West Kirby Grammar School

Curriculum Map – A-Level – Product Design (2022-23)

Topic Name	Term	Knowledge/Skills Developed	Other Notes	Next steps / prior knowledge
Materials and applications (1) Classification of materials	YEAR 12	Become familiar with a wide range of specific materials and their uses. Be able to identify the classification or group to which they belong.	**Starter** Explore existing knowledge of material classifications. Use the familiar materials from the GCSE specifications. Introduce the combining of core technical principles from GCSE at A-level. **Activities** ● Investigate classifications of materials –Using a collection of product images; match the product to the correct material. ● Using the correct product and material, categorise further into the appropriate classification group. ● Establish definitions of mechanical and physical properties.	Introduce material sample boxes
Investigating and testing materials		Have knowledge of a range of comparative workshop tests.	**Starter** Recall activity using materials from week 1 – mini whiteboard Q and A. Using new images identify material/classification and relevant property. **Activities** ● Students can design and perform their own workshop tests on a range of materials. ● Predict the results before testing and compare with the results of the samples tested. ● Recalling definitions of mechanical and physical properties from week 1 and using the first-hand knowledge gained from testing, identify products that exemplify the property. ● Videos of laboratory material testing are available online and can be used to compare the processes to the equivalent workshop tests.	Practical material testing- link to NEA (primary research). This may take a few lessons.

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<u>Performance characteristics of materials (2)</u> Papers and boards • watercolour paper painting • composites • tungsten carbide • concrete, including reinforced concrete • fibre cement.		Have knowledge of specific papers and boards along with their performance characteristics. Understand how they can be shaped and formed and how detail can be added through a range of printing techniques. Understand that materials can be combined to produce an enhanced material. Be able to explain and identify the suitability of composites for a given application.	**Activities** • Investigate paper and board products and identify the material used by its appearance and suitability for use. • Disassemble a series of cardboard packages to identify the different nets used. Using a paper and board handling collection, get students to record individual materials and properties. • Explore Avento CFRP Helmets. Make notes on the stages of production.	Practical workshop tasks- shaping materials. Link to NEA primary research.
Performance characteristics of materials • Polymer based sheet and film • Biodegradable Polymers		Have knowledge of specific polymer based sheet and film along with their performance characteristics. Be able to justify their use in a range of different applications. Be able to explain and identify the suitability of biodegradable polymers for a given application.	**Starter** Recall activity using materials from week 3 – mini whiteboard Q and A. Using product images identify the correct paper or board and composite used. **Activities** • Investigate a range of polymer-based sheets and explore their ability to be shaped, joined and finished. • Explore the rise of biodegradable packaging and research both the positive and negative arguments. • Compare a biodegradable cup with a polymer equivalent – draw conclusions about the environmental impact.	Demo strip heater and vac form.

		Understand how biodegradable polymers degrade.	• Compare a water-soluble detergent sachet with a more traditional packaged version – draw conclusions about their benefits to the consumer.	
Performance characteristics of materials • Woods • Smart and modern materials • planed all round (PAR) • timber mouldings • steam bending • machining qualities • moisture resistance • toxicity		Understand the term stock forms and be familiar with timber conversion. Have knowledge of timbers and their performance characteristics. Be able to explain and identify the suitability of a range of timbers for a given application. Understand the term smart material and be able to explain their suitability for a given application. • Be able to identify how the material responds to changes in external stimuli.	**Starter** Recall activity using materials from week 4 – Introduce an exam style question covering biodegradable polymers. Go through a model answer or mark scheme. **Activities** • Visit a local timber merchant to see the range of stock sizes of timber available. • Using a hardwood/softwood and manufactured board, select three relevant products and illustrate the journey from source through to manufacturing. • Research the steam bending process used to produce components parts of a Windsor chair. This can be demonstrated in the workshop if a steam chamber is available. Can be linked to material testing to illustrate the change in material characteristics. • Using a flexible thermochromic thermometer, produce a themed product for a baby's nursery. • Complete a prepared worksheet as a revision aid – 'Smart Materials and their uses'. Categorise those that react to changes in light, temperature and pressure	Introduce past paper questions

