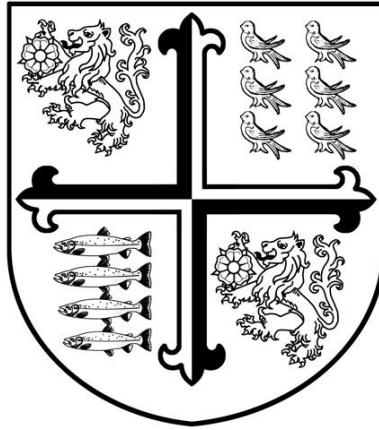




Year 12

A Level Product Design Exam Preparation

Exam Board: Edexcel

[https://qualifications.pearson.com/content/dam/pdf/A%20Level/Design%20and%20Technology%20-%20Product%20Design/2017/specification-and-sample-assessments/Pearson Edexcel Level 3 GCE in Design and Technology Specification issue2.pdf](https://qualifications.pearson.com/content/dam/pdf/A%20Level/Design%20and%20Technology%20-%20Product%20Design/2017/specification-and-sample-assessments/Pearson%20Edexcel%20Level%203%20GCE%20in%20Design%20and%20Technology%20Specification%20issue2.pdf)

Exam date information:

1 exam

2 hours 30 mins

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Year 12 Product Design Revision

Half Term 1

During year 12, you cover the first 2/3 of content.

If you **RED** or **AMBER** sections, make a note of the specific bits which you are struggling with.

Topics	Key Concepts	R	A	G
2.1 Material properties	Performance characteristics of woods, metals, polymers, smart and modern materials, papers, boards, textiles and composites in order to discriminate between materials and select appropriately: a) conductivity, strength, elasticity, plasticity, malleability, ductility, hardness, toughness, durability, biodegradability			
1.1 Woods	To apply a knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials: a) hardwoods – oak, mahogany, beech, jelutong, balsa b) softwoods – pine, cedar, larch, redwood.			
1.2 Metals	To apply a knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials: a) ferrous metals – mild steel, carbon steels, cast iron b) non-ferrous metals – aluminium, copper, zinc, tin c) alloys (ferrous and non-ferrous) – stainless steel, duralumin, brass			
1.3 Polymers	To apply a knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials: a) thermoplastics – acrylic, LDPE, HDPE, PET, PVC, PP, ABS b) thermosetting plastics – epoxy resins, urea formaldehyde, polyester resin c) elastomers – rubber			
1.4 Composite materials	To apply a knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials: a) carbon fibre (CFRP), glass fibre (GRP), Medium Density Fibre Board (MDF), hardboard, chipboard, plywood			
1.5 Papers and boards	To apply a knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials: a) drawing papers: layout, tracing, copier, cartridge b) commercial printing papers: bond, coated c) boards: mounting board, corrugated board, foam board, folding box board, foil-lined board			
1.6 Textiles	To apply a knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials: a) natural fibres: cotton, linen, wool b) manmade fibres: nylon, polypropylene, polyester c) textile treatments – flame resistant, PTFE			
1.7 Smart and modern materials	To apply a knowledge and understanding of working properties, characteristics, applications, advantages and disadvantages of the following types of materials: a) thermo-ceramics, shape memory alloys (SMA), reactive glass, liquid crystal displays (LCD), photo-chromic materials, quantum tunnelling composites			

Revision Questions:

2.1 Material properties

1. List at least 10 different hard material properties and then define them.

1.1 Woods

1. What are the differences between HWs and SWs?
2. Which 2 woods could be used for modelling and why?
3. Which HWs are used for furniture and why?
4. Which woods can be used outdoors?
5. What is the difference between pine and redwood?

1.2 Metals

1. What are the 3 categories of metals and what defines each one?
2. Which properties does mild steel have which the carbon steels don't?
3. Name the different alloys and their composition metals/elements.
4. Which metals are the most ductile?
5. What property makes cast iron very different from the other metals?

