The Castle School Design & Technology Curriculum Map

Intent:

- ❖ Inspire students through the iterative design and making process.
- ❖ Enable students through creativity and imagination, to design and make products that solve real and relevant problems within a variety of contexts.
- ❖ Equip students with knowledge to evaluate past and present design and technology, and develop a critical understanding of its impact on our daily life and the wider world.
- ❖ Support students to make an essential contribution to the creativity, culture, wealth and well-being of the nation.
- ❖ Enable students to learn how to take risks, becoming safe, resourceful, innovative, enterprising and capable citizens.

"You cannot understand good design if you do not understand people; design is made for people."

DIETER RAMS

KS2 Design and technology Curriculum

Design:

- Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups. Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design

Make:

- Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately. Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities

Evaluate:

- Investigate and analyse a range of existing products. Evaluate their ideas and products their own design criteria and consider the views of others to improve their work Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge:

- Apply their understanding of how to strengthen, stiffen and reinforce more complex structures. Understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages]. Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]. Apply their understanding of computing to program, monitor and control their products.

KS3 Design and technology Curriculum

Design:

- Use research and exploration, such as the study of different cultures, to identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them.
- Develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations. Use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses
- Develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools

Make:

- Select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture
- Select from and use a wider, more complex range of materials, components, taking into account their properties

Evaluate:

- Analyse the work of past and present professionals and others to develop and broaden their understanding. Investigate new and emerging technologies
- Test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups
- Understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists
- Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge:

- Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions
- Understand how more advanced mechanical systems used in their products enable changes in movement and force
- Understand how more advanced electrical and electronic systems can be powered and used in their products [for example, circuits with heat, light, sound and movement as inputs and outputs]
- Apply computing and use electronics to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components

Themes that run through the curriculum

- o Design (communication of ideas)
- ➢ Make (select tools and materials to perform practical tasks)
- ✓ Evaluate (Analyse, evaluate ideas/products, individuals, events and understand how they have shaped the world
- ❖ Technical knowledge (systems, materials, processes, computing)

Year 7	**SoL**: **(Night light)** **Rationale:** Students will learn how to select and use tools to safely perform practical tasks and learn how to make an electrical system turn on and off a light by using an input. **Substantive Knowledge:** ❖ Why is it important to be safe in the workshop? ❖ Why do we need to identify and understand user needs. ❖ How to research and solve their own design problems ➢ How to develop a design solution ❖ How to analyse products using ACCESSFM ❖ Why do designers/manufacturers analyse products? ✓ How to use tools to safely shape, cut and drill. ✓ Sustainable design. Why is this important? ✓ How to use tools to make an electrical circuit ✓ How to evaluate the night light? **Disciplinary Knowledge:** Creating design on card for night light Making night light Analysing night lights Research sustainable design and how products have been designed with the environment in mind. **Disciplinary literacy:** Thermometer, illumination, target market, aesthetics, adhesive, function, product analysis, smart material, coping saw, nibbler, tin snips, curved nose tin snips, abra file, woodwork vice, junior hacksaw, high impact polystyrene, adhesive, strip heater, circuit, bulb holder, solder, soldering iron, battery snap, copper tape, wire strippers, pillar drill, ball hammer, dot punch, files.	**SoL: (Squashed tomato challenge)** **Rationale:** Students will learn about different cultures through exploration and research into the farmers of Nepal. They will build on their knowledge of levers and pullies from KStage 2. They will have the opportunity to test mechanical systems and structural elements to help generate their own system for transporting food to solve a real problem using disciplines learnt in mathematics and science. **Substantive Knowledge:** ❖ What makes a strong structure? ❖ How does an aerial ropeway work? ❖ Why is Nepal good for farming tomatoes? ❖ How to farmers of Nepal live? ❖ What is the difference, between, 1st,2nd and 3rd order levers? ❖ What is a pulley? How does it work? ❖ How can levers change motion? ✓ What is the purpose of a container? ✓ What is a net? Why are nets used to package products? ✓ What makes a good presentation? **Disciplinary Knowledge:** Making structures Process of completing a research into farmers of Nepal. Design own net to hold and transport tomatoes Make a transportation system for transporting tomatoes **Disciplinary literacy:** Cord, string, transportation, subsistence farming, levers, pulleys, effort, load, fulcrum, net.	**SoL: (Design strategies/Key Fob)** **Rationale:** Allows a smooth transistion from primary school and introduces students to skills that can be applied in both KStage 3 & 4 Design & Technology. Students will be able solve their own design problems by using creativity and imagination and use CAD to generate creative ideas. **Substantive Knowledge:** ➢ What is biomimicry, scruffiti & 4x4 ➢ How to use different design approaches to generate creative designs? ➢ How to develop innovative and functional products that responds to different needs ➢ Develop designs using computer based tools (2d Design) ❖ How products can be manufactured using CAM(Computer Aided Manufacture) **Disciplinary Knowledge:** Process of completing design work using creativity and imagination Use of biomimicry, scruffiti and 4x4 to generate ideas Use of literacy for Design and Technology through oracy and in annotation of designs Use of (CAD) 2d Design to create a design Use of laser cutter to manufacture a keyfob **Disciplinary literacy:** Bio morphic, rearrange, eliminate, material, function, substitute, modify, combine, morphing, Scruffiti, CAD (Computer aided Design), CAM (Computer aided Manufacture), laser cutter	**SoL: (Ozobots)** **Rationale:** Students will be able to solve problems using robots within a given context and also understand the impact robots and the use of computers can have on our daily life. **Substantive Knowledge:** ❖ What is a robot? ❖ What is an input/output? ❖ What is track ✓ How to control a robot to fulfil a number of different commands ✓ The benefits and disadvantages of robots and their effect on daily life and the wider world. ❖ Problem solving using a robot **Disciplinary Knowledge:** Test and refine tracks to control a robot to complete a number of different tasks Investigate new and emerging technologies Understand the potential impact the use of robots has on society **Disciplinary literacy:** Programming, input, output, track, logic, robot, applications, industry, coding, ozobot

	Summative assessment: Night light created Booklet of tasks completed linked to night light Extended writing linked sustainable design. What makes the anglepoise lamp a design classic? **Article.** The Anglepoise lamp Design classic: the Anglepoise lamp by George Carwardine | Financial Times (ft.com) Extended writing. What is a Smart material and how does it impact on our lifes? **Article.** Smart materials - Nanoscience and smart materials - GCSE Chemistry (Single Science) Revision - WJEC - BBC Bitesize **Video** Thermochromic & Photochromic Plastics - YouTube **Links to NC:** Identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them Develop and communicate design ideas Select from and use specialist tools, techniques, processes, equipment and machinery precisely Analyse the work of others to develop and broaden their understanding Understand developments in design and technology, its impact on individuals, society and the environment	**Summative assessment:** Structures created, net Presentation - drawing conclusions from the build of transport system for tomatoes. Assess application of disciplinary knowledge to complete tasks Extended writing linked to Gherkin building and Norman Foster. Describe the appearance of the Gherkin building and explain why it is an important building. **Article** The Gherkin Building, 30 St Mary Axe, London | Architecture | Design - Architect Boy **Video** The Gherkin - Sustainable Building Design (UCL IEDE/VEIV) - YouTube **Links to NC:** Research, study of different cultures, identify and understand user needs. Identify and solve their own design problems. Develop and communicate design ideas Select from and use specialist tools, techniques, processes, equipment and machinery Understand how mechanical systems used in their products enable changes in movement and force Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions Understand developments in design and technology, its impact on individuals, society and the environment	**Summative assessment:** Designs created using different strategies Manufactured key fob Extended writing task. Who is Harry Beck? What did he design and why is his concept so successful? Article Harry Beck | London Underground Map Designer | Blue Plaques | English Heritage (english-heritage.org.uk) Video The genius of the London Tube Map | Small Thing Big Idea, a TED series - YouTube **Links to NC:** Use a variety of approaches to generate creative ideas and avoid stereotypical responses Develop and communicate design ideas using annotated sketches.	**Summative assessment:** Booklet of tasks completed by ozobot Extended writing- Discuss the benefits and disadvantages of using robots. Article 45 Unquestionable Advantages and Disadvantages of Robots — Wise, Healthy 'n' Wealthy (wisehealthynwealthy.com) Video Honda's Asimo: the penalty-taking, bar-tending robot - YouTube **Links to NC:** Embed intelligence in products that respond to inputs and control outputs using programmable components. Understand developments in design and technology, its impact on individuals and society

Year 7	**SoL**: **(Bug Hotel)** **Rationale:** Students will learn how insects are important to the sustainability of the planet. They will select and use tools to safely perform practical tasks and learn how to make a personalised bug hotel. **Substantive Knowledge:** ❖ What is a softwood? ❖ What are the characteristics of a softwood? ❖ What is a hardwood ❖ What are the characteristics of a hardwood? ❖ What is a manufactured board? ❖ What are the characteristics of manufactured board? ❖ Types of timber ❖ What is an insect? ❖ What are the 3 major parts of an insect? ❖ Why are insects important to our ecosystem? ❖ Why is important to create habitats for wildlife? ✓ How do insects effect food production? ➢ How to measure, cut and join timber to make a structural and functioning bug hotel ❖ What is the purpose of an Orthographic drawing? **Disciplinary Knowledge:** Using research to help understand insect needs Develop and communicate design ideas for a bug hotel Select and use specialist tools and equipment to manufacture bug hotel **Disciplinary literacy:** Hardwood, softwood, manufactured board, coniferous trees, deciduous trees, durable, eco system, pollination, insect, orthographic drawing, climate change, steel rule, pencil, try square, engineering square, bench hook, woodwork vice, g clamp, tenon saw, mitre saw, orbital sander, vertical sander, wood glue, masking tape, staple gun.			

	Summative assessment: Bug hotel created Booklet of tasks completed linked to bug hotel Extended writing linked sustainable design. What makes the anglepoise lamp a design classic? **Article.** Extended writing. “What is an insect & why are they so important to us? **Article.** ***The importance of insects and providing them with a home*** **Video** **https://www.youtube.com/watch?v=TyLTrejawx4** **Links to NC:** Identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them Develop and communicate design ideas Select from and use specialist tools, techniques, processes, equipment and machinery precisely Understand developments in design and technology, its impact on individuals, society and the environment			

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Evaluate:

- Investigate and analyse a range of existing products. Evaluate their ideas and products their own design criteria and consider the views of others to improve their work Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge:

- Apply their understanding of how to strengthen, stiffen and reinforce more complex structures. Understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages]. Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]. Apply their understanding of computing to program, monitor and control their products.