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Performance characteristics of materials Metals • H beam • I beam • thermal conductivity • electrical conductivity • melting points • cast iron • gold • titanium • brass • duralumin • pewter.		Understand the range of stock forms of metal. Be able to describe the performance characteristics of metal. Be familiar with a range of specific metals from the classifications: • ferrous • non-ferrous • ferrous alloys • non-ferrous alloys.	**Starter** Recall activity using materials from week 5 – mini whiteboard Q and A. Using product images identify the correct 'smart' material for a given application. **Activities** • Using the classifications of ferrous metals and ferrous alloys, identify products in the department that are manufactured from each. Investigate the desirable properties required that make the material suitable. • Gain practical familiarity of the properties and aesthetics through a product handling collection of metals products. • Record images of the products and materials; Research the original source material, working properties and characteristics. Compile these into a power point presentation.	HW task- ordering in stock forms (link research to NEA)
Performance characteristics of materials Polymers Melting points		Understand the range of stock forms of polymers. Be able to describe the performance characteristics of polymers. Be familiar with a range of specific polymers from the classifications: • thermoplastic • thermosets.	**Starter** Recall activity using materials from week 6 – introduce an exam style question covering the classification of metals. Go through a model answer or mark scheme. **Activities** • Introduce the SPI codes. • Using a product handling collection of polymer products identify the polymer used by the SPI resin identification codes. • Record images of the products and SPI codes; identify the polymer its working properties and characteristics. Compile these in a power point presentation. **New topic preparation**	Continuous design task (acrylic/strip heater). Link to iconic designers and biomorphic design. Show previous example (A*)

			In preparation for moving into Design and Making principles and to support the initial launch and delivery of the NEA, students should use the half term break to read around the subject and develop knowledge of product design in wider society. Websites such as yankodesign.com, dexeen.com/ or dexigner.com could provide insight.	
Enhancement of materials (3) • Polymer enhancement • Wood enhancement • Metal enhancement		Understand the range of enhancement methods used on materials. Understand how additives can be used to enhance polymers in use and disposal. Understand how wood can be enhanced to improve strength and aesthetics. Understand how heat treatment can be used to enhance the properties of metals	**Starter** Recall activity using materials from week 16 – mini whiteboard Q and A. Using measuring tool images, identify their correct use. **Activities** • Walk around the school grounds and identify polymers that have degraded due to exposure to UV. Focus on outdoor seating, polymer rubbish bins etc. Notice the discolouration and brittleness. • Produce a document that provides both the positive and negative arguments for the use of bio batch additives in polymers. • Issue students with a range of 30x30 plywood samples. Apply available finishes to the test pieces and compare their method of application, aesthetics and durability. Photograph the results and annotate. • Practical demonstration or focused task. Using some small low carbon steel samples heat treat using the brazing hearth to harden. Compare hardness vs an untreated piece by cutting or filing. Temper a sample and note the tempering colours **Homework/independent study** Issue students with supplementary information on forming, redistribution and addition processes (papers and boards – wood processes) or refer them to an AQA approved textbook – read and explore the content for the next lesson.	Past paper questions on enhancement and finishing techniques.

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Processes (4&5) • Paper and board forming processes • Wood processes Introduce joining methods, adhesives and fixings along with the use of jigs and fixtures where appropriate Wood processes: • coach bolts • milling.		Understand the methods that can be used to shape paper and board. Understand the methods that can be used to join and fabricate wood and wooden products. Understand the methods used to shape wood into 3D products.	**Starter** Recall activity using materials from week 17– mini whiteboard Q and A. Connect the correct surface finish for timber with a given situation eg preservatives for timber fencing. **Activities** • Redesign the cardboard packaging for a small product of their choice. This can be combined with a small modelling task in Styrofoam. • Focus on developing a full size laser cut net eg a Christmas cracker or small gift box. • Introduce calculating area and material costing along with efficient use of material and tessellation. • Add graphics and labelling using markers or CAD • Create an embossing die using a 3D printer. • Product disassembly – explore the knock down fittings and materials used in a small piece of IKEA furniture. • Practical task – Manufacture a simple Styrofoam mould to produce a laminated salad server **Homework/independent study** Visit the British Plastics Federation website Plastipedia and study the animations of the polymer manufacturing processes.	Flipped learning- wastage, reforming and redistribution techniques (AQA textbook)
• Polymer processes • Introduce joining methods, adhesives and fixings along with the use of jigs and fixtures		Understand the methods that can be used to shape polymers into 3D products. Be able to identify and explain the forming methods used to produce a specific product.	**Starter** Recall activity using materials from week 18, Students should provide commentary to the animations found on Plastipedia or equivalent source. **Activities** • Using a polymer product handling collection identify features that indicate the moulding process used eg ejector pin marks/mould lines, living hinges	3D modelling task- Sketchup and 3D print model. Link to NEA.

