KS5 Curriculum Map – SUBJECT: Design and Technology – Product Design

Topic	Knowledge *Substantive knowledge*: This is the specific, factual content for the topic, which should be connected into a careful sequence of learning.	Skills *Disciplinary knowledge*: This is the action taken within a particular topic in order to gain substantive knowledge.	Assessment Opportunities What assessments will be used to measure student progress?
Introduction to course	• AQA for A'level Design and Technology • How it's assessed – Product Design	• Technical principles • Paper 1 Written exam: • 2 hours and 30 minutes • 120 marks • 30% of A-level • Designing and making principles • Paper 12 Written exam: 1 hour 30 minutes • 80 marks • 20% of A-level	• **Paper 1** • Questions • Mixture of short answer and extended response • **Paper 2** **Section A:** • Product Analysis: 30 marks • Up to 6 short answer questions based on visual stimulus of product(s). **Section B:** • Commercial manufacture: 50 marks • Mixture of short and extended response questions • Mixture of short answer and extended response questions.

Technical principles	• Materials and their applications	• Physical and mechanical properties (working characteristics) • Product function • Aesthetics • Cost • Manufacture and disposal	• Questions and Answers • Notes from students • Exam style questions • Quiz
Classification of materials	• Metals • Woods • Polymers • Papers and boards • Composites • Smart materials • Modern materials.	• It is important for students to be able to identify the classifications of various materials and provide examples for each category. For example Metals- ferrous, non-ferrous and alloys. Woods -hardwoods, softwoods and manufactured boards. Polymers - thermoplastics, thermoset polymers and elastomers.	• Questions and Answers • Notes from students • Exam style questions • Quiz
Methods for investigating and testing materials	• Tensile strength • Toughness • Hardness • Malleability • Corrosion • Conductivity.	• To gain substantive knowledge students should possess the ability to explain the setup and testing procedures of workshop and industrial tests, as well as articulate the elements that will be tested, measured, and compared.	• Questions and Answers • Notes from students • Exam style questions • Samples
Performance characteristics of papers and boards	• The ability to be scored • Cutting • Folding • Surface qualities for printing • Impact resistance • Recyclability and/or biodegradability	• It is expected that students can explain the performance traits of both papers and boards.	• Questions and Answers • Notes from students • Exam style questions

Papers and boards are suitable for different applications	• Layout paper: sketch pads • Cartridge paper: printing • Tracing paper: copying images • Bleed proof paper: marker rendering • Reated paper: photographic printing • Watercolour paper: painting • Corrugated card: packaging • Bleached card: greeting cards and high quality packaging • Mount board: modelling • Duplex card: food packaging • Foil backed and laminated card: drinks packaging • Metal effect card: gift packaging • Moulded paper pulp: eco-friendly packaging.	• Papers and boards are versatile materials that can be utilized in a wide range of applications due to their diverse properties and characteristics. For instance, paper can be used for printing, packaging, writing, and decoration, while boards can be utilized for product packaging, displays, and signage. • The choice of paper or board for a particular application will depend on various factors, including the desired durability, strength, weight, thickness, texture, and appearance. • The selection process involves evaluating the suitability of different types of paper or board for the intended purpose and the environmental conditions the product will be exposed to. • The material chosen must meet the functional requirements and withstand any stresses or strains it may encounter during its use. Thus, students must possess the ability to identify the appropriate paper or board for a given application.	• Questions and Answers • Notes from students • Exam style questions • Find Samples
Technical principles	• Materials and their applications • Classification of materials • Methods for investigating and testing materials	• To explore and examine materials and conduct experiments on them. Students are expected to be able to name specific materials for a wide range of applications.	• Questions and Answers • Notes from students • Exam style questions • Samples • NEA - Coursework
Performance characteristics of materials	• Performance characteristics of papers and boards • Performance characteristics of polymer based sheet and film • Performance characteristics of woods • Performance characteristics of metals • Performance characteristics of polymers • Elastomers	• It is important to identifying various material types and articulating the performance attributes of papers, boards, polymers, woods, metals, polymers, elastomers, composites, smart materials, and modern materials.	• Questions and Answers • Notes from students • Exam-style questions