1.3 Polymers

1. What is the difference between thermoplastics and thermosetting plastics?
2. What makes elastomers unique?
3. Name the 3 thermosetting plastics; their properties and uses.
4. Which 2 thermoplastics are the most flexible?
5. Which plastic is not hard and is brittle?

1.4 Composites

1. Why are composite materials made? What is the advantage?
2. State how each composite material is manufactured.
3. Which is the better material: CFRP or GFRP and why?
4. What are the advantages of using manmade boards over natural timbers?

1.5 Papers and boards

1. What are the 2 papers used for copying designs?
2. Which paper is used for art sketchbooks and why?
3. Which papers are used commercially? What are their properties and specific uses?
4. What kind of packaging is each board used for and why?

1.6 Textiles

1. Name the 2 textile treatments and what they protect garments against.
2. Name the 2 natural fibres; their properties and uses.
3. What advantages do all 3 synthetic fibres have, when compared to natural fibres?

1.7 Modern and smart materials

1. What is the definition of a smart material?
2. What do the letters QTC stand for and what are the properties and uses of it?
3. What do the letters SMA stand for and what are the properties and uses of it?
4. What do the letters LCD stand for and what are the properties and uses of it?
5. What is the difference between reactive glass and photochromic glass?

Half Term 2

If you **RED** or **AMBER** sections, make a note of the specific bits which you are struggling with.

Topics	Key Concepts	R	A	G
3.1a Heat treatments	Processes, applications, characteristics, advantages and disadvantages of the following heat treatments: a) normalising b) case hardening c) annealing d) hardening and tempering			
3.1c Printing processes	Processes, applications, characteristics, advantages and disadvantages of the following printing processes: a) screen printing b) offset lithography c) flexography d) gravure			
3.1d Casting	Processes, applications, characteristics, advantages and disadvantages of the following casting processes: a) die casting (gravity + high pressure) b) sand c) investment d) resin e) plaster of Paris			
3.1e Machining	Processes, applications, characteristics, advantages and disadvantages of the following machining processes: a) milling/routing b) drilling c) turning d) stamping/pressing			

Revision Questions:

3.1a Heat treatments

1. What are the 2 reasons for using heat treatments on metals?

2. What is quenching?
3. What 2 metals are annealed?
4. How do the processes differ for annealing these metals?
5. Which is the simplest process? Explain it in 2 bullet points.
6. Explain the process case hardening in 4 points.
7. What is pickling?
8. What is the final heat treatment process called? Explain the process in 5 points.

3.1c Printing processes

1. Which is the only indirect printing process?
2. Explain this process in 4 points.
3. What are the differences between flexography and gravure printing?
4. Explain how the screen is made for screen printing.
5. Now explain the process of screen printing.

3.1d Casting

1. Name the 2 types of die casting processes.
2. Explain the differences between the 2.
3. Explain how the drag and cope differ in sand casting.
4. Explain how the drag is made in sand casting.
5. What are 2 disadvantages of sand casting?
6. Explain the process of investment casting in 6 points.
7. Explain the process resin casting, as well as a disadvantage of it.
8. Explain the process of Plaster of Paris casting, as well as an advantage.

3.1e Machining

1. What is the difference between routing and milling?
2. Explain how you'd mill a hole into a flat sheet of material.
3. Explain how you'd curve an edge on a piece of material, using a router.
4. Name all 5 different drill bits and their uses.
5. Explain the process of turning, using the centre lathe. Use a diagram of a lathe to help explain, add key labels.
6. Explain the process of turning, using the wooden lathe. Use a diagram of a lathe to help explain, add key labels.
7. What is the difference between stamping and pressing?

Half Term 3

If you **RED** or **AMBER** sections, make a note of the specific bits which you are struggling with.