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- Analyse the work of past and present professionals and others to develop and broaden their understanding. Investigate new and emerging technologies
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Technical knowledge:

- Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions
- Understand how more advanced mechanical systems used in their products enable changes in movement and force
- Understand how more advanced electrical and electronic systems can be powered and used in their products [for example, circuits with heat, light, sound and movement as inputs and outputs]
- Apply computing and use electronics to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components

Themes that run through the curriculum

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Year 8	**Sol**: **(Acrobat toy)** **Rationale:** Students will build upon design and making skills learnt in Year 7. Students will research data linked to the human body to help identify and understand user needs and solve their own design problems. Students will use a variety of tools and materials, taking account of their properties to safely perform practical tasks. They will learn how they can make their toy make changes in movement/force and direction. **Substantive Knowledge:** ✓ Why is it important to be safe in the workshop? ❖ Why do we need to identify and understand user needs. ❖ What is ergonomics and anthropometrics? ❖ How can ergonomic/anthropometric data be help solve design solutions ❖ Why are finishes applied to materials? ❖ How to research and solve their own design problems ➢ How to develop a design solution ✓ How to analyse products using ACCESSFM ❖ Why do designers/manufacturers analyse products? ➢ How to use tools to safely shape, cut and drill handles and acrobat. (Chisels, mortice gauge, surform, spoke shave, drill) ➢ How to make toy make changes in movement/force and direction ✓ How to evaluate the acrobat toy? **Disciplinary Knowledge:** Analysing anthropometric data to help generate a design solution Creating designs for acrobat and handles Making handles and acrobat Research types of finishes, tools and toys **Disciplinary literacy:** Safety, risk, ergonomics, anthropometrics, accuracy, finish, mdf, translate, chopping, paring, pencil, tenon saw, try square, engineers square, mortice gauge, chisel, spoke shave, surform, mallet, G clamp, class paper, fret saw, coping saw, woodwork vice, pillar drill, Pine, standard angle plane, steel rule **Summative assessment:** Booklet of tasks completed linked to acrobat toy. Acrobat toy created Extended writing tasks: 1.Margaret Clavert. What did she design and how did that impact on our daily lives 2. What is ergonomics and how does it effects our lives? Articles Read at Speed: The Work and Legacy of Margaret Calvert (shillingtoneducation.com) Ergonomics and anthropometrics - Considering usability when designing - OCR - GCSE Design and Technology Revision - OCR - BBC Bitesize **Video** Why Ergonomics? | Importance & Benefits of Ergonomic Workplace [LUMI] - YouTube Margaret Calvert: It's about knowing who you are designing for - YouTube	**Sol: (Steady hand game)** **Rationale:** Students will build upon and apply skills learnt in Year 7 to generate ideas and build their own steady hand game. Students will learn how to select and use tools to safely perform practical tasks. They will learn how to form a thermosetting plastic and make an electrical system create an output (sound) from an input (movement). **Substantive Knowledge:** ✓ What is a design brief? How to analyse requirements of a brief? ➢ How to develop a design solution ❖ Why is it important to be safe in the workshop? ❖ What is the difference between a thermosetting and a thermoforming plastic ❖ How to analyse products using ACCESSFM ➢ How to shape HIPS using a mould and vacuum former ❖ How to fix components onto vero board ➢ How to solder components ➢ How to strip wire ➢ How to shape copper wire ➢ How to drill ❖ Why do designers/manufacturers analyse products? ✓ How to test circuits (fault find) **Disciplinary Knowledge:** Analysing a task Fixing components onto vero board & fixing components into case Fault finding with an electrical circuit Bending and shaping wire Vacuum forming case using a mould Research thermosetting and thermo forming plastics **Disciplinary literacy:** Safety, risk, thermoforming plastic, thermosetting, High impact polystyrene, copper, solder, wire, resistor, switch, buzzer, component, accuracy **Summative assessment:** Booklet of tasks completed linked to steady hand game. Steady hand game created Extended writing: 1. electric cars. What are the pros and cons of using an electric car? Read www.topgear.com/car-news/electric/how-green-electric-car-really. **Video** Pros And Cons of Electric Cars-Advantages And Disadvantages Of Electric Cars - YouTube 2. Design companies. Explain what James Dyson has designed and the key design principles that made James Dyson and his company so successful. Read How we made the Dyson vacuum cleaner | Design | The Guardian **Video** Dyson Vacuum History: How One Man Built A Billion Dollar Empire - Bing video

	Links to NC: Identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them Develop and communicate design ideas using annotated sketches Select from and use specialist tools, techniques, processes, equipment and machinery precisely Analyse the work of others to develop and broaden their understanding Understand the properties of materials and the performance of structural elements to achieve functioning solutions Understand how mechanical systems used in their products enable changes in movement and force	**Links to NC:** Identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them Select and use specialist tools, techniques, processes, equipment and machinery precisely Analyse the work of others to develop and broaden their understanding Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions Understand how more advanced electrical and electronic systems can be used in their products [for example, circuits with sound and movement as inputs and outputs]

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- ❖ Technical knowledge (systems, materials, processes, computing)

Year 9	**SoL**: **(Swatch watch)** **Rationale:** Students will be able to apply skills learnt in the Design strategy unit and revisit ergonomics and anthropometrics to help generate ideas for their watches. Students will undertake an investigation into the needs of their potential user. Students will investigate new and emerging technologies and learn about different types of 3d printing and how this can be used to generate prototypes. Students will use PLA to print their products as it's biodegradable. **Substantive Knowledge:** ✓ Why do we need to identify and understand user needs? ❖ What is ergonomics and anthropometrics? ❖ How can ergonomic/anthropometric data be help solve design solutions? ❖ How to research and solve their own design problems ➢ How to develop a design solution ➢ How to use tools to safely shape and cut. ❖ What is 3d printing? What is additive manufacture? ❖ What is the purpose of a questionnaire? ❖ How to create a client profile **Disciplinary Knowledge:** Creating a client profile and taking account the views of users Analysing data linked to the human body Investigate new and emerging technology Make a Swatch watch including the use of CAD/CAM **Disciplinary literacy:** Safety, risk, ergonomics, anthropometrics, dimensions, orthographic drawing, customer/client/user, aesthetics, environment, function, material, 3D printer, additive manufacture, stereolithography, blister packaging, CAD (Computer Aided Design), CAM (Computer Aided Manufacture), safety rule, scapel, accuracy, tessellate, nest.	**SoL**: **(Phone Stand)** **Rationale:** Students will learn how to analyse the work of others to broaden their understanding about how things are manufactured. Students will develop their own design brief and Specification to inform the design of an appealing and commercial product. Students will build upon knowledge in year 7 and use CAD and card modelling to develop a design that can be manufactured using computer based tools. Students will manufacture a highly commercial product using specialist tools and equipment and consider how this could be scaled up using different production methods, (one off, batch, mass and continuous production **Substantive Knowledge:** ❖ What is a design brief? What is a design specification? ➢ Developing designs for Phone Stand. ➢ How to use a laser cutter to cut material. ➢ How to develop a design solution using card modelling ✓ How to analyse products using ACCESSFM ❖ Why do designers/manufacturers analyse products? ➢ How to use tools CAM to manufacture components ❖ How to tesselate and nest shapes ✓ How to test and evaluate a design against a specification ❖ Industrial Practice. Why are different scales of production are used for different products? (One off- Batch, Mass, Continuous Production, JIT **Disciplinary Knowledge:** Creating 3d models from card Analysing existing products Creation of design ideas Creation of working drawing using 2d design Assembling Phone Stand Evaluation and testing **Disciplinary literacy:** Safety, Design Specification, product analysis, aesthetics, client, cost, environment, size, function, material, manufacture, model, prototype, CAD, dimensions, CAM, laser cutter, HIPS, tessellate, nest, safety goggles, one off production, batch production, mass production, continuous production, Just in time.	**SoL**: **(Pendant Project)** **Rationale:** Students will learn how to cast molten metal into a pendant and create a display stand. Students will develop their own design brief and Specification to inform the design of an appealing and commercial product suitable for sale in a jewellery shop. Students will use CAD and CAM to create a design and jig to cast their pendant. This project will enable them to work with metals and plastics and allow them to take account of the properties material during manufacturing **Substantive Knowledge:** ❖ Why is it important to be safe in the workshop? ❖ How to create a Design Specification ❖ How to research and solve their own design problems ➢ How to develop a design solution ➢ How to develop models/prototypes ➢ How to cast, shape and finish metal ➢ How to cast shape and finish plastic ➢ How to use tools to safely shape, cut and drill ✓ How to evaluate against the design specification ✓ How to write a summative evaluation ➢ How to draw in isometric ❖ How to work out costings for a product **Disciplinary Knowledge:** Casting and shaping pendant Creating and shaping a stand for pendant to be hung on. Research existing products Creating an Isometric drawing Working out costings for manufacture Evaluation and testing **Disciplinary literacy:** Safety, risk, casting, jig, accuracy, isometric drawing, cost, design brief, specification, aesthetics, customer, cost, environment, size, safety, function, materials, 2d design, laser cutter, needle files, junior hacksaw, pillar drill, wet and dry paper, safety glasses, prototype, CAD, CAM

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The Castle School Design & Technology Curriculum Map

Intent:

- ❖ Inspire students through the iterative design and making process.
- ❖ Enable students through creativity and imagination, to design and make products that solve real and relevant problems within a variety of contexts.
- ❖ Equip students with knowledge to evaluate past and present design and technology, and develop a critical understanding of its impact on our daily life and the wider world.
- ❖ Support students to make an essential contribution to the creativity, culture, wealth and well-being of the nation.
- ❖ Enable students to learn how to take risks, becoming safe, resourceful, innovative, enterprising and capable citizens.

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DIETER RAMS

KS2 Design and technology Curriculum

Design:

- Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups. Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design

Make:

- Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately. Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities

Evaluate:

- Investigate and analyse a range of existing products. Evaluate their ideas and products their own design criteria and consider the views of others to improve their work Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge:

- Apply their understanding of how to strengthen, stiffen and reinforce more complex structures. Understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages]. Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]. Apply their understanding of computing to program, monitor and control their products.

KS3 Design and technology Curriculum

Design:

- Use research and exploration, such as the study of different cultures, to identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them.
- Develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations. Use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses
- Develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools

Make:

- Select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture
- Select from and use a wider, more complex range of materials, components, taking into account their properties

Evaluate:

- Analyse the work of past and present professionals and others to develop and broaden their understanding. Investigate new and emerging technologies
- Test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups
- Understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists
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Technical knowledge:

- Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions
- Understand how more advanced mechanical systems used in their products enable changes in movement and force
- Understand how more advanced electrical and electronic systems can be powered and used in their products [for example, circuits with heat, light, sound and movement as inputs and outputs]
- Apply computing and use electronics to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components

Themes that run through the curriculum

- o Design (communication of ideas)
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Evaluate:

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Technical knowledge:

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KS3 Design and technology Curriculum

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- Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions
- Understand how more advanced mechanical systems used in their products enable changes in movement and force
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Themes that run through the curriculum

- o Design (communication of ideas)
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Year 8	**Sol**: **(Acrobat toy)** **Rationale:** Students will build upon design and making skills learnt in Year 7. Students will research data linked to the human body to help identify and understand user needs and solve their own design problems. Students will use a variety of tools and materials, taking account of their properties to safely perform practical tasks. They will learn how they can make their toy make changes in movement/force and direction. **Substantive Knowledge:** ✓ Why is it important to be safe in the workshop? ❖ Why do we need to identify and understand user needs. ❖ What is ergonomics and anthropometrics? ❖ How can ergonomic/anthropometric data be help solve design solutions ❖ Why are finishes applied to materials? ❖ How to research and solve their own design problems ➢ How to develop a design solution ✓ How to analyse products using ACCESSFM ❖ Why do designers/manufacturers analyse products? ➢ How to use tools to safely shape, cut and drill handles and acrobat. (Chisels, mortice gauge, surform, spoke shave, drill) ➢ How to make toy make changes in movement/force and direction ✓ How to evaluate the acrobat toy? **Disciplinary Knowledge:** Analysing anthropometric data to help generate a design solution Creating designs for acrobat and handles Making handles and acrobat Research types of finishes, tools and toys **Disciplinary literacy:** Safety, risk, ergonomics, anthropometrics, accuracy, finish, mdf, translate, chopping, paring, pencil, tenon saw, try square, engineers square, mortice gauge, chisel, spoke shave, surform, mallet, G clamp, class paper, fret saw, coping saw, woodwork vice, pillar drill, Pine, standard angle plane, steel rule **Summative assessment:** Booklet of tasks completed linked to acrobat toy. Acrobat toy created Extended writing tasks: 1.Margaret Clavert. What did she design and how did that impact on our daily lives 2. What is ergonomics and how does it effects our lives? Articles Read at Speed: The Work and Legacy of Margaret Calvert (shillingtoneducation.com) Ergonomics and anthropometrics - Considering usability when designing - OCR - GCSE Design and Technology Revision - OCR - BBC Bitesize **Video** Why Ergonomics? | Importance & Benefits of Ergonomic Workplace [LUMI] - YouTube Margaret Calvert: It's about knowing who you are designing for - YouTube	**Sol: (Steady hand game)** **Rationale:** Students will build upon and apply skills learnt in Year 7 to generate ideas and build their own steady hand game. Students will learn how to select and use tools to safely perform practical tasks. They will learn how to form a thermosetting plastic and make an electrical system create an output (sound) from an input (movement). **Substantive Knowledge:** ✓ What is a design brief? How to analyse requirements of a brief? ➢ How to develop a design solution ❖ Why is it important to be safe in the workshop? ❖ What is the difference between a thermosetting and a thermoforming plastic ❖ How to analyse products using ACCESSFM ➢ How to shape HIPS using a mould and vacuum former ❖ How to fix components onto vero board ➢ How to solder components ➢ How to strip wire ➢ How to shape copper wire ➢ How to drill ❖ Why do designers/manufacturers analyse products? ✓ How to test circuits (fault find) **Disciplinary Knowledge:** Analysing a task Fixing components onto vero board & fixing components into case Fault finding with an electrical circuit Bending and shaping wire Vacuum forming case using a mould Research thermosetting and thermo forming plastics **Disciplinary literacy:** Safety, risk, thermoforming plastic, thermosetting, High impact polystyrene, copper, solder, wire, resistor, switch, buzzer, component, accuracy **Summative assessment:** Booklet of tasks completed linked to steady hand game. Steady hand game created Extended writing: 1. electric cars. What are the pros and cons of using an electric car? Read www.topgear.com/car-news/electric/how-green-electric-car-really. **Video** Pros And Cons of Electric Cars-Advantages And Disadvantages Of Electric Cars - YouTube 2. Design companies. Explain what James Dyson has designed and the key design principles that made James Dyson and his company so successful. Read How we made the Dyson vacuum cleaner | Design | The Guardian **Video** Dyson Vacuum History: How One Man Built A Billion Dollar Empire - Bing video