where appropriate		Understand how scales of production influence the choice of polymer process.	• Produce a small vacuum form moulding. Explore draft angles and understand the limitations of the process. • Practical demonstration – Using two halves of a vacuum form moulding and a quick setting liquid resin, demonstrate the concept of rotational moulding. • Practical task – Using a low metal glue gun to simulate injection moulding. The mould can be manufactured from acrylic on a laser cutter or thin plywood sandwiched between two outers. **Homework/independent study** Using online sources study the animations of the metal manufacturing processes.	
• Metal processes • Introduce joining methods, adhesives and fixings along with the use of jigs and fixtures where appropriate • cupping • deep drawing • investment casting • mig welding • tig welding • spot welding • oxy- acetylene welding • machine screws • flame cutting		Understand the methods that can be used to shape metals into 3D products. Be aware of the permanent and temporary joining methods that can be for metal. Understand the wastage processes that can be used to shape metal.	**Starter** Recall activity using materials from week 19, Students should provide commentary to the animations found online. **Activities** • Using a metal product handling collection identify the most appropriate manufacturing process used. • Compare the processes spinning and press forming. Both can be used to produce similar outcomes, but why is one chosen of the other for certain applications? • Practical task - using a low temperature casting system. Design and manufacture a key ring or piece of jewellery from pewter. • Practical demonstration. Use a series of standard samples of aluminium to illustrate the range of mechanical fastenings available.	Flipped learning (Metals section of AQA textbook).

• plasma cutting • laser cutting.				
<u>The use of finishes (6)</u> • Paper and board finishing Paper and board printing processes		Understand how papers and boards can be finished to improve their function, performance and aesthetic. Be aware of the printing processes that can be used and their suitability for specific products and scales of production.	**Starter** **Group discussion:** Explore the base knowledge around the topic of finishes for paper and board**.** Use a prepared slide of keywords for students to try and define or link. This will be particularly important for students that have not specialised in this area at GCSE. **Activities** • Using a paper and board handling collection, identify the use of techniques such as embossing and spot varnishing on gift cards packaging and promotional material. • Create a resource or powerpoint that illustrates the finishes, their function and the method of production or application. • Explore online to see practical examples of the printing processes.	HW task- research packaging
The use of finishes. Polymer finishing A-level additional content: • acrylic spray paints • thermoplastic elastomer • metal finishing • sealants • preservatives		Understand how polymers, metals and woods can be finished to improve their function, performance and aesthetic. Be aware that some polymers are self-finishing. Be aware that finishes on wood can be aesthetic and also help prevent decay.	**Starter** **Group discussion:** Explore the base knowledge around the topic of finishes for polymers, metals and woods. Use a pre-prepared slide of keywords for students to try and define and connect the finish to the correct material. **Activities** • Walk around your school site and identify a range of finishes used in outdoor products. Photograph the object and research how the finish has been applied and explain how it protects the base material eg galvanised school fencing	Feedback from school site task.

