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.

**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

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 mark’ed out of 120 marks
- That works out to 1 minute per mark
- The date of you GCSE Product Design Exam is Monday 22nd 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