	Links to NC: Identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them Develop and communicate design ideas using annotated sketches Select from and use specialist tools, techniques, processes, equipment and machinery precisely Analyse the work of others to develop and broaden their understanding Understand the properties of materials and the performance of structural elements to achieve functioning solutions Understand how mechanical systems used in their products enable changes in movement and force	**Links to NC:** Identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them Select and use specialist tools, techniques, processes, equipment and machinery precisely Analyse the work of others to develop and broaden their understanding Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions Understand how more advanced electrical and electronic systems can be used in their products [for example, circuits with sound and movement as inputs and outputs]

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DIETER RAMS

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- ❖ Technical knowledge (systems, materials, processes, computing)

Year 7	**SoL**: **(Night light)** **Rationale:** Students will learn how to select and use tools to safely perform practical tasks and learn how to make an electrical system turn on and off a light by using an input. **Substantive Knowledge:** ❖ Why is it important to be safe in the workshop? ❖ Why do we need to identify and understand user needs. ❖ How to research and solve their own design problems ➢ How to develop a design solution ❖ How to analyse products using ACCESSFM ❖ Why do designers/manufacturers analyse products? ✓ How to use tools to safely shape, cut and drill. ✓ Sustainable design. Why is this important? ✓ How to use tools to make an electrical circuit ✓ How to evaluate the night light? **Disciplinary Knowledge:** Creating design on card for night light Making night light Analysing night lights Research sustainable design and how products have been designed with the environment in mind. **Disciplinary literacy:** Thermometer, illumination, target market, aesthetics, adhesive, function, product analysis, smart material, coping saw, nibbler, tin snips, curved nose tin snips, abra file, woodwork vice, junior hacksaw, high impact polystyrene, adhesive, strip heater, circuit, bulb holder, solder, soldering iron, battery snap, copper tape, wire strippers, pillar drill, ball hammer, dot punch, files.	**SoL: (Squashed tomato challenge)** **Rationale:** Students will learn about different cultures through exploration and research into the farmers of Nepal. They will build on their knowledge of levers and pullies from KStage 2. They will have the opportunity to test mechanical systems and structural elements to help generate their own system for transporting food to solve a real problem using disciplines learnt in mathematics and science. **Substantive Knowledge:** ❖ What makes a strong structure? ❖ How does an aerial ropeway work? ❖ Why is Nepal good for farming tomatoes? ❖ How to farmers of Nepal live? ❖ What is the difference, between, 1st,2nd and 3rd order levers? ❖ What is a pulley? How does it work? ❖ How can levers change motion? ✓ What is the purpose of a container? ✓ What is a net? Why are nets used to package products? ✓ What makes a good presentation? **Disciplinary Knowledge:** Making structures Process of completing a research into farmers of Nepal. Design own net to hold and transport tomatoes Make a transportation system for transporting tomatoes **Disciplinary literacy:** Cord, string, transportation, subsistence farming, levers, pulleys, effort, load, fulcrum, net.	**SoL: (Design strategies/Key Fob)** **Rationale:** Allows a smooth transistion from primary school and introduces students to skills that can be applied in both KStage 3 & 4 Design & Technology. Students will be able solve their own design problems by using creativity and imagination and use CAD to generate creative ideas. **Substantive Knowledge:** ➢ What is biomimicry, scruffiti & 4x4 ➢ How to use different design approaches to generate creative designs? ➢ How to develop innovative and functional products that responds to different needs ➢ Develop designs using computer based tools (2d Design) ❖ How products can be manufactured using CAM(Computer Aided Manufacture) **Disciplinary Knowledge:** Process of completing design work using creativity and imagination Use of biomimicry, scruffiti and 4x4 to generate ideas Use of literacy for Design and Technology through oracy and in annotation of designs Use of (CAD) 2d Design to create a design Use of laser cutter to manufacture a keyfob **Disciplinary literacy:** Bio morphic, rearrange, eliminate, material, function, substitute, modify, combine, morphing, Scruffiti, CAD (Computer aided Design), CAM (Computer aided Manufacture), laser cutter	**SoL: (Ozobots)** **Rationale:** Students will be able to solve problems using robots within a given context and also understand the impact robots and the use of computers can have on our daily life. **Substantive Knowledge:** ❖ What is a robot? ❖ What is an input/output? ❖ What is track ✓ How to control a robot to fulfil a number of different commands ✓ The benefits and disadvantages of robots and their effect on daily life and the wider world. ❖ Problem solving using a robot **Disciplinary Knowledge:** Test and refine tracks to control a robot to complete a number of different tasks Investigate new and emerging technologies Understand the potential impact the use of robots has on society **Disciplinary literacy:** Programming, input, output, track, logic, robot, applications, industry, coding, ozobot

	Summative assessment: Night light created Booklet of tasks completed linked to night light Extended writing linked sustainable design. What makes the anglepoise lamp a design classic? **Article.** The Anglepoise lamp Design classic: the Anglepoise lamp by George Carwardine | Financial Times (ft.com) Extended writing. What is a Smart material and how does it impact on our lifes? **Article.** Smart materials - Nanoscience and smart materials - GCSE Chemistry (Single Science) Revision - WJEC - BBC Bitesize **Video** Thermochromic & Photochromic Plastics - YouTube **Links to NC:** Identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them Develop and communicate design ideas Select from and use specialist tools, techniques, processes, equipment and machinery precisely Analyse the work of others to develop and broaden their understanding Understand developments in design and technology, its impact on individuals, society and the environment	**Summative assessment:** Structures created, net Presentation - drawing conclusions from the build of transport system for tomatoes. Assess application of disciplinary knowledge to complete tasks Extended writing linked to Gherkin building and Norman Foster. Describe the appearance of the Gherkin building and explain why it is an important building. **Article** The Gherkin Building, 30 St Mary Axe, London | Architecture | Design - Architect Boy **Video** The Gherkin - Sustainable Building Design (UCL IEDE/VEIV) - YouTube **Links to NC:** Research, study of different cultures, identify and understand user needs. Identify and solve their own design problems. Develop and communicate design ideas Select from and use specialist tools, techniques, processes, equipment and machinery Understand how mechanical systems used in their products enable changes in movement and force Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions Understand developments in design and technology, its impact on individuals, society and the environment	**Summative assessment:** Designs created using different strategies Manufactured key fob Extended writing task. Who is Harry Beck? What did he design and why is his concept so successful? Article Harry Beck | London Underground Map Designer | Blue Plaques | English Heritage (english-heritage.org.uk) Video The genius of the London Tube Map | Small Thing Big Idea, a TED series - YouTube **Links to NC:** Use a variety of approaches to generate creative ideas and avoid stereotypical responses Develop and communicate design ideas using annotated sketches.	**Summative assessment:** Booklet of tasks completed by ozobot Extended writing- Discuss the benefits and disadvantages of using robots. Article 45 Unquestionable Advantages and Disadvantages of Robots — Wise, Healthy 'n' Wealthy (wisehealthynwealthy.com) Video Honda's Asimo: the penalty-taking, bar-tending robot - YouTube **Links to NC:** Embed intelligence in products that respond to inputs and control outputs using programmable components. Understand developments in design and technology, its impact on individuals and society

Year 7	**SoL**: **(Bug Hotel)** **Rationale:** Students will learn how insects are important to the sustainability of the planet. They will select and use tools to safely perform practical tasks and learn how to make a personalised bug hotel. **Substantive Knowledge:** ❖ What is a softwood? ❖ What are the characteristics of a softwood? ❖ What is a hardwood ❖ What are the characteristics of a hardwood? ❖ What is a manufactured board? ❖ What are the characteristics of manufactured board? ❖ Types of timber ❖ What is an insect? ❖ What are the 3 major parts of an insect? ❖ Why are insects important to our ecosystem? ❖ Why is important to create habitats for wildlife? ✓ How do insects effect food production? ➢ How to measure, cut and join timber to make a structural and functioning bug hotel ❖ What is the purpose of an Orthographic drawing? **Disciplinary Knowledge:** Using research to help understand insect needs Develop and communicate design ideas for a bug hotel Select and use specialist tools and equipment to manufacture bug hotel **Disciplinary literacy:** Hardwood, softwood, manufactured board, coniferous trees, deciduous trees, durable, eco system, pollination, insect, orthographic drawing, climate change, steel rule, pencil, try square, engineering square, bench hook, woodwork vice, g clamp, tenon saw, mitre saw, orbital sander, vertical sander, wood glue, masking tape, staple gun.			

	Summative assessment: Bug hotel created Booklet of tasks completed linked to bug hotel Extended writing linked sustainable design. What makes the anglepoise lamp a design classic? **Article.** Extended writing. “What is an insect & why are they so important to us? **Article.** ***The importance of insects and providing them with a home*** **Video** **https://www.youtube.com/watch?v=TyLTrejawx4** **Links to NC:** Identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them Develop and communicate design ideas Select from and use specialist tools, techniques, processes, equipment and machinery precisely Understand developments in design and technology, its impact on individuals, society and the environment			

The Castle School Design & Technology Curriculum Map

Intent:

- ❖ Inspire students through the iterative design and making process.
- ❖ Enable students through creativity and imagination, to design and make products that solve real and relevant problems within a variety of contexts.
- ❖ Equip students with knowledge to evaluate past and present design and technology, and develop a critical understanding of its impact on our daily life and the wider world.
- ❖ Support students to make an essential contribution to the creativity, culture, wealth and well-being of the nation.
- ❖ Enable students to learn how to take risks, becoming safe, resourceful, innovative, enterprising and capable citizens.

"You cannot understand good design if you do not understand people; design is made for people."

DIETER RAMS

KS2 Design and technology Curriculum

Design:

- Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups. Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design

Make:

- Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately. Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities

Evaluate:

- Investigate and analyse a range of existing products. Evaluate their ideas and products their own design criteria and consider the views of others to improve their work Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge:

- Apply their understanding of how to strengthen, stiffen and reinforce more complex structures. Understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages]. Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]. Apply their understanding of computing to program, monitor and control their products.

