GCSE: Design and Technology

CORE content revision and homework checklist and timetable for mock examinations

Below is a breakdown of all revision topics required for the exam along with useful links.

Alternatively the GCSE Bitesize website can be used to support all areas and can be found at;
www.bbc.com/bitesize/examspecs/z4nfwty

Revision topic: Design and technology and our world

www.technologystudent.com/despro_flsh/NEW_GCSE3.html

http://resource.download.wjec.co.uk.s3.amazonaws.com/vtc/2016-17/16-17_1-4/website/index.html

	Topic
1.	**The impact of new and emerging technologies.**
	Market pull
	Technology push
	Consumer choice- consumers wishing to own the latest technologies/products
	Product life cycle
	Global production
	Legislation to which products are subjected
	Consumer rights and protection
	Moral and ethical factors when manufacturing and selling products
	Sustainability; meeting today's needs without compromising future generations
	Advantages and disadvantages of CAD
	Advantages and disadvantages of CAM
	CAM equipment; CNC embroidery, vinyl cutting, CNC routing, laser cutting and 3D printing.
2.	**How the critical evaluation of new and emerging technologies informs design decisions.**
	Sustainable and environmental issues when designing and making
	Social, cultural, economic and environmental responsibilities when designing and making
	The Six R's of sustainability
	Life cycle analysis (the impact of a product on the environment)
	Fair Trade
	Ecological footprint and carbon footprint
3.	**How energy is generated and stored.**
	Types of renewable and non-renewable energy source. Including; wind, solar, geothermal, hydroelectric, wood/biomass, wave, coal, gas, nuclear and oil
	Issues surrounding the use of fossil fuels; coal, oil and gas
	Advantages and disadvantages of renewable energy sources
	The use of solar panels and wind turbines in manufacturing sites
	Renewable energy sources for products; wing up and photovoltaic
	Energy: motor vehicles (petrol, diesel, electricity) household products (battery, solar, mains electricity)

Revision topic: Smart materials, composites and technical textiles

resource.download.wjec.co.uk.s3.amazonaws.com/vtc/2016-17/16-17_1-4/website/index.html

www.technologystudent.com/despro_3/revcards_smart1.html

www.technologystudent.com/despro_flsh/revise20.html

	Topic
1.	**Developments in modern and smart materials.**
	Electroluminescent film or wire (LCD)
	Quantum Tunnelling Composite (QTC)
	Shape memory alloys (SMA)
	Polymorph
	Smart Fibres and fabrics that respond to the environment or stimuli: - *Photochromic* - *Thermo chromic* - *Microencapsulation* - *biometrics*
	Carbon fibre, Kevlar and GRP
	Interactive Textiles that function as electronic devices and sensors: - *circuits integrated into fabrics (e.g. heart rate monitor)* - *wearable electronics (e.g. mobile phones, music player, GPS, tracking systems and electronics integrated into fabrics itself)*
	Micro-fibres in clothing manufacturing
	Phase changing materials, breathable materials, proactive heat and moisture management
	Sun protective clothing
	Nomex
	Geotextiles for landscaping
	Rhovyl as an antibacterial fibre

Revision topic: Mechanical components and devices

resource.download.wjec.co.uk.s3.amazonaws.com/vtc/2016-17/16-17_1-4/website/index.html

www.technologystudent.com/cams/camdex.htm

	Topic
1.	**The functions of mechanical devices**
	Principles of a mechanical device to transform input motion and force into a desired output motion and force
	Analyse everyday mechanical devices and how they function
	Consider mechanical systems in terms of input, process, output
	Mechanical systems which; - *Increase or decrease speed of movement/rotation* - *Change magnitude/direction of force/movement/rotation*
	Simple calculations involving mechanical systems
	Analyse the function of mechanical products that have; - *Pulley system, e.g. curtain rails, sewing machine* - *Gear systems, e.g. whisk, hand rail* - *Levers and linkages, e.g. scissors* - *Rack and pinion, e.g. chair lift* - *Cams, e.g. automata toys*

