Subject Area : D&T - Product Design	
Year Group : 10	Unit of Work : Core Technical Principles
Half Term : 1	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
Reasons behind order of topic in this half term	

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<tr><td colspan="2">Subject Area : D&T - Product Design</td></tr>
<tr><td>Year Group : 10</td><td>Unit of Work : Core Technical Principles</td></tr>
<tr><td>Half Term : 2</td><td>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.</td></tr>
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<tr><td colspan="2">Subject Area : D&T - Product Design</td></tr>
<tr><td>Year Group : 10</td><td>Unit of Work : Core Technical Principles</td></tr>
<tr><td>Half Term : 3</td><td>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</td></tr>
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Subject Area : D&T - Product Design	
Year Group : 10	Unit of Work : Core Technical Principles
Half Term : 4	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.
Reasons behind order of topic in this half term	
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Subject Area : D&T - Product Design	
Year Group : 10	Unit of Work : **Specialist technical principles**
Half Term : 5	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).
Reasons behind order of topic in this half term	
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Subject Area : D&T - Product Design		
Year Group : 10	Unit of Work : Specialist technical principles	
Half Term : 6	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).	**Intro of Controlled Assessment NEA portfolio. 1 lesson of theory to continue to embed knowledge and 1 lesson of NEA.** Introduction to GCSE DT - Teach how to organise digital work on U Drive/USB/FROG and theory work in files Intro context and brief and analysis of context and brief Intro how to carry out and use primary and secondary data to understand client and/or user needs. Include examples of market research, interviews, focus groups and product analysis and evaluation Pupils to carry out their own user investigation/market research for project Presentation of client's responses using excel charts/tables - highlight that pupils will need to interpret data in their GCSE exam. Intro use of the work of others - • Harry Beck • Marcel Breuer • Coco Chane • Norman Foste • Sir Alec Issigoni • William Morri • Alexander McQueen • Mary Quant • Louis Comfort Tiffan • Raymond Templer • Marcel Breuer • Gerrit Reitveld • Charles Rennie Macintosh • Aldo Rossi • Ettore Sottsass • Philippe Starck • Vivienne Westwood. • Alessi • Apple • Braun • Dyson • Gap • Primark • Under Armour

	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	• Zara. Students must investigate, analyse and evaluate the work of 2 designers and 2 companies from the list provided in previous lesson and create an Inspiration page to inform their own designing. This may also form part of their exam, so all work will need to be printed to put into their theory folder. Intro Human factors and anthropometric data How the following techniques are used and applied: • human factors including ergonomics • the use of anthropometric data and percentiles. Students are to create a page of useful data and information to be referred to when designing for their client Intro Product analysis for improvement • planned obsolescence • design for maintenance • ethics • the environment. Class given same existing product to consider improvements/developments to make it suitable for their client, product maintenance, sustainability, planned obsolescence Intro impact of new and emerging technologies on contemporary and potential future scenarios in relation to industry and production techniques and systems. • the design and organisation of the workplace including automation and the use of robotics • buildings and the place of work • tools and equipment • automation • computer aided design (CAD) • computer aided manufacture (CAM) • flexible manufacturing systems

	• 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**	(FMS) • just in time (JIT) • lean manufacturing. Intro impact of new and emerging technologies on contemporary and potential future scenarios in relation to enterprise and people culture and society, Fairtrade. •Changes in fashion and trends in relation to new and emergent technologies. • Respecting people of different faiths and beliefs. • How products are designed and made to avoid having a negative impact on others: • design for disabled • elderly • different religious groups. • crowd funding • virtual marketing and retail • co-operatives • fair trade. • How technology push/market pull affects choice. • Changing job roles due to the emergence of new ways of working driven by technological change. Intro impact of new and emerging technologies on contemporary and potential future scenarios in relation to sustainability and environment, ecological, environmental and social issues in design, The impact of resource consumption on the planet: • finite • non–finite • disposal of waste. • Positive and negative impacts new products have on the environment: • continuous improvement • efficient working • pollution • global warming. • Deforestation, mining, drilling and farming. • Carbon footprint • 6rs - Reduce, refuse, re-use, repair, recycle and rethink.

	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.	Intro Design Specification - based on the analysis of their research, pupils are to use ACCESSFMMSME to write a detail Design Specification. Hand in Section A Intro Design strategies How different strategies can be applied, including: • collaboration • user cantered design • a systems approach • iterative design • avoiding design fixation. Intro Design Ideas - freehand sketching, isometric and perspective, 2D and 3D drawing. Students to generate imaginative and creative design ideas using a range of different design strategies. Design Ideas continued over Summer Holidays.
Reasons behind order of topic in this half term		
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