KS3 Design and technology Curriculum

Design:

- Use research and exploration, such as the study of different cultures, to identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them.
- Develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations. Use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses
- Develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools

Make:

- Select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture
- Select from and use a wider, more complex range of materials, components, taking into account their properties

Evaluate:

- Analyse the work of past and present professionals and others to develop and broaden their understanding. Investigate new and emerging technologies
- Test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups
- Understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists
- Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge:

- Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions
- Understand how more advanced mechanical systems used in their products enable changes in movement and force
- Understand how more advanced electrical and electronic systems can be powered and used in their products [for example, circuits with heat, light, sound and movement as inputs and outputs]

Apply computing and use electronics to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components [for example, microcontrollers]

Themes that run through the curriculum

- o Design (communication of ideas)
- ➢ Make (select tools and materials to perform practical tasks)
- ✓ Evaluate (Analyse, evaluate ideas/products, individuals, events and understand how they have shaped the world
- ❖ Technical knowledge (systems, materials, processes, computing)

GCSE DT	**SOL**: **(Core technical principles)** **Rationale:** In order to make effective design choices students need a breadth of core technical knowledge and understanding **Substantive Knowledge:** ❖ new and emerging technologies ❖ energy generation and storage ❖ developments in new materials ❖ systems approach to designing ❖ mechanical devices ❖ materials and their working properties. **Disciplinary Knowledge:** Students should be able to answer a mixture of multiple choice and short answer questions assessing a breadth of technical knowledge and understanding Students should be able to explain the impact of new and emerging technologies on contemporary and potential future scenarios Students should be able to explain how energy is generated and stored and how this is used as the basis for the selection of products and power systems. Students should be aware and be able to explain new developments in new materials Students should be able to consider how electronic systems including programmable components provide functionality to products and processes, and enhance and customise their operation. Students should be able to describe different types of mechanical movement Students should have an understanding, of the working and physical properties of materials and be able to select correct materials for their NEA **Disciplinary literacy:** Enterprise, Industry, Sustainability, People, Culture, Society, Environment, Production techniques, Systems, Fossil fuels, Nuclear power, Renewable energy, Modern materials, Smart materials, Composite materials, Inputs, Processes, Outputs, Movement, Direction, Magnitude, Force, Papers and boards, Natural and Manufactured timbers, Metals, Alloys, Polymers,	**SOL: (Specialist technical principles)** **Rationale:** Specialist technical principles allows students to experience at least one material in greater depth. **Substantive Knowledge:** ➢ selection of materials or components ❖ forces and stresses ❖ ecological and social footprint ❖ sources and origins ➢ using and working with materials ❖ stock forms, types and sizes ❖ scales of production ➢ specialist techniques and processes ○ surface treatments and finishes. **Disciplinary Knowledge:** Students should be able to answer questions assessing their knowledge of specialist technical principles. In relation to at least one material category or system, students should be able to select the correct materials and components needed to manufacture a product. Students should be able to explain the impact of forces and stresses and the way in which materials can be reinforced and stiffened In relation to at least one material category or system, students should be able to explain the ecological and social footprint left by designers. In relation to at least one material category, students should be able to explain the sources and origins of materials. In relation to at least one material category or system, students should be able to explain how the working properties of materials can be affected Students should understand the different stock forms types and sizes in order to calculate and determine the quantity of materials or components required. Students should be able to select materials and components considering scales of production Students should be able to select surface treatments and finishes **Disciplinary literacy:** Forces and Stresses, Ecological and Social footprint, The 6 R's, Sources and origins, Properties, Modification, Shape, Cutting, Abrasion, Addition, Stock Form, Production, Tools, Equipment, Processes, Cut, Formed, Tolerance, Commercial Processes, Quality Control, Surface Treatments, Finishes,	**SOL: (Designing and making principles)** **Rationale:** Students should know and understand that all activities take place within a wide range of contexts. They should also understand how the prototypes they develop must satisfy wants or needs for their intended use. **Substantive Knowledge:** ✓ investigation, primary and secondary data ❖ environmental, social and economic challenge ❖ the work of others ○ design strategies ○ communication of design ideas ➢ prototype development ❖ selection of materials and components • tolerances ❖ material management ➢ specialist tools and equipment ➢ specialist techniques and processes. **Disciplinary Knowledge:** Students should understand and be able to explain how the prototypes they develop must satisfy wants or needs and be fit for their intended use. Students should be able to demonstrate and apply knowledge and understanding of designing and making principles in their NEA Students should be able to **u**se a mixture of primary and secondary data to understand client and/or user needs. Students should be able to answer mathematical questions linked to tables and data. Students should be able to write a design brief and produce a design and manufacturing specification for their NEA Students should be able to carry out investigations in order to identify problems and needs of their client in their NEA Students should be able to generate imaginative and creative design ideas using a range of different design strategies Students should be able to develop their own ideas Students should develop, communicate, record and justify design ideas using a range of appropriate techniques Students should be able to cut materials efficiently and minimise waste Use appropriate marking out methods, data points and coordinates **Disciplinary literacy:** Primary and Secondary Data, Client, Design Brief, Specification, Manufacturing Specification, Investigation, Environmental, Social, Economic Challenge, Evaluate, Analyse, Design Strategies, Communication, Prototype, Development, Components, Tolerances, Waste, Data Points, Coordinates, Techniques, Tools, Processes, Treatments, Finishes,

	Summative assessment: Booklet of tasks completed linked to core technical principles Retrieval quizzes **Extended writing activities** 1.**"How can just in time (JIT) production can help manufacturers improve efficiency?"** ARTICLE: technology student.com (JIT) VIDEO: Nahiar attah utube (2 mins 11) 2. **Independent learning task. "Why has there been an increase in renewable energy use & why are some people still opposed to its use?"** ARTICLES: technology student.com VIDEO: Renewable energy 101 National Geographic utube (3 mins 16) 3. **"What is a smart material and how can it be incorporated into our lives?"** ARTICLE: technology student Smart materials and their properties VIDEO: Play with Smart materials Catarina MOta utube (9 mins 55) 4. **Explain in detail the properties required for each of the following products; A paddle board, bike, electrical plug and tennis racquet** ARTICLE: technology student Properties of materials VIDEO: Properties of materials Mike Turpin DT utube **Links to KS3 (NC)** Understand developments in design and technology, its impact on individuals, society and the environment Understand how mechanical systems used in their products enable changes in movement and force Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions Understand developments in design and technology, its impact on individuals, society and the environment	**Summative assessment:** Booklet of tasks linked to Specialist technical principles Retrieval quizzes Mirror Frame G Clamp **Extended writing activities** **1.When discussing sustainability we refer to the 6 R's. Explain in detail the meaning of each. (Reuse, Refuse, Recycle, Repair, Refuse, Rethink).** ARTICLE: technology student.com revision cards – The six R's VIDEO: 6R's of Sustainability Mr Everetts Design and Technology Workshop utube (4 mins 51) 2.**Create a leaflet to describe the life cycle of a plastic bottle** ARTICLE: rts.com The life cycle of a plastic bottle VIDEO: What really happens to the plastic you throw away – Emma Bryce utube (4 mins 6) 3. Explain each production method using an example of a product to support your answer. (one off, batch, mass and continuous) ARTICLE: mr-dt.com Scales of production (detailed explanations0 VIDEO: Scales of production –GCSE Revision S Stringwell utube 3 mins 40 4.Desribe how to use tools, equipment and processes to laminate a piece of wood VIDEO: Design & technology (D&T) KS3/Laminating wood/BBC Teach **Links to KS3 (NC)** Select from and use specialist tools, techniques, processes, equipment and machinery Understand how mechanical systems used in their products enable changes in movement and force Understand developments in design and technology, its impact on individuals, society and the environment Use a complex range of materials taking into account their properties Use the properties of materials and the performance of structural elements to achieve functioning solutions.	**Summative assessment:** Booklet of tasks linked to Designing and making principles Retrieval quizzes NEA folder and outcome **Extended writing activities** **1.Describe what is primary and secondary research and both the benefits and disadvantages of each.** ARTICLE: Primary vs Secondary market research. Mymaketresearchmethods.com **2.Designers sometimes choose materials according to their impact on society and the environment. This could include the use of fair trade products, recycled components and biodegradable packaging. Evaluate how the use of such materials might be seen as the ethical choice** ARTICLE: Fairtrade.org.uk What is Fairtrade? & The Break Down on Compostable and biodegradable packaging ecoandbeyond.com VIDEO: What is Fairtrade? FairtradeANZ utube (1min 46) Biodegradable and Non Biodegradeable Waste Azimuth Official 3. **Research the following 2 designers. Norman Foster and Philippe Starck. Explain in detail how they got their inspiration and what they designed** ARTICLE: technology student.com Philippe Starck V Ryan, brittania .com Norman Foster British Architect VIDEO: Introduction to Philippe Starck, the Designer V Ryan utube (4 min 22) Buildings by Norman Foster in London – utube (2min 10) 4.**What is a prototype, what materials can be used and what are the advantages and disadvantages of using them?** ARTICLE: interaction-design.org Prototyping VIDEO: What is a Prototype? Whittlesea Tech School utube (1 min 46) **Links to KS3 (NC)** Use a variety of approaches to generate creative ideas and avoid stereotypical responses Identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them Develop a design specification Develop and communicate design ideas using annotated sketches. Select from and use specialist tools, techniques, processes, equipment and machinery Use a complex range of materials taking into account their properties Use the properties of materials and the performance of structural elements to achieve functioning solutions. Understand developments in design and technology, its impact on individuals, society and the environment Analyse the work of others to develop and broaden their understanding Understand the properties of materials and the performance of structural elements to achieve functioning solutions Understand how mechanical systems used in their products enable changes in movement and force.

The Castle School Design & Technology Curriculum Map

Intent:

- ❖ Inspire students through the iterative design and making process.
- ❖ Enable students through creativity and imagination, to design and make products that solve real and relevant problems within a variety of contexts.
- ❖ Equip students with knowledge to evaluate past and present design and technology, and develop a critical understanding of its impact on our daily life and the wider world.
- ❖ Support students to make an essential contribution to the creativity, culture, wealth and well-being of the nation.
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DIETER RAMS

KS2 Design and technology Curriculum

Design:

- Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups. Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design

Make:

- Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately. Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities

Evaluate:

- Investigate and analyse a range of existing products. Evaluate their ideas and products their own design criteria and consider the views of others to improve their work Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge:

- Apply their understanding of how to strengthen, stiffen and reinforce more complex structures. Understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages]. Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]. Apply their understanding of computing to program, monitor and control their products.