Topics	Key Concepts	R	A	G
3.1f Moulding	Processes, applications, characteristics, advantages and disadvantages of the following moulding processes: a) blow moulding b) injection moulding c) rotational moulding d) vacuum forming e) extrusion			
3.1g Lamination	Processes, applications, characteristics, advantages and disadvantages of the following process: a) lamination			
3.1h Marking out techniques	To understand the different tools used for marking out on the following materials: a) woods b) metals c) polymers			
3.2 Specialist tools and equipment	Application of specialist measuring tools and equipment to determine and apply the accuracy and precision required for products to perform as intended: a) marking, cutting and mortise gauges b) odd leg, internal and external callipers c) squares: set, engineer, mitre, try d) micrometer and vernier callipers e) densitometer f) dividers g) jigs and fixtures h) go and no-go gauges			

Revision Questions:

3.1f Moulding

- For the following processes, draw the diagrams and then write down how they work in 4 points:

- Injection moulding
- Blow moulding
- Rotational moulding
- Vacuum forming
- Extrusion

2. Write down the advantages and disadvantages for each process.

3.1g Lamination

1. Explain the process of lamination in 4-6 points.
2. Explain the advantages of lamination.
3. Explain disadvantages of lamination.

3.1h Marking out techniques

1. Write down the specific functions, and materials they're used on, for the following tools:
 - Sliding bevel
 - Template
 - Set square
 - Spring dividers
 - Odd leg callipers
 - Circle template
 - Carpenters rule
 - Marking gauge
 - Centre punch

3.2 Specialist tools and equipment

1. Write down the specific functions for the following tools:
 - Cutting gauge
 - Internal/external callipers
 - Engineers square
 - Micrometer
 - Vernier callipers
 - Go and no-go gauges
 - Densitometer
 - Jigs
 - Fixtures

Half Term 4

If you **RED** or **AMBER** sections, make a note of the specific bits which you are struggling with.

Topics	Key Concepts	R	A	G
3.3 Communication techniques	<i>Use of media to convey design decisions, explain and communicate information and ideas using the following methods and techniques:</i> a) 3D forms: isometric, 2-point perspective b) working drawings: 3rd angle orthographic projection, triangulation c) nets d) translation between working drawings, pictorial drawings and nets e) report writing			
3.4 Permanent and semi-permanent joining techniques	<i>Uses, characteristics, advantages and disadvantages of the following permanent and semi-permanent joining techniques in order to discriminate between them, select appropriately and use safely:</i> a) adhesives: contact adhesive, acrylic cement, epoxy resin, PVA, hot melt glue, superglue, polystyrene cement b) mechanical: screws, nuts, bolts, washers, rivets, press c) heat: oxyacetylene welding, MIG welding, brazing, hard soldering, soft soldering d) jointing: traditional wood joints, knock-down fittings			
3.5 Finishing techniques	<i>Application, advantages and disadvantages of the following finishing techniques:</i> a) finishes: paints, varnishes, sealants, preservatives, anodising, electro-plating, powder coating, oil coating, galvanisation, cathodic protection b) paper and board finishing process – laminating, varnishing, hot foil blocking, embossing			

Revision Questions:

3.3 Communication techniques

1. Explain how isometric and oblique drawing differ.
2. Why is perspective drawing used the most by designers?
3. What are the reasons for using orthographic drawings?
4. What is report writing? When and why is it carried out?

Remember, you need to be able to draw in these styles, so it is worth practicing your drawing skills as part of your revision!

3.4 Permanent and semi-permanent joining techniques

1. List the 7 different types of adhesives and what they glue together.
2. Explain how each glue is applied to materials.
3. What is the purpose of a washer?
4. Explain how different rivets are applied to metal.
5. Explain how oxyacetylene welding work in 4 bullet points.
6. Explain how MIG welding works in 6 bullet points.
7. Explain the process of brazing in 4 bullet points.
8. What is the difference between hard and soft soldering?
9. What are KD fittings? What is their main function?
10. Name all of the different woodwork joints and name the tools used to mark them out and produce them.

3.5 Finishing techniques

1. List the different paints and what materials they are used on.
2. Which material is varnish and preservatives used on? Which one is for outdoor use?
3. What material is sealant used on?
4. Which metal is anodizing used on?
5. Explain the process of anodizing in 4 bullet points.
6. Explain the process electroplating in 4 points.
7. Explain the process powder coating in 4 points.
8. Explain the process of oil coating and why it is used.
9. What is the difference cathodic protection and galvanic cathodic protection?
10. What is the difference between embossing and debossing?
11. Explain the process hot foil blocking in 4 bullet points.
12. What are the reasons for applying finishes to materials?