Revision topic: Electronic systems and programmable components

resource.download.wjec.co.uk.s3.amazonaws.com/vtc/2016-17/16-17_1-4/website/index.html

www.technologystudent.com/elec1/elecex.htm

	Topic
1.	**How electronic systems provide functionality to products and processes**
	Circuit diagrams, block diagrams and flow charts
	Systems; input- process- output
	Principles of a control system; - *input data from a sensor: light dependent resistor (LDR) and thermistor* - *processing by control devices: semi-conductor, IC, microprocessor or computer* - *Output: buzzer, light emitting diode (LED)*
	The importance of feedback within the system
	The method of providing feedback in different systems
	Control devices that include counting, switching and timing
	Analogue and digital sensors as input components
2.	**The use of programmable components**
	Sub routines or macros in control systems
	Programmable microcontrollers can be used to control a range of systems
	Programmable microcontrollers can interface with other devices
	Programmable microcontrollers can be reprogrammed repeatedly
	The benefits and limitations of programmable microcontrollers
	Programmable interface controllers (PIC) and how they can be used to control products or systems

Revision topic: Materials

http://resource.download.wjec.co.uk.s3.amazonaws.com/vtc/2016-17/16-17_1-4/website/index.html

http://www.technologystudent.com/pdf15/POSTER_PAPERANDBOARDS1.pdf

	Topic
1.	**Papers and boards**
	The categorisation and properties of paper, cards, boards and composite materials. E.g. strength, folding ability, surface finish and absorbency
	Papers, cards and boards can be laminated to improve strength, finish and appearance
	Standard ISO sizes of paper
	The use of grammage i.e. grams per square metre (gsm) to measure weight of paper
	The use of microns to measure thickness of card
	The use of recycled materials to manufacture papers and boards
	The aesthetic and functional properties of common papers, cards and boards. E.g. layout paper, tracing paper, copier paper, recycled paper, corrugated board, cartridge paper, mounting board and folding boxboard

http://resource.download.wjec.co.uk.s3.amazonaws.com/vtc/2016-17/16-17_1-4/website/index.html

http://www.technologystudent.com/joints/joindex.htm

	Topic
2.	**Natural and manufactured timber**
	The categorisation and properties of hardwoods and softwoods
	Properties to be considered: strength, grain structure, surface finish and absorbency
	Natural timers is harvested from deciduous (hardwoods) and coniferous (softwood) trees
	Natural timbers is available in the following forms: plank, board, strip, square and dowel
	Natural timbres can be identified by weight, colour, grain, texture, durability and ease of working
	Different finishes are used on natural timbers to protect and give aesthetic appeal
	Categorisation and properties of manufactured timbers
	Manufactured timbres are made from natural timbers and are made from particles/ fibres or laminates
	Manufactured timbres are available in standard sizes and forms: plywood, MDF, chipboard, hardwood and veneered boards
	Finishes are used on manufactured timbers to protect and improve aesthetics

Materials

http://resource.download.wjec.co.uk.s3.amazonaws.com/vtc/2016-17/16-17_1-4/website/index.html

http://www.technologystudent.com/joints/joindex.htm

	Topic
3.	**Ferrous and non-ferrous metals**
	Categorisation and working properties if ferrous metals, non-ferrous metals and alloys
	Properties of metals: hardness, elasticity, conductivity, toughness, uctility, tensile strength and malleability
	Metals are sold as sheet, bar, rod, tube and angle
	Ferrous metals: cast iron, mild steel, medium carbon steel and high carbon steel
	Ferrous metals may require a protective finish and the is sometimes used to improve aesthetic appeal
	Non-ferrous metals: aluminium, copper, brass, bronze
	Alloys of metal are a base metal mixed with other metals or non-metals to change their properties or appearance
	Non-ferrous metals may require a protective finish which can sometimes improve aesthetic appeal

http://resource.download.wjec.co.uk.s3.amazonaws.com/vtc/2016-17/16-17_1-4/website/index.html

http://www.technologystudent.com/joints/joindex.htm

	Topic
4.	**Thermoforming and thermosetting polymers**
	Categorisation and physical properties of polymers
	Polymers can be made from both natural and synthetic resources
	Polymers are sold as sheet, film, bar, rod and tube
	The differences between a thermoforming (thermoplastic) and thermosetting material
	Properties of polymers: weight, hardness, elasticity, conductivity/insulation, toughness and strength
	The properties of thermoplastics: polythene, polystyrene, polypropylene and PVC
	The properties of the thermosetting plastics: UF (urea formaldehyde), MF (melamine formaldehyde), PR (polyester resin) and ER (epoxy resin)

http://resource.download.wjec.co.uk.s3.amazonaws.com/vtc/2016-17/16-17_1-4/website/index.html