Enhancement of materials	• Polymer enhancement • Wood enhancement • Metal enhancement	• It is anticipated that students can detail techniques for improving specific materials and justify their effectiveness for particular product applications.	• Questions and Answers • Notes from students • Exam style questions
Forming, redistribution and addition processes	• Paper and board forming processes • Polymer processes • Metal processes • Wood processes	• It is essential for students to possess knowledge regarding the various methods utilized to shape materials into diverse products.	• Questions and Answers • Notes from students • Exam style questions
The use of finishes	• Paper and board finishes • Paper and board printing processes • Polymer finishes • Metal finishing • Wood finishing	• Students should be aware of how paper and board can be finished to enhance their appearance or improve function. • Students should understand how pigments can be added to polymers in the moulding process, including: gel coats when laminating GRP, smart pigments such as thermochromic or phosphorescent. • Metal finishes: cellulose paint, acrylic paint, electro-plating, dip coating, powder coating, galvanizing, sealants, preservatives, anodizing, plating, coating, cathodic protection	• Questions and Answers • Notes from students • Exam style questions

Modern industrial and commercial practice	• Scales of production • Efficient use of materials • The use of computer systems • Sub-assembly	• All students should understand the various production levels and be able to provide specific manufacturing methods and example products for each scale. • To gain substantive knowledge, students should possess knowledge regarding the implementation of computer systems for planning and controlling manufacturing processes, minimizing waste, and quickly responding to shifts in consumer demand. • Modular/cell production • Just in time (JIT) • Quick response manufacturing (QRM) • Flexible manufacturing systems.	• Questions and Answers • Notes from students • Exam style questions
Digital design and manufacture	• Computer aided design (CAD) • Computer aided manufacture (CAM) • Electronic data interchange • Production, planning and control (PPC) networking • Virtual modelling • Rapid prototyping processes • Electronic data interchange	• It is important to know the pros and cons of utilizing CAD in contrast to manually generated alternatives. Students should be able to apply CAD to generate and showcase product ideas, using 2D CAD for working drawings and 3D CAD for presentation drawings. Additionally, students should understand how CAD is employed in industrial settings. • Students should be aware of, and be able to describe, how CAM is used in the manufacture of products. Specific processes to include: laser cutting, routing, milling, turning, plotter cutting.	• CAD work in projects • Use of CAM in projects • Questions and Answers • Notes from students • Exam style questions
The requirements for product design and development	• Product development and improvement • Inclusive design	• Through the study and critical analysis of existing products, students should develop an understanding of the requirements of: • The design, development and manufacture of products to meet specification criteria • Fitness for purpose	• Questions and Answers • Notes from students • Exam style questions

		• Accuracy of production • How the critical assessment of products can lead to the development of new designs.	
Health and Safety	• Safe working practices • Safety in products and services to the customer	• It is important to be aware of, and able to explain, health and safety procedures related to products and manufacturing, including: • Knowledge of the Health and Safety at Work Act (1974), and how it influences the safe manufacture of products • Control of Substances Hazardous to Health (COSHH) and safety precautions that should be taken with relevant materials • Safe working practices and identifying potential hazards for the school or college workshop and industrial contexts • Safety precautions that should be taken with specific manufacturing processes • The concept of risk assessment and its application to given manufacturing processes. • Skills should be able to explain, how designers and manufacturers ensure products are safe for consumers to use, including: • Legislation used to protect consumers and its impact on product design, eg Consumer Rights Act (2015), Sales of Goods Act (1979) • The British Standards Institute (BSI), and how specific products might be tested to meet safety standards • Measures to ensure the safety of toys, eg Lion Mark • Advice to consumers: • Manufacturer's instructions • Safety warnings • Aftercare advice.	• Questions and Answers • Notes from students • Exam style questions • Quiz