• anodising • plating • coating • cathodic protection • wood finishing • colour wash			• Explore online sources to see practical examples of the powder coating process. • Practical demonstration – use a fluidising tank or powdered polythene to demonstrate the process of dip coating.	
YEAR 12 **TEST 1** **UNITS 1-6**				
Modern and industrial commercial practice **Scales of production (7)** • unit production systems (UPS) • quick response manufacturing (QRM) • vertical in house production • the use of computer system • modular cell production		Be aware of the different scales of production and be able to provide specific examples to illustrate each. Understand how computer systems are used in production/distribution and storage. Understand JIT and QRM.	**Starter** **Group discussion:** Explore the base knowledge around the topic of scales of production**.** mini whiteboard Q and A. Define the terms one-off, bespoke, batch and mass/line production. Illustrate each with a range of appropriate examples. Complete a prepared worksheet with the comments from the class. **Activities** • Watch Life of a bolt – Red Bull racing. What are the pros and cons of this system against the company using a standard bought in component? • Watch How it's made – steel and aluminium • Case study – the manufacture of Morgan cars, BMW Mini, Tesla. Research the three manufactures and make note of the different scales of production? How much automation takes place? How do the manufacturing processes differ? • Research companies that make use of the JIT production system. What flexibility does it offer the manufacturer? What are the risks? **Homework/independent study**	Feedback from case study task.

• flexible manufacturing systems • sub assembly			How has CAD changed the work of a product designer? What came before?	
Digital design and manufacture (8) A-level additional content: • CAD in industrial applications • virtual modelling • rapid prototyping • electronic data exchange • production, planning and control networking (PPC).		Be aware of the role of CAD, its advantages and disadvantages. Understand how it can be used to develop and present work in 2D and 3D. Be aware of how virtual simulation can be used. Be aware of the role of CAM, its advantages and disadvantages.	**Starter** **Group discussion:** Explore the base knowledge around the topic of CAD and CAM. mini whiteboard Q and A. Define the term CAD and CAM and generate an extensive list of the advantages and disadvantages of both. **Activities** • Using a 3D CAD package produce a visual representation of the candidate's final NEA piece. • Generate or create a dimensioned orthographic or assembly drawing of the Students NEA piece. • Practical task – Produce a small design manually and then again using CAM. Compare the two processes, considering speed, accuracy, quality etc.	Link CAD activity to NEA. Ensure CAD/CAM example is included in NEA.
The requirements for product design and development Product development and improvement		Be able to critically analyse existing products and develop new design proposals. Understand how products need to meet	**Group discussion:** mini whiteboard Q and A. Using an object from one of the product handling collections, generate criteria that could have been used by the original design team. How well does the product perform? Could its performance or aesthetic be improved? **Activities**	ACCESS FM task. Link to NEA research.

• fitness for purpose • accuracy of production • consideration of aesthetics, ergonomics and anthropometrics		specification criteria and be fit for purpose.	• Case study – evaluate the success of a design specification: the 2CV. Research the original design specification of the 2CV and see how well the first version met its requirements. • Group work – using an object in the classroom or a familiar product, critically analyse and suggest improvements. Compare the findings of the group. • Link the assessment of an existing product to the critical evaluation of the final NEA outcomes of the group. Use this third party feedback to suggest improvements to the NEA prototype. **Homework/independent study** Identify safety warnings and symbols that are found on domestic products.	
Health and safety (9)		Be aware of safe working practices, the legislation and agencies responsible for health and safety. Be able to identify and take precautions to limit the potential hazards in a school workshop. Understand the legislation set out to protect consumers.	**Group discussion:** mini whiteboard Q and A. Using a pre prepared slide of symbols and health and safety markings, discuss as group what they represent and identify specific products where they may be found. Complete a prepared worksheet for future reference. **Activities** • Gather a range of products from the workshop that displays a COSHH hazard symbol. Use the Internet to research the accompanying data sheet. • Generate a risk assessment for one of the processes that they have used in the manufacture of their NEA eg use of a centre lathe or handheld router.	Discuss H&S in dept (COSHH).
Intellectual Property (10)		Be aware of and able to explain the importance of: copyright, design rights, patents · registered designs, trademarks and logos.	**Starter** Test existing knowledge and understanding – mini whiteboard Q and A. Who owns an idea? What is it important to protect designs? How can this be done? Group challenge – Using one of the many logo apps. How many logos can the group recognise. What factors make them instantly recognisable?	

