<table>
<tr><td colspan="2">Subject Area : D&T - Product Design</td></tr>
<tr><td>Year Group : 11</td><td>Unit of Work :NEA</td></tr>
<tr><td>Half Term : 1</td><td>Skills :

Intro communication of ideas - Use of annotated drawings that explain detailed development or the conceptual stages of designing and help to develop, communicate, record and justify design ideas

Continue annotation - Use of annotated drawings that explain detailed development or the conceptual stages of designing and help to develop, communicate, record and justify design ideas

Hand in ideas - Intro analysis of Ideas to help them explore and develop their own ideas

Development - Students are to design and develop prototypes in response to client wants and needs.
• satisfy the requirements of the brief
• respond to client wants and needs
• demonstrate innovation
• are functional
• consider aesthetics
• are potentially marketable.

Students should know and understand how to evaluate prototypes and be able to:
• reflect critically, responding to feedback when evaluating their own prototypes
• suggest modifications to improve them through inception and manufacture
• assess if prototypes are fit for purpose.</td></tr>
<tr><td colspan="2">Reasons behind order of topic in this half term</td></tr>
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Subject Area : D&T - Product Design	
Year Group : 11	Unit of Work : NEA
Half Term : 2	Skills : Development - Students are to design and develop prototypes in response to client wants and needs. • satisfy the requirements of the brief • respond to client wants and needs • demonstrate innovation • are functional • consider aesthetics • are potentially marketable. Students should know and understand how to evaluate prototypes and be able to: • reflect critically, responding to feedback when evaluating their own prototypes • suggest modifications to improve them through inception and manufacture • assess if prototypes are fit for purpose. Development - continued - demonstrate use of CAD/CAM to create initial models Development and modelling, use of CAD as communication tool Development - developed models as a result of previous anthropometric research Consideration of appropriate materials and components to make a prototype. How to select and use materials and components appropriate to the task considering: • functional need • cost • availability. Demonstrate techniques to pupils to show them how to prepare samples which can be annotated ready for use in the development section of their NEA • Papers and boards (how to cut, crease, score, fold and perforate card). • Timber based materials (how to cut, drill, chisel, sand and plane). • Metal based materials (how to cut, drill, turn, mill, cast, bronze and weld). • Polymers (how to cut, drill, cast, deform, print and weld). • Textile based materials (how to sew, pleat, gather, quilt and pipe). Direct pupils how to select and use specialist tools and equipment, including hand tools, machinery, digital design & manufacture, appropriate for the material and/or task to complete quality outcomes. How to use them safely to protect themselves and others from harm. How to select and use specialist techniques and processes appropriate for the material and/or task and use them to the required level of accuracy in order to complete quality outcomes. How to use them safely to shape, fabricate and construct a high quality prototype, including techniques such as wastage, addition, deforming and reforming.

	Development - consideration of materials, and suitability Development - consideration of joining methods, manufacturing processes Final Design - Demonstrate 3rd angle orthographic and exploded drawings - pupils to use Exploded diagrams to show constructional detail or assembly Working Drawings 3rd angle orthographic, using conventions, dimensions and drawn to scale Completion of working drawings
Reasons behind order of topic in this half term	
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Subject Area : D&T - Product Design	
Year Group : 11	Unit of Work : NEA
Half Term : 3	Skills : Manufacturing Specification Manufacture of product - scaled to ensure feasibility in time allocated. Pupils must photograph each stage of the manufacture to create a Diary of Manufacture as homework Manufacture of product - scaled to ensure feasibility in time allocated.
Reasons behind order of topic in this half term	
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Subject Area : D&T - Product Design	
Year Group : 11	Unit of Work : NEA
Half Term : 4	Skills : Pupils must photograph each stage of the manufacture to create a Diary of Manufacture as homework Evaluation of product against Design Brief and Spec Testing with client, considerations of modifications both proposed and undertaken **REVISION FOR EXAMINATION**
Reasons behind order of topic in this half term	
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Subject Area : D&T - Product Design	
Year Group : 11	Unit of Work : REVISION FOR EXAMINATION
Half Term : 5	Skills : 1.1 New and emerging technologies INDUSTRY • The impact of new and emerging technologies on: • the design and organisation of the workplace including automation and the use of robotics • buildings and the place of work • tools and equipment. ENTERPRISE • Enterprise based on the development of an effective business innovation: • crowd funding • virtual marketing and retail • co-operatives • fair trade. SUSTAINABILITY • The impact of resource consumption on the planet • Finite • non–finite • disposal of waste. PEOPLE • How technology push/market pull affects choice. • Changing job roles due to the emergence of new ways of working driven by technological change CULTURE • Changes in fashion and trends in relation to new and emergent technologies. Respecting people of different faiths and beliefs SOCIETY • How products are designed and made to avoid having a negative impact on others: • design for disabled • elderly • different religious groups ENVIRONMENT • Positive and negative impacts new products have on the environment: • continuous improvement • efficient working • pollution • global warming PRODUCTION TECHNIQUES AND SYSTEMS • The contemporary and potential future use of: • automation • computer aided design (CAD)