KS3 Design and technology Curriculum

Design:

- Use research and exploration, such as the study of different cultures, to identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them.
- Develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations. Use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses
- Develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools

Make:

- Select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture
- Select from and use a wider, more complex range of materials, components, taking into account their properties

Evaluate:

- Analyse the work of past and present professionals and others to develop and broaden their understanding. Investigate new and emerging technologies
- Test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups
- Understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists
- Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge:

- Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions
- Understand how more advanced mechanical systems used in their products enable changes in movement and force
- Understand how more advanced electrical and electronic systems can be powered and used in their products [for example, circuits with heat, light, sound and movement as inputs and outputs]

Apply computing and use electronics to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components [for example, microcontrollers]

Themes that run through the curriculum

- ○ Design (communication of ideas)
- ➢ Make (select tools and materials to perform practical tasks)
- ✓ Evaluate (Analyse, evaluate ideas/products, individuals, events and understand how they have shaped the world
- ❖ Technical knowledge (systems, materials, processes, computing)

GCSE ENGINEERING DESIGN	**SoL**: **R038** **(Principles of engineering design)** **Rationale:** Students will learn about the different design strategies and where they are used. Students will learn about the type of information needed to develop a design brief and specification, and the manufacturing and other considerations that can influence a design. Students will develop knowledge of the types of drawing used in engineering to communicate designs, as well as the techniques used to evaluate design ideas and outcomes, including modelling methods. **Designing processes** **Topic area 1:** **The stages involved in design strategies.** **Stages of the iterative design process and activities carried out within each stage.** **Make and evaluate.** **Substantive Knowledge:** **The stages involved in design strategies.** ❖ What is Linear design ❖ What is Iterative design ❖ What is Inclusive design ❖ What is user-centred design ❖ What is Sustainable design ❖ What is Ergonomic design ❖ Where will each strategy be applied ❖ What are the advantages/disadvantages of each strategy **Stages of the iterative design process and activities carried out within each stage.** ❖ How to analyse a design brief ❖ What types of information can be obtained from primary research (strengths and weaknesses) ❖ What types of information obtained from secondary research (strengths and weaknesses) ❖ Using market research to inform the development of design ideas ❖ How to conduct interviews with potential users and focus groups. ❖ How to use tables of anthropometric data	**SoL: R039** **(Communicating Designs)** **Rationale:** By using drawing skills designers can provide a far better sense of what a new product will look like and encourage the creative process that can enhance a successful design. Students will learn how to develop techniques in sketching, and gain industrial skills in engineering drawing using standard conventions that include dimensioning, line types, abbreviations, and representation of mechanical features. Students will enhance their confidence and capabilities by using computer aided design (CAD), 2D and 3D software, to produce accurate and detailed drawings and models that visually communicate your designs **Manual production of freehand sketches** **Topic area 1:** **Sketches for a design idea** **Substantive Knowledge:** **Sketches for a design idea** o How to use hand-drawing techniques to design and present ideas and concepts in 2d/3d o How to use produce a freehand sketch of a design idea using: thick/thin lines , texture, tone and shading o How to use annotation and labelling techniques that demonstrate design ideas (e.g. show/explain key features, functions, dimensions, materials o How to use sketching to create regular solid shapes, cubes, rectangular blocks, hollow objects, cylinders and compound shapes o How to produce an isometric design proposal **Disciplinary Knowledge:** Students should be able to use drawing techniques to design and present ideas and concepts. (freehand sketching in 2D and 3D, rendering using shade, tone and texture) Students should be able to produce isometric sketches for pen holder Students will be able to use annotation on their work to demonstrate key features, functions, dimensions, materials, construction techniques/manufacture methods, access to components, areas for further investigation.	**Sol:R040** **(Design, evaluation and modelling)** **Rationale:** Designers need an understanding of how products are manufactured to ensure that their ideas can be produced effectively. Analysing how products are made can help to inform designs, and it can be useful to disassemble existing products to discover how they function and how they were manufactured. Students will learn how designers can quickly create and test models to develop a prototype of a design. Students will develop virtual modelling skills using computer aided design (CAD) 3D software, to produce a high-quality model that will be able to simulate your design prototype. You will also develop your physical modelling skills using modelling materials or rapidprototyping processes to produce a physical prototype. **Design, evaluation and modelling** **Topic area 1:** **Product evaluation** **Product analysis** **Carry out product disassembly** **Substantive Knowledge:** ❖ How to carry out product analysis using ACCESSFM (Aesthetics, cost, customer, environment, size, safety, function, materials and manufacturing) ❖ How to compare products using ranking matrices and quality function deployment (QFD) ❖ How to identify the advantages and disadvantages of a product using primary and secondary research ❖ How to disassemble products using manufacturers manuals tools and instruments ❖ How to analyse the disassembled product focusing on components and their functions, assembly methods, materials, production methods and maintenance considerations **Disciplinary Knowledge:** Students should be able interpret a product specification to help them develop their own product Students will be able to use tools and processes to disassemble a product Students will be able to compare products and identify their strengths and merits Students will analyse disassembled products. **Disciplinary literacy:**

	❖ How to analyse products using: ACCESS FM (Aesthetics, Cost, Customer, Environment, Size, Safety, Function, Materials and Manufacturing) o product disassembly ❖ How to produce an engineering design specification ○ How to design ideas by sketching, modifying, modelling, improving an existing design **Make and evaluate.** ❖ What are the reasons the use of modelling ❖ How a model can test proportions, scale and function ○ How to virtual model design ideas ➢ How to make a physical model of a design idea ➢ How to modify a prototype ❖ How to make a comparison of the model or prototype against the requirements of the design brief and specification **Disciplinary Knowledge:** Students should be able to explain how different strategies might be applied Students should be able to explain the advantages and disadvantages of different strategies Students should be able to explain the advantages and disadvantages of primary and secondary research for product requirements Students should be able to use the information obtained from each method to contributes to the generation of design ideas Students should be able to model ideas physically and using CAD/CAM Students should be able to apply knowledge and understanding gained in this unit to help complete NEA tasks in R039 & R040 **Disciplinary literacy:** Linear design, iterative design, inclusive design, user-centred design, sustainable design, ergonomic design, anthropometric data, analysis, aesthetics, cost, customer, environment, size, safety, function, materials, virtual modelling, physical modelling, manufacturing, disassembly, design brief, specification, primary research, secondary research, focus groups, proportions, scale, function, **Topic 2: Design requirements** **Types of criteria included in an engineering specification** **How manufacturing considerations affect design** **Influences on engineering product design** **Substantive Knowledge:** **Types of criteria included in an engineering specification** ❖ What is the difference between the needs and wants of a client ❖ What is the difference between quantitative and a qualitative criteria ❖ How to create a product criteria using ACCESSFM and the reasons for doing this	Students should be able to produce, modify and enrich design proposals (e.g. text, graphics) Students will be able to use understanding to complete NEA task R039 **Disciplinary literacy:** Hand-drawing techniques, present ideas, concepts, freehand sketching in 2D and 3D, rendering, shade, tone and texture, lines, annotation, features, functions, dimensions, materials, construction, modify, design proposals, text, graphics, isometric sketch **Topic area 2: Manual production of engineering drawings** **Drawings for a design ideas** **Substantive Knowledge:** **Drawings for a design idea** ○ How to produce a 3rd angle orthographic drawing using standard conventions ○ How to use produce an assembly drawing for a design proposal ○ How to produce an isometric projection ○ How draw an exploded view ○ How to draw a sectional view ❖ How to use Centre lines ❖ How to create a parts list to include up to 4 parts ❖ How to use parts referencing ❖ How to use assembly instructions **Disciplinary Knowledge:** Students should be able to produce 2d & 3D engineering drawings (isometric, exploded views, assembly drawings) that could be understood by a potential client Students should be able to produce 2D engineering drawings (3rd angle orthographic). Students should be able to show scale, dimensions, materials, parts lists, sectional views with relevant notes that could be understood by a third party. Students should be able to apply knowledge and understanding gained in this unit to help develop their skills further during the completion of their NEA in R0939 **Disciplinary literacy:** Technical drawings, 2D/3D sketches, isometric, exploded views, assembly drawings, 3rd angle orthographic, scale, dimensions, materials, parts lists, sectioned view, annotation, Assembly instructions and sectional view **Topic area 3: Use of computer aided design (CAD)** **Produce a 3D CAD model of a design proposal to include compound 3d shapes**	Product Specification, processes, tools/equipment, components, function, assembly methods, materials, production methods, maintenance considerations, ranking matrices, quality function deployment, health and safety requirements/hazards, planning stages, testing & evaluation **Topic area 2: Modelling design ideas** **Methods of modelling** **Substantive Knowledge:** ❖ How to create a 3d model using CAD 3D software ❖ How to simulate the mechanical operation of a product using CAD software (single components and components in assembly) ❖ How to create single components in a 3D CAD model ❖ How to assemble CAD parts to form a product ❖ How to ❖ What are safe working procedures when using materials, chemicals, finishes and solvents ❖ How to create physical models out of sheet (card and polymers), block (foam and wood), breadboarding and by using 3D printing ❖ How to select and use tools, processes, materials and equipment to make a model ❖ How to apply safe working practices when making a prototype ❖ How to record the key stages of making the prototype ❖ How to identify potential improvements in a design **Disciplinary Knowledge:** Students will be able to identify risks in the workshop Students will be able to assess risks for practical tasks Students will be able to take precautions when using tools and machines to reduce risks Students will use personal protective equipment (PPE) during production processes Students will be able to use safe working procedures when using materials for modelling Students record the stages of disassembling a product Students will be able to create, using CAD, 3D models. Students will be able to animate their CAD models Students will be able to use understanding gained in this unit to complete NEA for R040 **Disciplinary literacy:** Risks, production plans, assess, hazards, precautions, personal protective equipment (PPE), CAD, virtual models, simulate, assembly, components, sheet, block, specification, 3d printing, breadboarding

	How manufacturing considerations affect design ❖ What are the different scales of manufacture used to create products ❖ What is one-off production. ❖ What is batch production. ❖ What is mass production. ❖ What products can be made using the different scales of production ❖ What are the different types of materials and stock form available ❖ Types of manufacturing processes: wasting, shaping, forming, joining, finishing, assembly ❖ What are Production costs ❖ How are production costs effected by labour and capital costs **Influences on engineering product design** ❖ What is the difference between Market pull and technology push ❖ What is planned obsolescence and how doe this effect products ❖ What are British and International Standards and why are they used ❖ What is a British Standard (BS) ❖ What is meant by UKCA or United Kingdom Conformity Assesssed ❖ Why does legislation relate to health and safety ❖ What is the purpose of a risk assessment ❖ What is sustainable design. ❖ Why is sustainable design important and what are the (6Rs) Rethink, Reuse, Recycle, Repair, Reduce, Refuse ❖ What is Design for the circular economy how does this influence manufacture of products **Disciplinary Knowledge:** Students should be able to explain what is a quantative and qualitive criteria and be able to explain the purpose of a design specification and generate their own. Students should be able to use a design specification to help generate designs for a desk tidy Students should be able to make a batch produced desk tidy Students should be able to explain what is meant by product requirements and what needs to be considered in the manufacture of a product. Students should be able to select the correct scale of manufacture for different given products. Students should be able to explain the need for regulations and safeguarding in industry Students should be able to apply knowledge and understanding gained in this unit to help complete NEA tasks in R039 & R040	**Substantive Knowledge:** ○ How to use CAD applications to produce and communicate 3D design proposals ○ How to use different techniques to communicate design proposals ○ How to use CAD sketch tool features to communicate designs. (lines, arcs, polygons, extrudes, revolves, sizing, dimensioning, shelling and holes). ○ How to use CAD reference geometry (work planes) ○ How to use CAD to render designs ○ How to generate complex shapes which includes dimensions, lines and angles. ○ How to make 3D CAD assemblies of components ❖ How to use mate tools, mates constraints tool ❖ How to animate assemblies **Disciplinary Knowledge:** Students should be able to use CAD to draught, create 3D models, render designs, create assembly drawings and animate their work. Students will use knowledge gained in this unit to help develop their skills further during the completion of NEA in unit R039 **Disciplinary literacy:** CAD (Computer aided design, draughting, 3D modelling, mate tools, mate constraint tools, rendering, assemblies, animation, shelling communicate, extrudes, dimensiong **Summative assessment:** Technical drawings and CAD work created for R039 Design tasks completed linked to R039 **Extended writing activities** 1. The advantages and disadvantages of using CAD/CAM 2. The impact of Jock Kinneir **Links to KS3:** Use a variety of approaches to generate creative ideas and avoid stereotypical responses Develop and communicate design ideas using annotated sketches. Select from and use specialist techniques, processes precisely	**Summative assessment:** Focused designing and making activities (pen holder, coat hanger) NEA tasks completed linked to R040. Retrieval quizzes **Extended writing activities** 1. How to assess risk in the workplace 2. The use of jigs and formers **Links to KS3:** Select from and use specialist tools, techniques, processes, equipment and machinery precisely Understand the properties of materials and the performance of structural elements to achieve functioning solutions