			Activities Create a resource that provides information on the main types of intellectual property rights. Using an example product, illustrate how each can be applied. · Visit espacenet.com or the website of the intellectual property office and explore the database of existing patents. · Research the significant patent battles by companies such as Dyson, Apple and Trunki. How have the companies protected their designs.	
Maintenance, repair, disposal, feasibility (11) • Manufacture • Repair • Disposal • reduction in the number of manufacturing processes • maintenance • ease of manufacture • disassembly.		Be aware of how the choice of material affects the use, care and disposal of products. Be aware of how products can be designed to be easy to disassemble and materials labelled to aid separation. Understand the six Rs of sustainability.	**Starter** Recall activity using materials from week 26 – mini whiteboard Q and A. Define COSHH, what legislation exists to protect consumers? **Activities** • Using a bicycle, identify the components that can be maintained and those that are disposed at the end of life. Identify how the designer has considered maintenance. What are the advantages and disadvantages to the user? • Research how bamboo and PLA have been used in products as more eco-friendly material alternative. • Dissemble a small product such as torch or small radio. How easy is it to disassemble? Has any thought been given to maintenance? Are there any mouldings or fixtures that have been used to reduce the amount of components or to aid assembly?	IKEA flat pack task. Record and include in NEA research. This may take a few lessons.
Enterprise, marketing, design communication (12) • global marketing • costings and profit • entrepreneurs.		Be aware of the importance of marketing and brand identity.	**Starter** Recall activity using materials from week 26 – mini whiteboard Q and A. Define the six Rs of sustainability. **Activities** • Develop a new product concept that could be launched by an established brand. The product should display a clear brand identity and be instantly recognisable eg a new digital concept for Crayola. The next product in the household range from Joseph Joseph. Explore recent degree show booklets from product design schools to gain inspiration. This could also provide valuable UCAS research.	Present new product concept.

Design communication		Be aware of a range of communication and presentation techniques used for conveying design proposals to clients.	**Starter** Recall activity using materials from week 26 – mini whiteboard Q and A. Define the six Rs of sustainability. **Activities** ● Produce of series of promotion product boards using their NEA outcome to present to potential clients or users. Use a range of media to enhance the presentation. ● Introduce the maths skills needed to interpret graphs tables and charts. **Revision preparation** Issue students with a checklist of the specification content for them to self-assess their knowledge. RAG rate the content, this can then be used to fine tune the remaining lessons in the build-up to the external exam.	Rendering technique lessons (recap and build on GCSE skills).
YEAR 12 **TEST 2** **UNITS 7-12**				
Design methods and processes (1) ● The use of a design process	YEAR 13	Be aware of and be able to discuss and implement a range of design processes.	**Starter** Recap the material from the first year and develop depth. **Group discussion:** Using their visual image boards students should discuss the development process of their chosen project. What decision did they take that influenced the outcome? How had the investigation that they had undertaken influence their final prototype?	Iterative design process NEA. Client centred design.

• Design processes used in the NEA		Be aware of the stages of the design process used in the NEA. Be aware of and able to discuss and demonstrate the development of a prototype from a design proposal.	**Activities** • Link to A-level NEA – Explore strategies to determine the needs of the client, target market or user. • Undertake a meeting or consult user groups to identify key requirements needed to be able to generate a design specification. What does the prototype need to do, are there any specific performance requirements it must meet? • Research any standards or guidelines that the prototype must meet. British standards, safety standards etc. • In small groups undertake the De Bono thinking hats exercise. Each coloured hat analyses a design concept from a different viewpoint. How can the discussion help develop a product or idea. **Homework/independent study** In preparation for covering collaborative working. Students should individually generate a series of initial ideas for a simple design task such as measuring children or hanging clothes.	
Design processes Iterative design in commercial contexts		Be aware of and be able to discuss and implement a range of design processes. Understand how different design methodologies are used by designers in the corporate world including, collaborative working and the cyclic nature of commercial design and manufacture.	**Starter** Recap the material from the first year and develop depth. **Group discussion:** What are the potential issues when designing in isolation? What opportunities may collaborative design offer a designer? **Activities** • Using the child measuring brief or clothes hanger, individuals should present their ideas. Record the variety of different approaches, materials, and designs created. Are there any common features across the group? • Building on the group exercise, explore the methodology of collaborative design. Generate a range of initial concepts for their NEA, present to the group and gain feedback and inspiration to further develop areas such as aesthetics, function and materials.	Present findings.