	• computer aided manufacture (CAM) • flexible manufacturing systems (FMS) • just in time (JIT) • lean manufacturing HOW THE CRITICAL EVALUATION OF NEW AND EMERGING TECHNOLOGIES INFORMS DESIGN DECISIONS? • That it is important to consider scenarios from different perspectives and considering: • planned obsolescence • design for maintenance • ethics • the environment Skills : • 1.2 Energy generation and storage FOSSIL FUELS How power is generated from: • coal • gas • oil. Arguments for and against the selection of fossil fuels NUCLEAR POWER How nuclear power is generated. Arguments for and against the selection of nuclear power RENEWABLE ENERGY How power is generated from: • wind • solar • tidal • hydro-electrical • biomass. ENERGY STORAGE SYSTEMS INCLUDING BATTERIES • Kinetic pumped storage systems • Alkaline and re-chargeable batteries. • 1.3 Developments in new materials MODERN MATERIALS Developments made through the invention of new or improved processes eg Graphene, Metal foams and Titanium. Alterations to perform a particular function eg Coated metals, Liquid Crystal Displays (LCDs) and Nanomaterials. SMART MATERIALS That materials can have one or more properties that can be significantly changed in a controlled fashion by external stimuli, such as stress, temperature, moisture, or PH eg shape memory alloys, thermochromic pigments and photochromic pigments

	COMPOSITE MATERIALS That composite materials are produced by combining two or more different materials to create an enhanced material e.g. glass reinforced plastic (GRP) and carbon fibre reinforced plastic (CRP). TECHNICAL TEXTILES How fibres can be spun to make enhanced fabrics eg conductive fabrics, fire resistant fabrics, kevlar and microfibres incorporating micro encapsulation. Skills : • 1.4 Systems approach to designing INPUTS The use of light sensors, temperature sensors, pressure sensors and switches. PROCESSES The use of programming microcontrollers as counters, timers and for decision making, to provide functionality to products and processes. OUTPUTS The use of buzzers, speakers and lamps, to provide functionality to products and processes. • 1.5 Mechanical devices DIFFERENT TYPES OF MOVEMENT The functions of mechanical devices to produce linear, rotary, reciprocating and oscillating movements. CHANGING MAGNITUDE AND DIRECTION OF FORCE Levers: • first order • second order • third order Linkages: • bell cranks • push/pull Rotary systems: • CAMs and followers • simple gear trains • pulleys and belts Skills : • 1.6 Materials and their working properties PAPERS AND BOARDS Papers including: • bleed proof • cartridge paper • grid • layout paper

