral and legal responsibility for the products that they create;
- Testing: to ensure that the products you make are safe for your specific user group
- Risk Assessment

## Quality

- Factor affecting Quality: cost, availability of resources, social factors;
- Quality Assurance: quality circles, teamworking, BS EN ISO 9000;
- Quality Control Tests

## Ethical, Environmental and Sustainability Issues

- Ethical , Environmental and Sustainability issues relating to the design and manufacture of products
  - fair trade, product miles, carbon footprint, product disposal,
- The 6 “R”s and their meanings: Re-use, Recycle, Repair, Reduce, Rethink, Refuse
- Recycling Materials: Identification, separation, Collection, Processing, energy costs, later use, waste.
- Environmentally friendly products, or “Green Designs”: identify a range of these;

  
  
  

## Consumer issues

- Consumer groups and pressure groups that test products – e.g. Which? reports;
- Standards agencies: BSI Kitemark, ISO and how these standards affect product design, manufacture & testing;
- Consumer Protection and the Law: Specific Legislation

  
  

## Processes and Manufacture

### Product Manufacture

- How a range of materials are cut, shaped and formed
- Tolerances;
- The difference between quality control and quality assurance techniques;
- Time planning schedules: flow charts, production plans, identifying QA and QC, in the making process
- Evaluation: Looking at the quality of products and devising modifications (changes) to improve them.

  
  
  
  

## Industrial and Commercial Practice

### Methods of production

Candidates should:

- Computer Aided Manufacture (CAM): Machines, Uses, Advantages & Disadvantages
- Scales of production: One-off, Batch, Mass, Continuous, Just In time (JIT);
- Batch Production techniques: Jigs, Templates, Formers, CAM

  
  

### Manufacturing systems

- Understand that commercial manufacturing is a system, which requires:
  - special buildings or places of work;
  - The organisation of people;
  - The organisation of tools and equipment;
  - Risk assessment and compliance with health and safety regulations;
  - The organisation of materials;
  - Information systems to help people communicate with each other reliably;
  - Ways of changing the shape and form of materials to increase their usefulness;
  - Ways of using tools and equipment to transform the materials into products;
  - The design and production of many products in a systematic way;
  - Quality Assurance (QA) procedures and Quality Control (QC) checks
  - Efficient working methods;
  - Ways of safely processing waste: disposal or recycling, avoiding pollution

### Use of ICT (Information and Communication Technology)

- ICT and how it's used in Manufacturing:: Just In Time (JIT), video conferencing, software sharing, stock control, data transfer and remote manufacturing;
- CNC (Computer Numeric Control) and how it applied in modern manufacturing
- CAM (Computer Aided Manufacture) and its use in manufacturing (both small batch and mass production)
- How CAD & CAM works together for higher levels of accuracy, repeatability and efficiency.

  
  
  

**All of the above may or may not come up in the exam. All you can do is revise, read & research as much as you can, so that you are well prepared, whatever comes up.**

**Of course, there are some things that we *do* know about the exam:**

- The **Final exam** is worth **40%** of the final GCSE
- It will be **2 hours** and is marked out of 120marks
- That works out to **1 minute per mark**
- The date of you GCSE Product Design Exam is **Monday 22<sup>nd</sup> June in the morning**
- You should attend a **“Warm-up”** session at 07:30 on the morning of the exam.
  
- **Section A** of the paper (the first bit you do) is a **THEMED question**.
- This year the Preliminary Material gives this information:  
**Context: Pattern & Structure found in nature can inspire the design & manufacture of products.**
- So you must research and prepare to answer a DESIGN QUESTION in Section A that will definitely **be related to Pattern and Structure found in nature**