SPECIALIST TECHNICAL PRINCIPLES

In addition to the core technical principles you must develop an in depth 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

This is delivered through at least one material category. The following refer to a range of categories including **timber, metal, polymer, and textiles** but you should choose just one to focus on where highlighted.

Selection of materials or components	**R**	**A**	**G**
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 purchasing			
Cultural factors: sensitive to cultural influences			
Ethical factors: purchased from ethical sources such as FSC (Forestry Stewardship Council)			
WEBLINKS BBC Bitesize revision (timber), (metals), (polymers), (textiles)			
Forces and stresses	**R**	**A**	**G**
Materials can be manipulated to resist and work with forces and stresses: - Tension - Compression - Bending - Torsion - Shear			
Materials can be enhances to resist and work with forces and stresses to improve functionality - Laminating - Bending - Folding			
WEBLINKS BBC Bitesize revision (timber), (metals), (textiles)			

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Ecological and Social Footprint	**R**	**A**	**G**
Deforestation, mining, drilling and farming			
Mileage and Transport - Raw material - Manufacture - Distribution - User Location - Final disposal			
Carbon Footprint of the material			
The six R's - Reduce - Reuse - Repair - Recycle - Rethink - Refuse			
Social issues in the design and manufacture of products - Safe working conditions - Reducing pollution - Reducing the negative impact on others in the conversion of materials			
WEBLINKS BBC Bitesize revision (timber), (metals), (polymers), (textiles)			
Sources and Origins *CHOOSE ONE MATERIAL CATEGORY*	**R**	**A**	**G**
Primary sources of materials and the main processes involved in converting into workable forms: - Seasoning, Conversion, Creation of manufactured boards (timbers) - Extraction and refining (metals) - Refining crude oil, fractional distillation and cracking (polymers) - Obtaining raw material from animal, chemical and vegetable sources, processing and spinning (textiles)			
WEBLINKS BBC Bitesize revision (timber), (metals), (polymers), (textiles)			
Using and working with materials *CHOOSE ONE MATERIAL CATEGORY*	**R**	**A**	**G**
Know and understand how different properties of materials and components are used in commercial products and how these properties affect performance. For example: - Choice of timber for a traditional children toy - Choice of manufactured board for flat pack furniture - Choice of papers and boards for flyers/leaflets and card based food packaging). - Choice of metal for cooking utensils and hand tools - Choice of polymers for seating and electrical fittings - Choice of textile for sportswear and furnishings			
Modification of properties for specific purposes: - Seasoning of timbers to reduce moisture content - Annealing to soften metals and improve malleability - Stabilisers to resist UV degradation in polymers - Flame retardants to reduce combustion and fire hazards			
How to shape and forum using cutting, abrasion and addition: - Cut (methods), Drill, Chisel, Sand, Plane for timbers - Cut (methods), drill, turn, mill, cast, bronze and weld (metals) - cut (methods), drill, cast, deform, print and weld (polymers) - sew, pleat, gather, quilt and pipe (textiles)			
WEBLINKS BBC Bitesize revision (timber), (metals), (polymers), (textiles)			

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Stock forms, types and sizes *CHOOSE ONE MATERIAL CATEGORY*	**R**	**A**	**G**
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 mouldings • sold by length, width, thickness and diameter • standard components eg woodscrews, hinges, Knock Down 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. - Polymer based materials: • 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.			
WEBLINKS BBC Bitesize revision (timber), (metals), (polymers), (textiles)			
Scales of Production	**R**	**A**	**G**
How products are produced in different volumes and the reason why different manufacturing processes are used. - prototype - batch - mass - continuous			
WEBLINKS BBC Bitesize revision (timber), (metals), (polymers), (textiles)			
Specialist techniques and processes	**R**	**A**	**G**
The use of production aids - How to use measurement/reference points - templates - jigs - reasons for using these production aids			
Tools equipment and processes *CHOOSE ONE MATERIAL CATEGORY*	**R**	**A**	**G**
A range of tools, equipment and processes that can be used to shape, fabricate, construct and assemble high quality prototypes including: - wastage, such as: o turning, sawing, drilling o die cutting (paper/textiles) - addition, such as: o lamination (timbers) o brazing, welding, soldering (metals) o 3D printing (polymers) o piping, quilting, sewing (textiles) - deforming and reforming such as: o vacuum forming, blow moulding, injection moulding (polymers) o bending, folding, casting (metals) o drape forming			
How materials are cut shaped and formed to a tolerance	**R**	**A**	**G**
The manufacture to minimum and maximum measurements (tolerances)			

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Commercial Processes *CHOOSE ONE MATERIAL CATEGORY*	**R**	**A**	**G**
Timber based materials: - routing and turning Metal based materials: - milling and casting Polymer based materials: - injection moulding and extrusion Textile based materials: - weaving, dying and printing			

Quality Control *CHOOSE ONE MATERIAL CATEGORY*	**R**	**A**	**G**
The application and use of a quality control to include measurable and quantitative systems used during manufacture such as dimensional accuracy: - using go/no go fixture (timbers) - using a depth stop (metals) - selecting correct laser settings (laser cutter) - registration marks (papers & boards) - using a seam allowance (textiles)			
WEBLINKS Tools, equipment and processes: (timber), (metals), (polymers), (textiles) Commercial processes: (timber), (metals), (polymers), (textiles) Accuracy and quality control: (timber), (metals), (polymers), (textiles)			
Surface Treatments and Finishes *CHOOSE ONE MATERIAL CATEGORY*	**R**	**A**	**G**
The preparation and application of treatments and finishes to enhance function and aesthetic properties: - painting, varnishing, tantalising (timbers) - dip coating, powder coating and galvanizing (metals) - polishing, printing and vinyl decals (polymers) - printing, dyes and stain protection (textiles)			
WEBLINKS BBC Bitesize revision (timber), (metals), (polymers), (textiles)			