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Topics	Key Concepts	R	A	G
4.1 CAD/CAM	<i>Understand the advantages and disadvantages of the following technologies:</i> a) computer-aided design (CAD): 2D and 3D design to create and modify designs and create simulations, 3D modelling for creating 'virtual' products b) computer-aided manufacture (CAM) and rapid prototyping: CNC lathes, CNC routers, CNC milling machine, CNC laser, CNC vinyl cutters, rapid prototyping			
5.1 User centred design	<i>The importance and influence of user centred design in ensuring products are fit-for-purpose and meet the criteria of specifications in relation to:</i> a) user needs, wants and values b) purpose c) functionality d) innovation e) authenticity			
5.2 Ergonomics and anthropometrics	<i>Principles, applications and the influence on design of anthropometrics and ergonomics:</i> a) sources and applications of anthropometric data b) ergonomic factors for a designer to consider when developing products and environments with which humans react			
5.3 Form vs. function	<i>The influence of aesthetics, ergonomics and anthropometrics on the design, development and manufacture of products:</i> a) form over function b) form follows function			

Revision Questions:

4.1 CAD/CAM

1. Write down as many advantages of using CAD as you can think of.
2. Write down as many advantages of using CAM as you can think of.
3. What are the main disadvantages of using CAD/CAM?
4. What do the letters CNC stand for and what does it refer to?
5. What is rapid prototyping and what are the advantages of using it?

5.1 User centred design

1. What does user centred design mean? Explain it as fully as possible.
2. What are the advantages of incorporating user centred design into your products?
3. What are the disadvantages of user centred design?
4. How does authenticity and innovation link to user centred design?

5.2 Ergonomics and anthropometrics

1. What do they both mean and how do they interlink together?
2. Where can you find accurate anthropometric data?
3. What is the difference between qualitative and quantitative data?
4. Draw the percentile diagram and explain how designers use it.
5. Is anthropometric data the same across the world?

5.3 Form vs. function

1. What is the difference between the words form and function?
2. What is the difference between 'form over function' and 'form follows function'?
3. Why is it important for a designer to understand their target market when designing and developing their products?
4. What was the name of the kettle which was removed from production, designed by Phillippe Starck?
5. Why was it removed from production?

If you **RED** or **AMBER** sections, make a note of the specific bits which you are struggling with.

Topics	Key Concepts	R	A	G
5.4 Design movements	<i>Design theory through the influences and methods of the following key historical movements and figures:</i> a) Arts and Crafts – William Morris b) Art Nouveau – Charles Rennie Mackintosh c) Bauhaus Modernist – Marianne Brandt d) Art Deco – Eileen Gray e) Post Modernism – Philippe Starck f) Streamlining – Raymond Lowey g) Memphis – Ettore Sottsass			
6.1 Technological developments	<i>Current and historical technological developments that have had an effect on the work of designers and technologists and their social, moral and ethical impacts:</i> a) mass production: the consumer society, built-in obsolescence, the effect mass production has on employment b) the 'new' industrial age of high-technology production: computers and the development and manufacture of products, miniaturisation of products and components, the use of smart materials, products from innovative applications c) the global marketplace: multinational companies in developed and developing countries, manufacturing 'offshore' in developing countries and local and global production			

Revision Questions:

5.4 Design movements

1. Write down as many trends as you can think of for the following design movements:
 - Arts and crafts
 - Art Nouveau
 - Bauhaus
 - Art Deco
 - Streamlining
 - Post-Modernism
2. Write down the key designer for each design movement.
3. What are the reasons for design movements to change? What triggers them?

6.1 Technological developments

1. What were the main changes to occur post Industrial Revolution?
2. What is a throw away culture?
3. What is mass consumerism?
4. What is built in obsolescence?
5. What are the advantages for the consumer and the manufacturer?
6. What are the disadvantages of built in obsolescence?
7. How has miniaturisation effected products nowadays?
8. What is a multinational company?
9. Define manufacturing offshore.
10. What are the advantages of this?