Protecting designs and intellectual property	• Copyright and design rights • Patents • Registered designs • Trademarks • Logos	• It is important to be aware of, and able to explain, the concept of 'open design'. Specifically referring to the development of products for the common good of society, including potential use. Students should be able to give examples of this in practice, eg humanitarian projects and file sharing for 3D printing.	• Questions and Answers • Notes from students • Exam style questions
Design for manufacturing, maintenance, repair and disposal	• Manufacture, repair, maintenance and disposal • Ease of manufacture • Disassembly • Feasibility studies • Enterprise and marketing in the development of products • Design communication	• To have the skill to be aware of, and able to explain, the need to modify designs to make them more efficient to manufacture. Develop skills involve examining if a product concept is practical, cost-effective, and can be manufactured within the given resources and constraints. Students should be able to use various methods used to convey and present design ideas and concepts to stakeholders, such as sketches, renderings, and 3D models.	• Questions and Answers • Notes from students • Exam style questions
Designing and making principles	• Iterative design process	• All students should be aware of, and able to explain, different approaches to user centred design. That in approaching a design challenge there is not a single process, but that good design always addresses many issues.	• NEA – Coursework • Model making • CAD Fusion 360
Design theory	• Design influences • Design styles and movements • Designers and their work	• To possess the ability to engage in discussions about the influence of significant historical design styles, design movements, and designers that have played a vital role in shaping product design and manufacturing.	• Questions and Answers • Notes from students • Exam style questions • Book work

How technology and cultural changes can impact on the work of designers	• Socio economic influences • Major developments in technology • Social, moral and ethical issues	• Students should be aware of, and able to discuss, how socio economic influences have helped to shape product design and manufacture	• Questions and Answers • Notes from students • Exam style questions
Product life cycle	• Design introduction, evolution, growth, maturity, decline and replacement	• To have the skill to be familiar with examples of how designers refine and re-develop products in the lifecycle of specific products.	• Questions and Answers • Notes from students • Exam style questions
3.2.4 Design processes	• The use of a design process • Prototype development • The iterative design process in industrial or commercial contexts	• Students should be aware of, and able to discuss and implement, the stages of a range of design processes in order to apply personal judgement and relevant criteria in the appraisal of products and systems.	• NEA – Coursework • Model making
Critical analysis and evaluation	• Testing and evaluating products in commercial products • Use of third party feedback in the testing and evaluation process	• All students should be aware of, and able to discuss, their own and commercial products leading to possible improvements/modifications of the original idea	• NEA – Coursework • Model making • Notes from students • Questions and Answers
Selecting appropriate tools, equipment and processes	• The importance of using the correct tools and equipment for specific tasks • The importance of ensuring their own safety and that of others when in a workshop situation • How designs are developed from a single prototype into mass produced products • The effect on the manufacturing process that is brought about by the need for batch and mass manufacture • How to select the most appropriate manufacturing process to be able to realise their, or others', design proposals	• Students should be aware of, and able to discuss and demonstrate, good and safe working practices. Evidence with photos, sketches written stages, client feedback and self-evaluation on specific task.	• NEA – Coursework • Model making • Notes from students • Questions and Answers

Accuracy in design and manufacture	• How testing can eliminate errors • the value in the use of measuring aids, eg templates, jigs and fixtures in ensuring consistency of accuracy and the reduction of possible human error.	• It is important to be aware of, and able to discuss and demonstrate, the importance of accuracy in manufacturing, whatever the scale of production.	• Questions and Answers • Notes from students • Exam style questions
Responsible design	• The responsibilities of designers and manufacturers in ensuring products are made from sustainable materials and components • The environmental impact of packaging of products, eg the use of excessive packaging and plastics.	• Areas that will be taught is knowledge about the significance of environmental concerns in design and manufacturing and have the ability to engage in discussions about them. Case study - Polestar Precept • Battery Recycling • Material Recycling • End-of-Life Vehicle • Closed-Loop Recycling	• Questions and Answers • Notes from students • Exam style questions