	Topic
5.	**Natural, synthetic, blended and mixed fibres, and woven, non-woven and knitted textiles.**
	The categorisation and working properties of fibres and textiles.
	The raw materials of textiles are classified according to their source.
	Natural polymers:

	Animal polymers: wool/fleece – mohair, cashmere, angora, alpaca, camel (hair). *Insect polymers: silk.* *Plant polymers: cotton, linen hemp, jute, rayon, viscose.*
	Manufactured polymers: *Synthetic: polyester, polypropylene, nylon, acrylic, elastane, lycra, aramid fibres.* *Microfibres – Tactel, Tencel (Lyocell).*
	The properties of textiles fibres: strength, elasticity, absorbency, *durability, insulation, flammability, water-repellence, anti-static and resistance to acid, bleach and sunlight.*
	Blending and mixing fibres improves the properties and uses of yarns and materials.

INDEPTH content

Revision topic: Natural and Manufactured Timber *(Mr. Nines group only)*

http://www.technologystudent.com/joints/joindex.htm

Topic
The physical and working properties of hardwoods, softwoods and man-made boards: toughness, flexibility, grain structure, strength, absorbency, surface finish, colour and hardness.
Natural solid timber - strengths and weaknesses
Defects: shrinkage, splits, shakes, knots, fungal attack.
Hardwoods: beech, oak, mahogany, balsa and jelutong.
Softwoods: scots pine, western red cedar and parana pine.
Strengths, weaknesses of the following manufactured boards: • plywood, • MDF - medium density fibreboard, • Chipboard • hardboard.
The impact on the environment of deforestation.
Ecological and social footprint.
Changing society's view on waste, encourage recycling.
Living in a greener world.
Life-cycle analysis of a material or product.
Aesthetic properties of natural and manufactured timbers.
Functional properties of natural and manufactured timbers.
Responsibilities of designers and manufacturers who design using timber with respect to: • the environment; • working conditions in third world countries, low labour costs and poverty; • exploitation of employees; • recyclability and waste.
Biodiversity and deforestation.
Estimating the true costs of a prototype or product.
Comparison costs of hardwoods, softwoods and manufactured board.
The behaviour of natural and manufactured timber under forces or under stress.
The stiffness and a strength of natural timber will depend upon the wood, the cross sectional area and the depth of the section.

Reinforcement of natural timber by laminating.
The strength of plywood will depend upon the number of layers and the wood grain being at right angles. The strength of a timber product will depend upon how the product is jointed or what fixing method is used.
Natural timber is available in different sectional forms, various standard sizes and can have a different finish (sawn or planed).
Manufactured boards are commonly available in sheet form and in standard sizes and various thicknesses.
Calculate the costs involved in the design of products: fixtures, fittings, finishes required and the material cost.
Advantages and disadvantages of producing single, one off products.
The advantages and disadvantages of producing products in limited quantities (batch production).
The need to produce a number of identical products. • Jigs and devices to control repeat activities. • The advantages and disadvantages of high volume, continuous production. • Issues related to high volume production. • The importance of CAM in modern high volume production.
Tools and equipment to mark out, hold, cut, shape, drill and form laminates of natural timbers and manufactured boards.
The pillar drill to drill holes to various diameters.
Jigs and formers to ensure accuracy as part of the process of drilling, bending, cutting wood materials.
Material joining can be permanent or temporary.
The principles of producing wood products using the following processes: jointing, veneering, laminating and steam bending.
Classification of wood joints as frame or box construction. • Frame: mitre, dowel, mortise and tenon, halving and bridle joint. • Box/carcass: butt, lap, housing, dovetail and comb joint.
Adhesives: PVA (wood to wood), contact adhesive and epoxy resin (wood to other materials).
Temporary: screw (countersunk and round head) and knock down fittings.
The use of Laser cutters with wood
CAM machines • CNC router • CNC lathe
Surface treatments of natural timber and manufactured boards to prolong life of a product: • sealants and primers.
Finishes for aesthetic or functional reasons: • varnish • wood stains • oils • polishes • preservative paints.