			Homework/independent study In preparation for covering **design theory**, allocate a different design movement to members of the group. Issue students with supplementary information on **design movements** or refer them to an AQA approved textbook – read and explore the content for the next lesson.	
Design theory **Design styles and movements (2)**		Be aware of the key historical design styles, design movements and influential designers and the role they played in shaping product design and manufacture.	**Starter** Recap the material from the first year and develop depth. **Individual presentation:** Members of the group can begin the lesson with a short overview of their chosen design movement. Dates, key figures, styles etc. **Activities** ● Develop greater depth of knowledge of key design styles or movements ● Produce a display board that focuses on the iconic products produced, materials and manufacturing processes used, and key features that contribute to each style or movement. **Homework/independent study** Students will need to be taught how this information will be recalled and used in the written paper. Introduce a sample question for students to research in an open book exercise. Using an appropriate product example, explain how it conforms to the design theory of form follows function. In their answer, they should reference a specific design movement.	The Genius of Design DVD. Link to NEA research cycle and design in the style of cycle 2. This may take a few lessons.
Design theory Design styles and movements		Be aware of the key historical design styles, design movements and influential designers and the role they	**Starter** **Worked question example:** Members of the group can begin the lesson contributing to create an essay plan or mind map around the material to answer the question. Mark scheme can be found in specimen paper 2 (Q3)	Dieter Rams NEA page. Students apply ten principles of good design to their own design. Show A* examples.

		played in shaping product design and manufacture.	**Activities** ● Focusing on 'Dieter Rams' 10 principles for good design. Identify iconic products that meet some of the principles. ● Compare the work of Dieter Rams and Jonathon Ives. Can they find any similarities? There are several resources that can be found online to help illustrate the work of Dieter Rams and Ives.	
Design theory ● Design influences ● Designers and their work		Be aware of the key historical design styles, design movements and influential designers and the role they played in shaping product design and manufacture.	**Starter** Recall activity using materials from week 8 – mini whiteboard Q and A. Define ergonomics and anthropometrics and explain how designers make use of each. **Activities** ● Using a range of iconic design products, identify the elements, materials or features that are synonymous with a range of design movements eg the sunburst element for Art Deco. ● Create a timeline illustrating the major design movements of the 20th century. ● In groups research the iconic pieces or products that are attributed to a particular designer. What makes them iconic? Display the images on a 'hot or not' board, students should explain their arguments for or against. ● Focusing on Dieter Rams' 10 principles for good design. Identify iconic products that meet some of the principles. ● Compare the work of Dieter Rams and Jonathon Ives. Can they find any similarities?	HW- famous designer research task- link to NEA.

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How technology and cultural changes can impact design (3) • Socio economic influences • Major developments in technology • Social, moral and ethical issues, Product life cycle		Understand how socio economic influences have helped shape product design and manufacture. Be able to discuss how major developments in technology have shaped product design and manufacture. Be aware of social, moral and ethical responsibilities of a designer.	**Starter** **Group discussion:** What has been the biggest factor or development in technology that has taken place in the last 20 years? **Activities** • Group work – Allocate a decade to members of the class. Research and produce a presentation to cover the major technological advancements that took place during that period. Link these to prominent designers or products. • Focus on a particular product and document its development over time eg the torch – covering batteries, bulbs, micro-electronics etc. • Investigate how manufacturing methods and material development have influenced the production of a piece of sports equipment eg The tennis racket or the bicycle. • Define and illustrate the six Rs of sustainability. Explore how sustainable materials are being used as replacements for more traditional materials eg bamboo and recycled rubber.	Students to present findings to the rest of the class.
Social, ethical, Product Life Cycle (4)		Understand how socio economic influences have helped shape product design and manufacture. Be able to discuss how major developments in technology have shaped product design and manufacture. Be aware of social, moral and ethical responsibilities of a designer. Be familiar with the concept of product lifecycle. Understand how designers refine and re-	**Starter** Recap the material from the first year and develop depth. Using a prepared resource, highlight the major landmark events that helped shaped product design and manufacture. Highlight key dates, new materials and manufacturing processes. **Activities** Develop greater depth of knowledge on developments in technology. Undertake a case study of an electrical product such as a personal stereo or camera, identifying the developments over time. · Using a selection of iconic product images from key movements. Identify common materials, manufacturing processes and finishes. What common features and styles can be identified? Eg chairs · Focus on an area such as micro-electronics. Research and present their findings on how elements of product design and manufacture have changed as the technology has developed. eg – sketching to CAD/destructive testing to FEA. · Research the work of Trevor Bayliss. Explore how his clockwork	