	Disciplinary literacy: Design specification, user needs, aesthetics , ergonomics, anthropometrics, safety, product requirements, function, features, performance, target group/intended users, working environment, limitations, constraints, size, weight, functional limitations, appearance, ergonomics, lifecycle, product maintenance, product safety, sustainability considerations, the 6 r's, manufacturing considerations, materials, supply chain, ease of manufacture, standard components, pre-manufactured components, design for manufacturing assembly (DFMA), design for disassembly, manufacturing processes, scale of production, prototyping, just-in-time production, one off, batch, mass production, durability and reliability, tolerances, regulations, safeguards, copyright, patents, registered designs, trademarks, British Standards and European Conformity (CE), UKCA, circular economy **Topic 3: Communicating design outcomes** **Types of drawing used in engineering** **Working drawings** **Using CAD drawing software** **Substantive Knowledge:** **Types of drawing used in engineering** ❖ What is Freehand sketching ❖ What is Isometric ❖ What is Oblique ❖ What are Orthographic drawings ❖ What is an exploded view of a drawing ❖ What is an assembly drawing ❖ What is a block diagrams ❖ What is a flowchart ❖ What is a circuit diagrams ❖ What is a wiring diagrams ❖ What are the typical applications and advantages/disadvantages of drawing techniques listed above **Working drawings:** ○ How to use hand-drawing techniques to design and present ideas and concepts ○ How to use annotation and labelling techniques that demonstrate design ideas ○ How to use of ICT software to produce, modify and enrich design proposals (e.g. text, graphics) ○ How to use Standard conventions in BS 8888 and how to apply them ○ How to create a 2D engineering drawings using third angle orthographic projection ○ How to lay out drawing using standard conventions, title block, metric units of measurement, scale and tolerance		

	○ How to dimension drawings using standard conventions for linear measurements, radius, diameter and surface finish ○ What are the meaning of different line types in a working drawing; outlines, hidden detail, centre line, projection, dimension and leader line (dots and arrows) ○ How to show abbreviations, across flats, centre line, diameter, material and square ○ How to represent mechanical features: threads, holes, chamfers and counters **Using CAD drawing software** ❖ Advantages and limitations of using CAD drawing software compared to manual drawing software **Disciplinary Knowledge:** Students should be able to explain the advantages and disadvantages of different drawing techniques used in engineering Students should be able to produce 3D engineering drawings (isometric and oblique, exploded views, assembly drawings) that could be understood by a potential client Students should be able to produce 2D engineering drawings (3rd angle orthographic). Students should be able to show scale, dimensions, materials, parts lists, sectional views with relevant notes that could be understood by a third party. Students should be able to apply knowledge and understanding gained in this unit to help develop their skills further during the completion of units R039 and R040. **Disciplinary literacy:** Hand-drawing techniques, present ideas, concepts, freehand sketching in 2D and 3D, rendering, shade, tone and texture, annotation, features, functions, dimensions, materials, construction, manufacture methods, software, modify, design proposals, text, graphics. Technical drawings, 3D engineering drawings, isometric, oblique, exploded views, assembly drawings, 2D engineering drawings, 3rd angle orthographic, scale, dimensions, materials, parts lists, sectioned view, annotation **Topic 4: Evaluating design ideas** **Methods of evaluating design ideas** **Modelling methods** **Methods of evaluating a design outcome** **Substantive Knowledge:** **Methods of evaluating design ideas** ❖ What is the purpose of a production model ✓ How to make a qualitative comparison with the design brief and specification ❖ How to use a ranking matrices ❖ What is Quality Function Deployment (QFD)		

	Modelling methods ❖ What information can be obtained through different modelling methods ❖ What equipment is required in modelling ❖ What are the advantages and limitations of different modelling methods ❖ How to evaluate a virtual model using 3D CAD ➢ How to evaluate a model in card ✓ How to evaluate a model using block ✓ How to evaluate using breadboarding kin electronics ✓ How to evaluate using 3d printing **Methods of evaluating a design outcome** ❖ How to select a method to evaluate a design outcome by understanding the advantages and limitations of each method ❖ How to use methods of measuring the dimensions and checking the functionality of the product to evaluate a product ✓ How to make a quantitative comparison with the design brief and specification to evaluate the success of a product ✓ How to evaluate a product through user testing ❖ How to identify potential modifications and improvements to the design **Disciplinary Knowledge:** Students should be able to evaluate design work using a variety of different strategies Students should be able to select the best method to evaluate work by understand the advantages and limitations in each method Students should be able to apply knowledge and understanding gained in this unit to help develop their skills further during the completion of units R039 and R040. **Disciplinary literacy:** Qualitative, design brief, specification, ranking matrices, QFD, virtual, CAD, block, breadboarding, 3d printing, quantitative comparison, modiifcations **Summative assessment:** Focused designing and making activity linked to manufacture of a desk tidy and coat hanger Written tasks completed linked to R038. Retrieval quizzes **Extended writing activities** **1.** The Design cycle **2.** Scales of manufacture **3.** Intellectual property **Links to KS3:**		

	Identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them Develop and communicate design ideas Select from and use specialist tools, techniques, processes, equipment and machinery precisely Analyse the work of others to develop and broaden their understanding Understand developments in design and technology, its impact on individuals, society and the environment		

The Castle School Design & Technology Curriculum Map

Intent:

- ❖ Inspire students through the iterative design and making process.
- ❖ Enable students through creativity and imagination, to design and make products that solve real and relevant problems within a variety of contexts.
- ❖ Equip students with knowledge to evaluate past and present design and technology, and develop a critical understanding of its impact on our daily life and the wider world.
- ❖ Support students to make an essential contribution to the creativity, culture, wealth and well-being of the nation.
- ❖ Enable students to learn how to take risks, becoming safe, resourceful, innovative, enterprising and capable citizens.

"You cannot understand good design if you do not understand people; design is made for people."

DIETER RAMS

KS2 Design and technology Curriculum

Design:

- Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups. Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design

Make:

- Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately. Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities

Evaluate:

- Investigate and analyse a range of existing products. Evaluate their ideas and products their own design criteria and consider the views of others to improve their work Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge:

- Apply their understanding of how to strengthen, stiffen and reinforce more complex structures. Understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages]. Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]. Apply their understanding of computing to program, monitor and control their products.

KS3 Design and technology Curriculum

Design:

- Use research and exploration, such as the study of different cultures, to identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them.
- Develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations. Use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses
- Develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools

Make:

- Select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture
- Select from and use a wider, more complex range of materials, components, taking into account their properties

Evaluate:

- Analyse the work of past and present professionals and others to develop and broaden their understanding. Investigate new and emerging technologies
- Test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups
- Understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists
- Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge:

- Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions
- Understand how more advanced mechanical systems used in their products enable changes in movement and force
- Understand how more advanced electrical and electronic systems can be powered and used in their products [for example, circuits with heat, light, sound and movement as inputs and outputs]

Apply computing and use electronics to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components [for example, microcontrollers]

Themes that run through the curriculum

- o Design (communication of ideas)
- ➢ Make (select tools and materials to perform practical tasks)
- ✓ Evaluate (Analyse, evaluate ideas/products, individuals, events and understand how they have shaped the world
- ❖ Technical knowledge (systems, materials, processes, computing)

GCSE DT	**SOL**: **(Core technical principles)** **Rationale:** In order to make effective design choices students need a breadth of core technical knowledge and understanding **Substantive Knowledge:** ❖ new and emerging technologies ❖ energy generation and storage ❖ developments in new materials ❖ systems approach to designing ❖ mechanical devices ❖ materials and their working properties. **Disciplinary Knowledge:** Students should be able to answer a mixture of multiple choice and short answer questions assessing a breadth of technical knowledge and understanding Students should be able to explain the impact of new and emerging technologies on contemporary and potential future scenarios Students should be able to explain how energy is generated and stored and how this is used as the basis for the selection of products and power systems. Students should be aware and be able to explain new developments in new materials Students should be able to consider how electronic systems including programmable components provide functionality to products and processes, and enhance and customise their operation. Students should be able to describe different types of mechanical movement Students should have an understanding, of the working and physical properties of materials and be able to select correct materials for their NEA **Disciplinary literacy:** Enterprise, Industry, Sustainability, People, Culture, Society, Environment, Production techniques, Systems, Fossil fuels, Nuclear power, Renewable energy, Modern materials, Smart materials, Composite materials, Inputs, Processes, Outputs, Movement, Direction, Magnitude, Force, Papers and boards, Natural and Manufactured timbers, Metals, Alloys, Polymers,	**SOL: (Specialist technical principles)** **Rationale:** Specialist technical principles allows students to experience at least one material in greater depth. **Substantive Knowledge:** ➢ selection of materials or components ❖ forces and stresses ❖ ecological and social footprint ❖ sources and origins ➢ using and working with materials ❖ stock forms, types and sizes ❖ scales of production ➢ specialist techniques and processes ○ surface treatments and finishes. **Disciplinary Knowledge:** Students should be able to answer questions assessing their knowledge of specialist technical principles. In relation to at least one material category or system, students should be able to select the correct materials and components needed to manufacture a product. Students should be able to explain the impact of forces and stresses and the way in which materials can be reinforced and stiffened In relation to at least one material category or system, students should be able to explain the ecological and social footprint left by designers. In relation to at least one material category, students should be able to explain the sources and origins of materials. In relation to at least one material category or system, students should be able to explain how the working properties of materials can be affected Students should understand the different stock forms types and sizes in order to calculate and determine the quantity of materials or components required. Students should be able to select materials and components considering scales of production Students should be able to select surface treatments and finishes **Disciplinary literacy:** Forces and Stresses, Ecological and Social footprint, The 6 R's, Sources and origins, Properties, Modification, Shape, Cutting, Abrasion, Addition, Stock Form, Production, Tools, Equipment, Processes, Cut, Formed, Tolerance, Commercial Processes, Quality Control, Surface Treatments, Finishes,	**SOL: (Designing and making principles)** **Rationale:** Students should know and understand that all activities take place within a wide range of contexts. They should also understand how the prototypes they develop must satisfy wants or needs for their intended use. **Substantive Knowledge:** ✓ investigation, primary and secondary data ❖ environmental, social and economic challenge ❖ the work of others ○ design strategies ○ communication of design ideas ➢ prototype development ❖ selection of materials and components • tolerances ❖ material management ➢ specialist tools and equipment ➢ specialist techniques and processes. **Disciplinary Knowledge:** Students should understand and be able to explain how the prototypes they develop must satisfy wants or needs and be fit for their intended use. Students should be able to demonstrate and apply knowledge and understanding of designing and making principles in their NEA Students should be able to **u**se a mixture of primary and secondary data to understand client and/or user needs. Students should be able to answer mathematical questions linked to tables and data. Students should be able to write a design brief and produce a design and manufacturing specification for their NEA Students should be able to carry out investigations in order to identify problems and needs of their client in their NEA Students should be able to generate imaginative and creative design ideas using a range of different design strategies Students should be able to develop their own ideas Students should develop, communicate, record and justify design ideas using a range of appropriate techniques Students should be able to cut materials efficiently and minimise waste Use appropriate marking out methods, data points and coordinates **Disciplinary literacy:** Primary and Secondary Data, Client, Design Brief, Specification, Manufacturing Specification, Investigation, Environmental, Social, Economic Challenge, Evaluate, Analyse, Design Strategies, Communication, Prototype, Development, Components, Tolerances, Waste, Data Points, Coordinates, Techniques, Tools, Processes, Treatments, Finishes,