Revision topic: Natural and Synthetic Fibres and Fabrics *(Miss. Williams group only)*

http://resource.download.wjec.co.uk.s3.amazonaws.com/vtc/2016-17/16-17_1-4/website/index.html

	Topic
1.	**Characteristics of fabrics and fibres**
	Construction method. Advantages and disadvantages.
	Weaving: Plain, Twill, Satin, herringbone, pile
	Knitting: Weft knit and Warp knit
	Bonding: Adhesives, heating thermoplastic fibres, stitching a web of fibres
	Laminating
	Felting
	Natural polymers: (properties of) - *Animal polymers: wool/fleece- mohair, cashmere, angora, alpaca, camel (hair)* - *Insect polymers: silk* - *Plant polymers: cotton, linen hemp, jute, rayon, viscose*
	Manufactured polymers: (properties of) - *Synthetic: polyester, polypropylene, nylon, acrylic, elastane, lycra, aramid fibres* - *Microfibers: Tactel, Tencel (lyocell)*
	The properties of textiles fibres: strength, elasticity, absorbency, durability, insulation, flammability, water-repellence, anti-static and resistance to acid, bleach and sunlight
	Blending and mixing fibres improves the properties and uses of yarns and materials: *Blends:* - *Polyester and Cotton* - *Silk and Viscose* - *Hemp and Cotton or Silk* *Mixture:* - *Cotton and Wool* - *Lycra with Wool, Cotton or Nylon*
	Staple and continuous filaments: textured yarns, novelty yarns (chenille) and these determine weight, flexibility, handle and end use
	Bonding breathable waterproof membrane to outer fabrics: - *Gore Tex* - *Permatex*
	Bonding foam to knitted or woven fabrics
	Bonding plastic to loosely woven cotton to simulate leather
	Quilting- polyester wadding between outer and lining material
2.	***Material choice***
	Finishing methods of enhancing appearance: - *Colouring* - *Surface decoration* - *Embossing* - *Glazing* - *Moire effect* - *Stiffening* - *Increasing luster (calendaring, mercerising)*

	- *Brushing* - *Satin resistance (Scotchguard, Teflon)*
	To enhance fabric life: - *Flame retardant* - *Moth proofing*
	To improve function: - *Shower proofing using PVC or PVA or wax* - *Crease resistance using resin* - *Waterproofing using silicones* - *Shrink resistance using chlorine treatment* - *Anti-static finish* - *Coating with PVC* - *Neoprene* - *Silicone rubber* - *Polyurethane* - *Use of barrier membranes laminated to an outer or inner shell to make them breathable yet waterproof* - *Windproof (close weave construction)*
	Responsibilities of designers and manufacturers: - *The environment* - *Fairtrade (working conditions, low labour costs, poverty, exploitation)* - *Recyclability and waste* - *biodiversity*
3.	**Fabric strength**
	Fabrics and components behave differently when subjected to force or stress: - *loaded rucksack, tents, geotextiles, active sportswear, work wear ,normal daily wear*
	Textiles can be strengthened by laminating, bonding and quilting
	Strength of fabric depends on joining or fixing methods used
4.	**Fabric sizes**
	Textiles materials come in standard widths 90cm, 115cm, 150cm, 200cm, 240cm
	Lay plan to help cost and quantity of fabric needed
	Calculate cost and quantities for components
5.	**Scales of production**
	Scales of production: - *custom made or one off* - *batch production* - *mass production* - *line production* - *progressive bundle system* - *cell production* - *JIT*
6.	**Technical processes**
	Use of correct materials, tools and equipment for practical tasks. E.g. Tailors chalk
	Use of zipper foot and embroidery foot
	Methods to neaten raw edges: overlocking, binding, zig zag stitch, lining, rolled hem

	CAD/ CAM for cutting templates
	Pattern language and lay plans
	Visual checks for pattern drop/ match
	Seam tolerances and the importance
	Cutting on bias, notches, hot notch marking in industry, grain lines, balance marks, tuck/pleat lines, darts, position of pockets, buttons/ holes, centre front/ back
	Methods of transferring important marks onto material prior to product manufacture
	Cutting tools in industry and their uses: - *Straight knives, round or band knives, automated die cutters, computer controlled cutting machines, laser cutters, band saw*
	Equipment used for lay planning and material quantities (several layers)
7.	**Decorative techniques**
	Dyeing: piece, dip, random, tie and dye, batik
	Printing: silk screen, roller, discharge, block, burn out, stencilling, marbling, air brushing
	Painting: felt tip, dimensional, fabric paint, silk paints
	Transfers: image- marker, ink jet transfer (CAM)
	Embroidery: hand embroidery, machine embroidery (CAM)
	Applique, beadwork