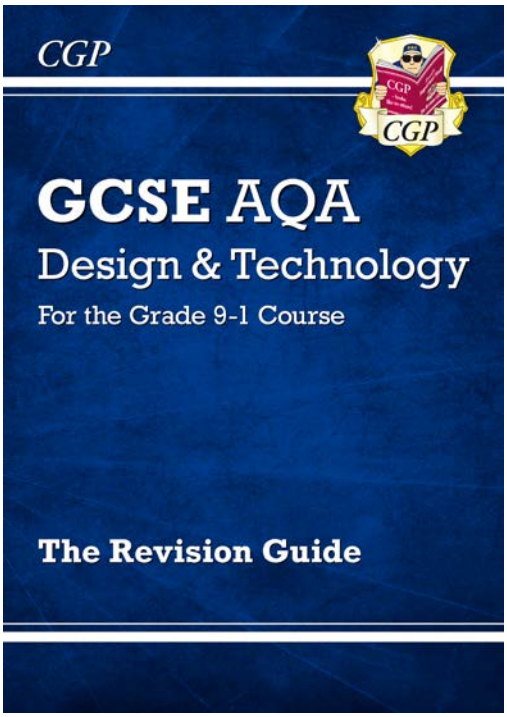
Please use your Blue Revision guides and class notes to revise the following topics for the exam:

In Section 3.2 Specialist technical principles: Focus on your material area only i.e.

- Papers and Boards,
- Woods, metals and plastics, or
- Textiles



New and emerging technologies

Students must know and understand the impact of new and emerging technologies on contemporary and potential future scenarios in relation to the following areas:

Industry

Content	Revised:
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

Content	Revised:
Enterprise based on the development of an effective business innovation: • crowd funding • virtual marketing and retail • co-operatives • fair trade.	

Sustainability

Content	Revised:
The impact of resource consumption on the planet: • finite • non–finite • disposal of waste.	

People

Content	Revised:
How technology push/market pull affects choice. Changing job roles due to the emergence of new ways of working driven by technological change.	

Culture

Content	Revised:
Changes in fashion and trends in relation to new and emergent technologies. Respecting people of different faiths and beliefs.	

Society

Content	Revised:
How products are designed and made to avoid having a negative impact on others: • design for disabled • elderly • different religious groups.	

Environment

Content	Revised:
Positive and negative impacts new products have on the environment: • continuous improvement • efficient working • pollution • global warming.	

Production techniques and systems

Content	Revised:
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

Content	Revised:
That it is important to consider scenarios from different perspectives and considering: • planned obsolescence • design for maintenance • ethics • the environment.	

1.1.1 Energy generation and storage

Students should understand how energy is generated and stored and how this is used as the basis for the selection of products and power systems.

Fossil fuels

Content	Revised:
How power is generated from: • coal • gas • oil. Arguments for and against the selection of fossil fuels.	

Nuclear power

Content	Revised:
How nuclear power is generated. Arguments for and against the selection of nuclear power.	

Renewable energy

Content	Revised:
How power is generated from: • wind • solar • tidal • hydro-electrical • biomass. Arguments for and against the selection of renewable energy.	

Energy storage systems including batteries

Content	Revised:
Kinetic pumped storage systems. Alkaline and re-chargeable batteries.	

1.1.2 Developments in new materials

Students should be aware of developments in new materials.

Modern materials

Content	Revised:
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

Content	Revised:
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

Content	Revised:
That composite materials are produced by combining two or more different materials to create an enhanced material eg glass reinforced plastic (GRP) and carbonfibre reinforced plastic (CRP).	

Technical textiles

Content	Revised:
How fibres can be spun to make enhanced fabrics eg conductive fabrics, fire resistant fabrics, kevlar and microfibres incorporating micro encapsulation.	

11.3 Systems approach to designing

Students should consider electronic systems including programmable components to provide functionality to products and processes, and enhance and customise their operation.

Inputs

Content	Revised:
The use of light sensors, temperature sensors, pressure sensors and switches.	

Processes

Content	Revised:
The use of programming microcontrollers as counters, timers and for decision making, to provide functionality to products and processes.	

Outputs

Content	Revised:
The use of buzzers, speakers and lamps, to provide functionality to products and processes.	

1.1.4 Mechanical devices

Different types of movement

Content	Revised:
The functions of mechanical devices to produce linear, rotary, reciprocating and oscillating movements.	

Changing magnitude and direction of force

Content	Revised:
Levers: • first order • second order • third order Linkages: • bell cranks • push/pull. Rotary systems: • CAMs and followers • simple gear trains • pulleys and belts.	

1.1.5 Materials and their working properties

Students should know and understand the categorisation of the types and properties of the following materials.

1.1.5.1 Material categories

Papers and boards

Content	Revised:
Students should have an overview of the main categories and types of 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

Content	Revised:
Students should have an overview of the main categories and types of 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

Content	Revised:
Students should have an overview of the main categories and types of metals and alloys: ferrous metals including: • low carbon steel • cast Iron • high carbon/tool steel non ferrous metals including: • aluminum • copper • tin • zinc alloys including: • brass • stainless steel • high speed steel.	