	Summative assessment: Booklet of tasks completed linked to core technical principles Retrieval quizzes **Extended writing activities** 1.**"How can just in time (JIT) production can help manufacturers improve efficiency?"** ARTICLE: technology student.com (JIT) VIDEO: Nahiar attah utube (2 mins 11) 2. **Independent learning task. "Why has there been an increase in renewable energy use & why are some people still opposed to its use?"** ARTICLES: technology student.com VIDEO: Renewable energy 101 National Geographic utube (3 mins 16) 3. **"What is a smart material and how can it be incorporated into our lives?"** ARTICLE: technology student Smart materials and their properties VIDEO: Play with Smart materials Catarina MOta utube (9 mins 55) 4. **Explain in detail the properties required for each of the following products; A paddle board, bike, electrical plug and tennis racquet** ARTICLE: technology student Properties of materials VIDEO: Properties of materials Mike Turpin DT utube **Links to KS3 (NC)** Understand developments in design and technology, its impact on individuals, society and the environment Understand how mechanical systems used in their products enable changes in movement and force Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions Understand developments in design and technology, its impact on individuals, society and the environment	**Summative assessment:** Booklet of tasks linked to Specialist technical principles Retrieval quizzes Mirror Frame G Clamp **Extended writing activities** **1.When discussing sustainability we refer to the 6 R's. Explain in detail the meaning of each. (Reuse, Refuse, Recycle, Repair, Refuse, Rethink).** ARTICLE: technology student.com revision cards – The six R's VIDEO: 6R's of Sustainability Mr Everetts Design and Technology Workshop utube (4 mins 51) 2.**Create a leaflet to describe the life cycle of a plastic bottle** ARTICLE: rts.com The life cycle of a plastic bottle VIDEO: What really happens to the plastic you throw away – Emma Bryce utube (4 mins 6) 3. Explain each production method using an example of a product to support your answer. (one off, batch, mass and continuous) ARTICLE: mr-dt.com Scales of production (detailed explanations0 VIDEO: Scales of production –GCSE Revision S Stringwell utube 3 mins 40 4.Desribe how to use tools, equipment and processes to laminate a piece of wood VIDEO: Design & technology (D&T) KS3/Laminating wood/BBC Teach **Links to KS3 (NC)** Select from and use specialist tools, techniques, processes, equipment and machinery Understand how mechanical systems used in their products enable changes in movement and force Understand developments in design and technology, its impact on individuals, society and the environment Use a complex range of materials taking into account their properties Use the properties of materials and the performance of structural elements to achieve functioning solutions.	**Summative assessment:** Booklet of tasks linked to Designing and making principles Retrieval quizzes NEA folder and outcome **Extended writing activities** **1.Describe what is primary and secondary research and both the benefits and disadvantages of each.** ARTICLE: Primary vs Secondary market research. Mymaketresearchmethods.com **2.Designers sometimes choose materials according to their impact on society and the environment. This could include the use of fair trade products, recycled components and biodegradable packaging. Evaluate how the use of such materials might be seen as the ethical choice** ARTICLE: Fairtrade.org.uk What is Fairtrade? & The Break Down on Compostable and biodegradable packaging ecoandbeyond.com VIDEO: What is Fairtrade? FairtradeANZ utube (1min 46) Biodegradable and Non Biodegradeable Waste Azimuth Official 3. **Research the following 2 designers. Norman Foster and Philippe Starck. Explain in detail how they got their inspiration and what they designed** ARTICLE: technology student.com Philippe Starck V Ryan, brittania .com Norman Foster British Architect VIDEO: Introduction to Philippe Starck, the Designer V Ryan utube (4 min 22) Buildings by Norman Foster in London – utube (2min 10) 4.**What is a prototype, what materials can be used and what are the advantages and disadvantages of using them?** ARTICLE: interaction-design.org Prototyping VIDEO: What is a Prototype? Whittlesea Tech School utube (1 min 46) **Links to KS3 (NC)** Use a variety of approaches to generate creative ideas and avoid stereotypical responses Identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them Develop a design specification Develop and communicate design ideas using annotated sketches. Select from and use specialist tools, techniques, processes, equipment and machinery Use a complex range of materials taking into account their properties Use the properties of materials and the performance of structural elements to achieve functioning solutions. Understand developments in design and technology, its impact on individuals, society and the environment Analyse the work of others to develop and broaden their understanding Understand the properties of materials and the performance of structural elements to achieve functioning solutions Understand how mechanical systems used in their products enable changes in movement and force.

The Castle School Design & Technology Curriculum Map

Intent:

- ❖ Inspire students through the iterative design and making process.
- ❖ Enable students through creativity and imagination, to design and make products that solve real and relevant problems within a variety of contexts.
- ❖ Equip students with knowledge to evaluate past and present design and technology, and develop a critical understanding of its impact on our daily life and the wider world.
- ❖ Support students to make an essential contribution to the creativity, culture, wealth and well-being of the nation.
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DIETER RAMS

KS2 Design and technology Curriculum

Design:

- Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups. Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design

Make:

- Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately. Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities

Evaluate:

- Investigate and analyse a range of existing products. Evaluate their ideas and products their own design criteria and consider the views of others to improve their work Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge:

- Apply their understanding of how to strengthen, stiffen and reinforce more complex structures. Understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages]. Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]. Apply their understanding of computing to program, monitor and control their products.

KS3 Design and technology Curriculum

Design:

- Use research and exploration, such as the study of different cultures, to identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them.
- Develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations. Use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses
- Develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools

Make:

- Select from and use specialist tools, techniques, processes, equipment and machinery precisely, including computer-aided manufacture
- Select from and use a wider, more complex range of materials, components, taking into account their properties

Evaluate:

- Analyse the work of past and present professionals and others to develop and broaden their understanding. Investigate new and emerging technologies
- Test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups
- Understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists
- Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work Understand how key events and individuals in design and technology have helped shape the world

Technical knowledge:

- Understand and use the properties of materials and the performance of structural elements to achieve functioning solutions
- Understand how more advanced mechanical systems used in their products enable changes in movement and force
- Understand how more advanced electrical and electronic systems can be powered and used in their products [for example, circuits with heat, light, sound and movement as inputs and outputs]

Apply computing and use electronics to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components [for example, microcontrollers]

Themes that run through the curriculum

- ○ Design (communication of ideas)
- ➢ Make (select tools and materials to perform practical tasks)
- ✓ Evaluate (Analyse, evaluate ideas/products, individuals, events and understand how they have shaped the world
- ❖ Technical knowledge (systems, materials, processes, computing)

GCSE ENGINEERING DESIGN	**SoL**: **R038** **(Principles of engineering design)** **Rationale:** Students will learn about the different design strategies and where they are used. Students will learn about the type of information needed to develop a design brief and specification, and the manufacturing and other considerations that can influence a design. Students will develop knowledge of the types of drawing used in engineering to communicate designs, as well as the techniques used to evaluate design ideas and outcomes, including modelling methods. **Designing processes** **Topic area 1:** **The stages involved in design strategies.** **Stages of the iterative design process and activities carried out within each stage.** **Make and evaluate.** **Substantive Knowledge:** **The stages involved in design strategies.** ❖ What is Linear design ❖ What is Iterative design ❖ What is Inclusive design ❖ What is user-centred design ❖ What is Sustainable design ❖ What is Ergonomic design ❖ Where will each strategy be applied ❖ What are the advantages/disadvantages of each strategy **Stages of the iterative design process and activities carried out within each stage.** ❖ How to analyse a design brief ❖ What types of information can be obtained from primary research (strengths and weaknesses) ❖ What types of information obtained from secondary research (strengths and weaknesses) ❖ Using market research to inform the development of design ideas ❖ How to conduct interviews with potential users and focus groups. ❖ How to use tables of anthropometric data	**SoL: R039** **(Communicating Designs)** **Rationale:** By using drawing skills designers can provide a far better sense of what a new product will look like and encourage the creative process that can enhance a successful design. Students will learn how to develop techniques in sketching, and gain industrial skills in engineering drawing using standard conventions that include dimensioning, line types, abbreviations, and representation of mechanical features. Students will enhance their confidence and capabilities by using computer aided design (CAD), 2D and 3D software, to produce accurate and detailed drawings and models that visually communicate your designs **Manual production of freehand sketches** **Topic area 1:** **Sketches for a design idea** **Substantive Knowledge:** **Sketches for a design idea** o How to use hand-drawing techniques to design and present ideas and concepts in 2d/3d o How to use produce a freehand sketch of a design idea using: thick/thin lines , texture, tone and shading o How to use annotation and labelling techniques that demonstrate design ideas (e.g. show/explain key features, functions, dimensions, materials o How to use sketching to create regular solid shapes, cubes, rectangular blocks, hollow objects, cylinders and compound shapes o How to produce an isometric design proposal **Disciplinary Knowledge:** Students should be able to use drawing techniques to design and present ideas and concepts. (freehand sketching in 2D and 3D, rendering using shade, tone and texture) Students should be able to produce isometric sketches for pen holder Students will be able to use annotation on their work to demonstrate key features, functions, dimensions, materials, construction techniques/manufacture methods, access to components, areas for further investigation.	**Sol:R040** **(Design, evaluation and modelling)** **Rationale:** Designers need an understanding of how products are manufactured to ensure that their ideas can be produced effectively. Analysing how products are made can help to inform designs, and it can be useful to disassemble existing products to discover how they function and how they were manufactured. Students will learn how designers can quickly create and test models to develop a prototype of a design. Students will develop virtual modelling skills using computer aided design (CAD) 3D software, to produce a high-quality model that will be able to simulate your design prototype. You will also develop your physical modelling skills using modelling materials or rapidprototyping processes to produce a physical prototype. **Design, evaluation and modelling** **Topic area 1:** **Product evaluation** **Product analysis** **Carry out product disassembly** **Substantive Knowledge:** ❖ How to carry out product analysis using ACCESSFM (Aesthetics, cost, customer, environment, size, safety, function, materials and manufacturing) ❖ How to compare products using ranking matrices and quality function deployment (QFD) ❖ How to identify the advantages and disadvantages of a product using primary and secondary research ❖ How to disassemble products using manufacturers manuals tools and instruments ❖ How to analyse the disassembled product focusing on components and their functions, assembly methods, materials, production methods and maintenance considerations **Disciplinary Knowledge:** Students should be able interpret a product specification to help them develop their own product Students will be able to use tools and processes to disassemble a product Students will be able to compare products and identify their strengths and merits Students will analyse disassembled products. **Disciplinary literacy:**