	• tracing paper Boards including: • corrugated card • duplex board • foil lined board • foam core board • ink jet card • solid white board NATURAL AND MANUFACTURED TIMBERS Hardwoods including: • ash • beech • mahogany • oak • balsa Softwoods including: • larch • pine • spruce Manufactured boards including: • medium density fibreboard (MDF) • plywood • chipboard METALS AND ALLOYS Ferrous metals including: • low carbon steel • cast Iron • high carbon/tool steel Non ferrous metals including: • aluminium • copper • tin • zinc Alloys including: • brass • stainless steel • high speed steel POLYMERS Thermoforming including: • acrylic (PMMA) • high impact polystyrene (HIPS) • high density polythene (HDPE) • polypropylene (PP) • polyvinyl chloride (PVC) • polyethylene terephthalate (PET) Thermosetting including:

	• epoxy resin (ER) • melamine-formaldehyde (MF) • phenol formaldehyde (PF) • polyester resin (PR) • urea–formaldehyde (UF TEXTILES Natural fibres including: • cotton • wool • silk Synthetic fibres including: • polyester • polyamide (nylon) • elastane (lycra) Blended and mixed fibres including: • cotton/polyester woven including: • plain weave Non-woven including: • bonded fabrics • felted fabrics Knitted textiles including: • knitted fabrics MATERIAL PROPERTIES In relation to the main categories outlined above (not the specific materials identified), students should know and understand physical properties such as: • absorbency (resistance to moisture) • density • fusibility • electrical and thermal conductivity. In relation to the main categories outlined above (not the specific materials identified), students should know and understand working properties such as: • strength • hardness • toughness • malleability • ductility and elasticity. Skills : 2 Specialist technical principles In addition to the core technical principles, all students should develop an in-depth knowledge and understanding of the following specialist technical principles: • 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 2.1 Selection of materials or components In relation to at least one material category or system, students should be able to select materials and components considering the factors listed below • Functionality: application of use, ease of working. • Aesthetics: surface finish, texture and colour. • Environmental factors: recyclable or reused materials. • Availability: ease of sourcing and purchase. • Cost: bulk buying. • Social factors: social responsibility. • Cultural factors: sensitive to cultural influences. • Ethical factors: purchased from ethical sources such as FSC 2.2 Forces and stresses Materials and objects can be manipulated to resist and work with forces and stresses Tension, compression, bending, torsion and shear. Materials can be enhanced to resist and work with forces and stresses to improve functionality How materials can be reinforced, stiffened or made more flexible: eg lamination, bending, folding, webbing, fabric interfacing. 2.3 Ecological and social footprint Ecological issues in the design and manufacture of products Deforestation, mining, drilling and farming. Mileage of product from raw material source, manufacture, distribution, user location and final disposal. That carbon is produced during the manufacture of products. The six Rs Reduce Refuse Re-use Repair Recycle Rethink. Social issues in the design and manufacture of products Safe working conditions; reducing oceanic/ atmospheric pollution and reducing the detrimental (negative) impact on others. 2.4 Sources and origins Primary sources of materials and the main processes involved in converting into workable forms for at least one material area.

	• Paper and board (how cellulose fibres are derived from wood and grasses and converted into paper). • Timber based materials (Seasoning, conversion and creation of manufactured timbers). • Metal based materials (extraction and refining). • Polymers (refining crude oil, fractional distillation and cracking). • Textile based materials (obtaining raw material from animal, chemical and vegetable sources, processing and spinning). 2.5 Using and working with materials Properties of materials Students must know and understand how different properties of materials and components are used in commercial products, how properties influence use and how properties affect performance. Students must know and understand the physical and mechanical properties relevant to commercial products in their chosen area as follows: • Papers and boards (flyers/leaflets and card based food packaging). • Timber based materials (traditional timber children's toys and flat pack furniture). • Metal based materials (cooking utensils and hand tools). • Polymers (polymer seating and electrical fittings). • Textile based materials (sportswear and furnishings). • Electronic and mechanical systems (motor vehicles and domestic appliances). The modification of properties for specific purposes • Additives to prevent moisture transfer (paper and boards). • Seasoning to reduce moisture content of timbers (timber based materials). • Annealing to soften material to improve malleability (metal based materials). • Stabilisers to resist UV degradation (polymers). • Flame retardants reduce combustion and fire hazards (textile based materials). • Photosensitive PCB board in PCB manufacture and anodizing aluminium to improve surface hardness (electronic and mechanical systems). How to shape and form using cutting, abrasion and addition • Papers and boards (how to cut, crease, score, fold and perforate card). • Timber based materials (how to cut, drill, chisel, sand and plane). • Metal based materials (how to cut, drill, turn, mill, cast, bronze and weld).