		develop products in the lifecycle of a specific product.	radio was used in South Africa to help spread health information. Paying particular attention to how the specification for the radio was developed from a specific user group. Using the phase, introduction, growth, maturity, decline, illustrate the product lifecycle of a product of their choice.	
YEAR 13 **TEST 1** **UNITS 1-4**				
Design processes (5) • the use of the design process in the NEA • prototype development • iterative design process in industrial or commercial contexts.		Be aware of and able to discuss and implement a range of design processes.	**Starter** In small groups individuals start to generate an idea for a given product. After a certain period of time the designs are passed around and further developed and finally annotated. This can continue until the design arrives back at the start. Variations include adding further specifications as the task takes place eg must be lightweight/used outdoors/methods of construction/materials etc. **Activities** • Using their current project, context or NEA if following the AS course, context, explore how a mood board can be used to help generate ideas for a particular target market. • Case study – Investigate how 'Under Armour' has used generative design in the development of their 3D printed trainer. **Link to NEA** Students should explore alternative methods of idea generation to further develop their NEA. Study the approaches used by the product designer productank.	Collaborative work and group discussions. Encourage students to share their ideas.

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Critical analysis and evaluation (6)		Be able to critically analyse and evaluate the work of others and the student's own project work. Understand how commercial products are tested and evaluated. Be aware of the role of third party feedback in the testing and evaluation process.	**Starter** Group discussion: Why is it important for designers and manufactures to test and evaluate their designs before being launched in the market place? **Activities** ● Critically assess an existing product and suggest developments. Ideally this would be a hands on exercise, but online videos can help provide greater detail if needed. Use criteria such as safety, usability, manufacture. Produce a new product proposal eg Children's seating. ● Case Study: Trunki – Product testing. See the extensive product testing that takes place before a product goes to market, also highlight how user feedback and focus groups have influenced design improvements. A supporting video resource can be found on the STEM website. **Link to NEA** Students should evaluate their initial ideas against their initial design specification. Where possible incorporating third party feedback and the thoughts of their client or user group.	Group work- students present and share their ideas.
Selecting appropriate tools, equipment and processes A-level additional content: ● how designs are developed from single prototype to mass-produced product		Be aware of, discuss and demonstrate good and safe working practice. Understand and be able to identify the correct tools and equipment for a specific task. Understand and be able to identify the most appropriate manufacturing process to realise their or others design proposals.	**Starter** Group discussion: Critical analysis - display an image of a product on the board and gain analysis from the group. If you also have the physical product, students can interact with it and then add to/adjust their initial comments. **Activities** ● Using a range of workshop tools, establish the correct working practice and identify the range of materials with which they can be used. This can be done in a workshop environment or picture cards linking tools and materials could be used. ● 'How it's made' Using either real products or a selection of initial ideas from the groups NEA. Discuss the most appropriate method of manufacture.	HW task- watch how its made and report back to class.

• how scales of production effect the manufacturing process • health and safety in a commercial setting.			• Compare a range of similar tools such as saws and identify which materials could be used with each and what specific action could take place eg hacksaw/coping saw/tenon saw/jig saw/fret saw. What are the pros and cons of each? **Homework/independent study** Issue students with supplementary information on jigs, templates and fixtures or refer them to the textbook – read and explore the content for the next lesson.	
Accuracy in design and manufacture (7)		Be aware of the importance of accuracy in manufacture. Understand how to eliminate errors. Understand how jigs, templates and fixtures can be used to increase accuracy and reduce human error.	**Starter** Recall activity using materials from week 13 – mini whiteboard Q and A. Using tool images, identify its correct use and identify the material that it is intended to be used with. **Activities** Group work – Using a small product such as key ring or coat hook. Produce a one off outcome and then design and manufacture a jig or fixture to improve accuracy. Compare the tolerances of the two outcomes. **Link to NEA** Students should explore the prototype from their NEA and identify any process or component whose accuracy may be improved by the use of a jig, template or fixture.	Demo jig and mould samples (use bag press)
Responsible design (8) • Environmental issues • Conservation of energy and resources • how products are designed to		Be aware of the importance of environmental issues in design and manufacture. Understand the responsibilities in the use of sustainable materials and components.	**Starter** Recall activity using materials from week 14 – mini whiteboard Q and A. What are the definitions of a **template**, **jig** and **fixture**? **Activities** • Analyse the packaging design of a mobile phone or small electronic device. Redesign and develop the packaging to reduce its environmental impact.	Circular economy video clip. Also use Phillippe Starck responsible consumer task.