	❖ How to analyse products using: ACCESS FM (Aesthetics, Cost, Customer, Environment, Size, Safety, Function, Materials and Manufacturing) o product disassembly ❖ How to produce an engineering design specification ○ How to design ideas by sketching, modifying, modelling, improving an existing design **Make and evaluate.** ❖ What are the reasons the use of modelling ❖ How a model can test proportions, scale and function ○ How to virtual model design ideas ➢ How to make a physical model of a design idea ➢ How to modify a prototype ❖ How to make a comparison of the model or prototype against the requirements of the design brief and specification **Disciplinary Knowledge:** Students should be able to explain how different strategies might be applied Students should be able to explain the advantages and disadvantages of different strategies Students should be able to explain the advantages and disadvantages of primary and secondary research for product requirements Students should be able to use the information obtained from each method to contributes to the generation of design ideas Students should be able to model ideas physically and using CAD/CAM Students should be able to apply knowledge and understanding gained in this unit to help complete NEA tasks in R039 & R040 **Disciplinary literacy:** Linear design, iterative design, inclusive design, user-centred design, sustainable design, ergonomic design, anthropometric data, analysis, aesthetics, cost, customer, environment, size, safety, function, materials, virtual modelling, physical modelling, manufacturing, disassembly, design brief, specification, primary research, secondary research, focus groups, proportions, scale, function, **Topic 2: Design requirements** **Types of criteria included in an engineering specification** **How manufacturing considerations affect design** **Influences on engineering product design** **Substantive Knowledge:** **Types of criteria included in an engineering specification** ❖ What is the difference between the needs and wants of a client ❖ What is the difference between quantitative and a qualitative criteria ❖ How to create a product criteria using ACCESSFM and the reasons for doing this	Students should be able to produce, modify and enrich design proposals (e.g. text, graphics) Students will be able to use understanding to complete NEA task R039 **Disciplinary literacy:** Hand-drawing techniques, present ideas, concepts, freehand sketching in 2D and 3D, rendering, shade, tone and texture, lines, annotation, features, functions, dimensions, materials, construction, modify, design proposals, text, graphics, isometric sketch **Topic area 2: Manual production of engineering drawings** **Drawings for a design ideas** **Substantive Knowledge:** **Drawings for a design idea** ○ How to produce a 3rd angle orthographic drawing using standard conventions ○ How to use produce an assembly drawing for a design proposal ○ How to produce an isometric projection ○ How draw an exploded view ○ How to draw a sectional view ❖ How to use Centre lines ❖ How to create a parts list to include up to 4 parts ❖ How to use parts referencing ❖ How to use assembly instructions **Disciplinary Knowledge:** Students should be able to produce 2d & 3D engineering drawings (isometric, exploded views, assembly drawings) that could be understood by a potential client Students should be able to produce 2D engineering drawings (3rd angle orthographic). Students should be able to show scale, dimensions, materials, parts lists, sectional views with relevant notes that could be understood by a third party. Students should be able to apply knowledge and understanding gained in this unit to help develop their skills further during the completion of their NEA in R0939 **Disciplinary literacy:** Technical drawings, 2D/3D sketches, isometric, exploded views, assembly drawings, 3rd angle orthographic, scale, dimensions, materials, parts lists, sectioned view, annotation, Assembly instructions and sectional view **Topic area 3: Use of computer aided design (CAD)** **Produce a 3D CAD model of a design proposal to include compound 3d shapes**	Product Specification, processes, tools/equipment, components, function, assembly methods, materials, production methods, maintenance considerations, ranking matrices, quality function deployment, health and safety requirements/hazards, planning stages, testing & evaluation **Topic area 2: Modelling design ideas** **Methods of modelling** **Substantive Knowledge:** ❖ How to create a 3d model using CAD 3D software ❖ How to simulate the mechanical operation of a product using CAD software (single components and components in assembly) ❖ How to create single components in a 3D CAD model ❖ How to assemble CAD parts to form a product ❖ How to ❖ What are safe working procedures when using materials, chemicals, finishes and solvents ❖ How to create physical models out of sheet (card and polymers), block (foam and wood), breadboarding and by using 3D printing ❖ How to select and use tools, processes, materials and equipment to make a model ❖ How to apply safe working practices when making a prototype ❖ How to record the key stages of making the prototype ❖ How to identify potential improvements in a design **Disciplinary Knowledge:** Students will be able to identify risks in the workshop Students will be able to assess risks for practical tasks Students will be able to take precautions when using tools and machines to reduce risks Students will use personal protective equipment (PPE) during production processes Students will be able to use safe working procedures when using materials for modelling Students record the stages of disassembling a product Students will be able to create, using CAD, 3D models. Students will be able to animate their CAD models Students will be able to use understanding gained in this unit to complete NEA for R040 **Disciplinary literacy:** Risks, production plans, assess, hazards, precautions, personal protective equipment (PPE), CAD, virtual models, simulate, assembly, components, sheet, block, specification, 3d printing, breadboarding

	How manufacturing considerations affect design ❖ What are the different scales of manufacture used to create products ❖ What is one-off production. ❖ What is batch production. ❖ What is mass production. ❖ What products can be made using the different scales of production ❖ What are the different types of materials and stock form available ❖ Types of manufacturing processes: wasting, shaping, forming, joining, finishing, assembly ❖ What are Production costs ❖ How are production costs effected by labour and capital costs **Influences on engineering product design** ❖ What is the difference between Market pull and technology push ❖ What is planned obsolescence and how doe this effect products ❖ What are British and International Standards and why are they used ❖ What is a British Standard (BS) ❖ What is meant by UKCA or United Kingdom Conformity Assesssed ❖ Why does legislation relate to health and safety ❖ What is the purpose of a risk assessment ❖ What is sustainable design. ❖ Why is sustainable design important and what are the (6Rs) Rethink, Reuse, Recycle, Repair, Reduce, Refuse ❖ What is Design for the circular economy how does this influence manufacture of products **Disciplinary Knowledge:** Students should be able to explain what is a quantative and qualitive criteria and be able to explain the purpose of a design specification and generate their own. Students should be able to use a design specification to help generate designs for a desk tidy Students should be able to make a batch produced desk tidy Students should be able to explain what is meant by product requirements and what needs to be considered in the manufacture of a product. Students should be able to select the correct scale of manufacture for different given products. Students should be able to explain the need for regulations and safeguarding in industry Students should be able to apply knowledge and understanding gained in this unit to help complete NEA tasks in R039 & R040	**Substantive Knowledge:** ○ How to use CAD applications to produce and communicate 3D design proposals ○ How to use different techniques to communicate design proposals ○ How to use CAD sketch tool features to communicate designs. (lines, arcs, polygons, extrudes, revolves, sizing, dimensioning, shelling and holes). ○ How to use CAD reference geometry (work planes) ○ How to use CAD to render designs ○ How to generate complex shapes which includes dimensions, lines and angles. ○ How to make 3D CAD assemblies of components ❖ How to use mate tools, mates constraints tool ❖ How to animate assemblies **Disciplinary Knowledge:** Students should be able to use CAD to draught, create 3D models, render designs, create assembly drawings and animate their work. Students will use knowledge gained in this unit to help develop their skills further during the completion of NEA in unit R039 **Disciplinary literacy:** CAD (Computer aided design, draughting, 3D modelling, mate tools, mate constraint tools, rendering, assemblies, animation, shelling communicate, extrudes, dimensiong **Summative assessment:** Technical drawings and CAD work created for R039 Design tasks completed linked to R039 **Extended writing activities** 1. The advantages and disadvantages of using CAD/CAM 2. The impact of Jock Kinneir **Links to KS3:** Use a variety of approaches to generate creative ideas and avoid stereotypical responses Develop and communicate design ideas using annotated sketches. Select from and use specialist techniques, processes precisely	**Summative assessment:** Focused designing and making activities (pen holder, coat hanger) NEA tasks completed linked to R040. Retrieval quizzes **Extended writing activities** 1. How to assess risk in the workplace 2. The use of jigs and formers **Links to KS3:** Select from and use specialist tools, techniques, processes, equipment and machinery precisely Understand the properties of materials and the performance of structural elements to achieve functioning solutions

	Disciplinary literacy: Design specification, user needs, aesthetics , ergonomics, anthropometrics, safety, product requirements, function, features, performance, target group/intended users, working environment, limitations, constraints, size, weight, functional limitations, appearance, ergonomics, lifecycle, product maintenance, product safety, sustainability considerations, the 6 r's, manufacturing considerations, materials, supply chain, ease of manufacture, standard components, pre-manufactured components, design for manufacturing assembly (DFMA), design for disassembly, manufacturing processes, scale of production, prototyping, just-in-time production, one off, batch, mass production, durability and reliability, tolerances, regulations, safeguards, copyright, patents, registered designs, trademarks, British Standards and European Conformity (CE), UKCA, circular economy **Topic 3: Communicating design outcomes** **Types of drawing used in engineering** **Working drawings** **Using CAD drawing software** **Substantive Knowledge:** **Types of drawing used in engineering** ❖ What is Freehand sketching ❖ What is Isometric ❖ What is Oblique ❖ What are Orthographic drawings ❖ What is an exploded view of a drawing ❖ What is an assembly drawing ❖ What is a block diagrams ❖ What is a flowchart ❖ What is a circuit diagrams ❖ What is a wiring diagrams ❖ What are the typical applications and advantages/disadvantages of drawing techniques listed above **Working drawings:** ○ How to use hand-drawing techniques to design and present ideas and concepts ○ How to use annotation and labelling techniques that demonstrate design ideas ○ How to use of ICT software to produce, modify and enrich design proposals (e.g. text, graphics) ○ How to use Standard conventions in BS 8888 and how to apply them ○ How to create a 2D engineering drawings using third angle orthographic projection ○ How to lay out drawing using standard conventions, title block, metric units of measurement, scale and tolerance		

	○ How to dimension drawings using standard conventions for linear measurements, radius, diameter and surface finish ○ What are the meaning of different line types in a working drawing; outlines, hidden detail, centre line, projection, dimension and leader line (dots and arrows) ○ How to show abbreviations, across flats, centre line, diameter, material and square ○ How to represent mechanical features: threads, holes, chamfers and counters **Using CAD drawing software** ❖ Advantages and limitations of using CAD drawing software compared to manual drawing software **Disciplinary Knowledge:** Students should be able to explain the advantages and disadvantages of different drawing techniques used in engineering Students should be able to produce 3D engineering drawings (isometric and oblique, exploded views, assembly drawings) that could be understood by a potential client Students should be able to produce 2D engineering drawings (3rd angle orthographic). Students should be able to show scale, dimensions, materials, parts lists, sectional views with relevant notes that could be understood by a third party. Students should be able to apply knowledge and understanding gained in this unit to help develop their skills further during the completion of units R039 and R040. **Disciplinary literacy:** Hand-drawing techniques, present ideas, concepts, freehand sketching in 2D and 3D, rendering, shade, tone and texture, annotation, features, functions, dimensions, materials, construction, manufacture methods, software, modify, design proposals, text, graphics. Technical drawings, 3D engineering drawings, isometric, oblique, exploded views, assembly drawings, 2D engineering drawings, 3rd angle orthographic, scale, dimensions, materials, parts lists, sectioned view, annotation **Topic 4: Evaluating design ideas** **Methods of evaluating design ideas** **Modelling methods** **Methods of evaluating a design outcome** **Substantive Knowledge:** **Methods of evaluating design ideas** ❖ What is the purpose of a production model ✓ How to make a qualitative comparison with the design brief and specification ❖ How to use a ranking matrices ❖ What is Quality Function Deployment (QFD)		

	Modelling methods ❖ What information can be obtained through different modelling methods ❖ What equipment is required in modelling ❖ What are the advantages and limitations of different modelling methods ❖ How to evaluate a virtual model using 3D CAD ➢ How to evaluate a model in card ✓ How to evaluate a model using block ✓ How to evaluate using breadboarding kin electronics ✓ How to evaluate using 3d printing **Methods of evaluating a design outcome** ❖ How to select a method to evaluate a design outcome by understanding the advantages and limitations of each method ❖ How to use methods of measuring the dimensions and checking the functionality of the product to evaluate a product ✓ How to make a quantitative comparison with the design brief and specification to evaluate the success of a product ✓ How to evaluate a product through user testing ❖ How to identify potential modifications and improvements to the design **Disciplinary Knowledge:** Students should be able to evaluate design work using a variety of different strategies Students should be able to select the best method to evaluate work by understand the advantages and limitations in each method Students should be able to apply knowledge and understanding gained in this unit to help develop their skills further during the completion of units R039 and R040. **Disciplinary literacy:** Qualitative, design brief, specification, ranking matrices, QFD, virtual, CAD, block, breadboarding, 3d printing, quantitative comparison, modiifcations **Summative assessment:** Focused designing and making activity linked to manufacture of a desk tidy and coat hanger Written tasks completed linked to R038. Retrieval quizzes **Extended writing activities** **1.** The Design cycle **2.** Scales of manufacture **3.** Intellectual property **Links to KS3:**		

	Identify and understand user needs. Identify and solve their own design problems and understand how to reformulate problems given to them Develop and communicate design ideas Select from and use specialist tools, techniques, processes, equipment and machinery precisely Analyse the work of others to develop and broaden their understanding Understand developments in design and technology, its impact on individuals, society and the environment		