	• Polymers (how to cut, drill, cast, deform, print and weld). • Textile based materials (how to sew, pleat, gather, quilt and pipe). • Electronic and mechanical systems (how to cut, drill and solder). Skills : 2.6 Stock forms, types and sizes Commercially available types and sizes of materials and components. Papers and boards: • sheet, roll and ply • sold by size eg A3, thickness, weight and colour • standard components eg fasteners, seals and bindings • cartridge paper and corrugated card. Timber based materials: • planks, boards and standard moldings • sold by length, width, thickness and diameter • standard components eg woodscrews, hinges, KD fittings. Metal based materials: • sheet, rod, bar and tube • sold by length, width, thickness and diameter • standard components eg rivets, machine screws, nuts, and bolts. Polymers: • sheet, rod, powder, granules, foam and films • sold by length, width, gauge and diameter • standard components eg screws, nuts and bolts, hinges. Textile based materials: • yarns and fabrics • sold by roll size, width, weight and ply • standard components eg zips, press studs, velcro. Electrical and mechanical components: • sold by quantity, volt and current rating • standard components eg E12 resistor series, dual in line IC packages (DIL), microcontrollers (PIC). 2.7 Scales of production How products are produced in different volumes. The reasons why different manufacturing methods are used for different production volumes: • prototype • batch • mass • continuous. 2.8 Specialist techniques and processes The use of production aids

How to use measurement/reference points,
templates, jigs and patterns where suitable.

Tools, equipment and processes
A range of tools, equipment and processes that can be used to shape, fabricate, construct and assemble
high quality prototypes, as appropriate to the materials and/or components being used including:
wastage, such as:

- die cutting
- perforation
- turning
- sawing
- milling
- drilling
- cutting and shearing

addition, such as:

- brazing
- welding
- lamination
- soldering
- 3D printing
- batik
- sewing
- bonding
- printing

deforming and reforming such as:

- vacuum forming
- creasing
- pressing
- drape forming
- bending
- folding
- blow moulding
- casting
- injection moulding
- extrusion.

How materials are cut shaped and formed to a tolerance
The manufacture to minimum and maximum measurements.
Extracting information on tolerances and using it to control quality and make a prototype.
Commercial processes
Papers and boards (offset lithography and die cutting).

- Timber based materials (routing and turning).
- Metal based materials (milling and casting).
- Polymers (injection molding and extrusion).
- Textile based materials (weaving, dying and printing).
- Electrical and mechanical systems (pick and place assembly and flow soldering).

The application and use of Quality Control to include measurable and quantitative systems used during manufacture

	• Papers and boards (registration marks). • Timber based materials (dimensional accuracy using go/no go fixture). • Metal based materials (dimensional accuracy using a depth stop). • Polymers (dimensional accuracy by selecting correct laser settings). • Textile based materials (dimensional accuracy checking a repeating print against an original sample). • Electrical and mechanical systems (UV exposure, developing and etching times in PCB manufacture). 2.9 Surface treatments and finishes The preparation and application of treatments and finishes to enhance functional and aesthetic properties. • Papers and boards (printing, embossing and UV varnishing). • Timber based materials (painting, varnishing and tanalising). • Metal based materials (dip coating, powder coating and galvanizing). • Polymers (polishing, printing and vinyl decals). • Textile based materials (printing, dyes and stain protection). • Electronic and mechanical systems (PCB lacquering, and lubrication). Surface treatments to inhibit corrosion and oxidation.
Reasons behind order of topic in this half term	
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Subject Area : D&T - Product Design	
Year Group : 11	Unit of Work : REVISION FOR EXAMINATION
Half Term : 6	Skills : PAST PAPERS and MARK SCHEMES **EXAMINATION**
Reasons behind order of topic in this half term	
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