conserve energy, materials and components • the reuse of material off cuts, chemicals, heat and water.		Be aware of the environmental impact of packaging. Be aware of methods to conserve energy resources and the concept of circular economy.	• Take a product and undertake a study into its environmental impact from raw material extraction, manufacture and disposal. • Critically analyse how a product can be maintained to extend its durability. **Homework/independent study** Research the manufacture of the BMW Mini. Try to identify all of the quality control measures that take place throughout its manufacture.	
Design for manufacture and Project management (9) • Planning for accuracy and efficiency • Quality control • accuracy in scale production • quality assurance • go/no-go gauges, laser scanning and measuring • non-destructive testing.		Be aware of and be able to demonstrate how to plan for accuracy and efficiency. Understand and be able to demonstrate quality control measures.	**Starter** **Group discussion:** List the quality control measures that BMW mini or other car manufacturers use. Watch an MP4 clip and add/clarify any additional detail. Take note of the definitive list. **Activities** • Gather all the measuring devices that are commonly found in a school workshop. Arrange the devices by the level of accuracy that can be achieved when in use eg steel rule, vernier callipers, digital callipers. Demonstrate their correct use and function. • Using a range of measuring devices, analyse a building block from a child's modular kit. Identify the tolerance needed for the blocks to successfully connect. Use a 3D printer and the measurements gained to produce an accurate accessory that will connect to the kit. • The same exercise can be adjusted to cover CAD skills/orthographic drawing and dimensioning.	Practical workshop task to reinforce neatness and accuracy. Compare to CAD/CAM/CNC.

Curriculum Map – A-Level – Product Design (2022-23)

Design for manufacture and project management • Planning for accuracy and efficiency • Quality assurance • Quality control • Go/no-go gauges, laser or probe scanning and measuring Non-destructive testing such as x-rays and ultrasound		Be aware of and be able to demonstrate how to plan for accuracy and efficiency. Understand and be able to demonstrate quality control measures. Be able to clear define both quality control and quality assurance.	**Starter** Recap the material from the first year and develop depth. **Group discussion:** What is quality control and What is quality assurance? What are their key functions and how do they differ? **Activities** • Research the quality assurance system introduce by Motorola in the 1980s. What are the five key stages and how does each help in reducing and minimising defects within a manufacturing process? • Introduce the concept of critical path analysis. Use a familiar process of action (such as making a cup of tea) to help students understand the concept before introducing more challenging processes. • Using a project with which they are familiar, product a critical path analysis diagram to identify the critical path. • Investigate the use of a Go no go gauge and identify why it is used in favour of other measuring devices with which they are familiar? Identify situations where non-destructive testing would be used.	Go no go gauge demo. Students to design and make their own (Sketchup and 3D print). Link to NEA QA and QC.
National and international standards (10) Agencies, BSI/ ISO Legislation, ROHS/WEEE · Eco labelling – mobius loop, EC energy label, FSC		Be aware of and able to discuss the importance of national and international standards in product design.	**Starter** Test existing knowledge and understanding – mini whiteboard Q and A. What national or international standards are the group familiar with? What do they do or why are they important to the consumer or manufacturer? **Activities** Research how BSI standards are applied and tested before a product reached the market place. · Investigate the WEEE directive and explore the measures that companies such as Dyson go to meet the directive. · Explore a range of products in various materials and identify the markings that they carry to indicate the standards that they conform to.	

			Look for Mobius loop markings on polymer products and EC marks or battery directive icons on electrical products.	
YEAR 13 **TEST 2** **UNITS 5-10**				