Polymers

Content	Revised:
Students should have an overview of the main categories and types of 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

Content	Revised:
Students should have an overview of the main categories and types of 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.	

1.1.5.2 Material properties

Students should have an understanding of the working and physical properties of the materials in Material categories (page 16).

Material properties

Content	Revised:
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.	

3.2 Specialist technical principles: Focus on your material area only

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.

Each specialist technical principle should be delivered through **at least one** material category **or** system. Not all of the principles outlined above relate to every material category or system, but all must be taught.

The categories through which the principles can be delivered are:

- papers and boards
- timber based materials
- metal based materials
- polymers
- textile based materials
- electronic and mechanical systems.

3.2.1 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.

Content	Revised:
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.	

3.2.2 Forces and stresses

In relation to **at least one** material category or system, students should know and understand the impact of forces and stresses and the way in which materials can be reinforced and stiffened.

Materials and objects can be manipulated to resist and work with forces and stresses

Content	Revised:
Tension, compression, bending, torsion and shear.	

Materials can be enhanced to resist and work with forces and stresses to improve functionality

Content	Revised:
How materials can be reinforced, stiffened or made more flexible: eg lamination, bending, folding, webbing, fabric interfacing.	

3.2.3 Ecological and social footprint

In relation to **at least one** material category or system, students should have a knowledge and understanding of the ecological and social footprint left by designers.

Ecological issues in the design and manufacture of products

Content	Revised:
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

Content	Revised:
Reduce, refuse, re-use, repair, recycle and rethink.	

Social issues in the design and manufacture of products

Content	Revised:
Safe working conditions; reducing oceanic/ atmospheric pollution and reducing the detrimental (negative) impact on others.	

3.2.4 Sources and origins

In relation to **at least one** material category, students should know and understand the sources and origins of materials.

Content	Revised:
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).	

3.2.5 Using and working with materials

In relation to **at least one** material category or system, students should know and understand in addition to material properties (page 15), the factors listed below.

Properties of materials

Content	Revised:
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

Content	Revised:
• 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

Content	Revised:
• 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).	

Stock forms, types and sizes

In relation to **at least one** material category or system, students should know and understand the different stock forms types and sizes in order to calculate and determine the quantity of materials or components required.

Content	Revised:
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).	

3.2.6 Scales of production

In relation to **at least one** material category or system, students should be able to select materials and components considering scales of production and referencing the processes listed in Specialist Techniques and processes. (page 25)

Content	Revised:
How products are produced in different volumes. The reasons why different manufacturing methods are used for different production volumes: • prototype • batch • mass • continuous.	

3.2.7 Specialist techniques and processes

In relation to **at least one** material category or system, students should know and understand the factors listed below.

The use of production aids

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

Tools, equipment and processes

Content	Revised:
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

Content	Revised:
The manufacture to minimum and maximum measurements.	

Commercial processes

Content	Revised:
• 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

Content	Revised:
• 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).	

3.2.8 Surface treatments and finishes

In relation to **at least one** material category or system, students should have knowledge and understanding of surface treatments and finishes.

Content	Revised:
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).	

3.3 Designing and making principles

Students should know and understand that all design and technology activities take place within a wide range of contexts.

They should also understand how the prototypes they develop must satisfy wants or needs and be fit for their intended use. For example, the home, school, work or leisure.

They will need to demonstrate and apply knowledge and understanding of designing and making principles in relation to the following areas:

- 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

Use primary and secondary data to understand client and/or user needs

Content	Revised:
How the following techniques are used and applied: • market research, interviews and human factors including ergonomics • focus groups and product analysis and evaluation • the use of anthropometric data and percentiles.	

How to write a design brief and produce a design and manufacturing specification

Content	Revised:
Students should consider their own needs, wants and interests and those of others.	

Carry out investigations in order to identfy problems and needs

Content	Revised:
Why a designer considers alterations to a brief and modifying the brief as required.	

Content	Revised:
The environment, social and economic challenges that influence design and making. How the following might present opportunities and constraints that influence the processes of designing and making: • deforestation • possible increase in carbon dioxide levels leading to potential global warming • the need for fair trade.	

Content	Revised:
Students should investigate, analyse and evaluate the work of past and present designers and companies to inform their own designing. Students should investigate the work of a minimum of two of the following designers: • Harry Beck • Marcel Breuer • Coco Chanel • Norman Foster • Sir Alec Issigonis • William Morris • Alexander McQueen • Mary Quant • Louis Comfort Tiffany • Raymond Templer • Marcel Breuer • Gerrit Reitveld • Charles Rennie Macintosh • Aldo Rossi • Ettore Sottsass • Philippe Starck • Vivienne Westwood. Students should investigate the work of a minimum of two of the following companies: • Alessi • Apple • Braun • Dyson • Gap • Primark • Under Armour • Zara.	