The English Martyrs Catholic School and Sixth Form College

Year 11 Knowledge organiser

Textiles

A Member Of Bishop Hogarth Catholic Education Trust

Name:

Natural and synthetic fibres

- Fibres are the raw materials that all textile materials are made from.
- Fibres are fine hair-like structures that are twisted together to make yarn.
- Yarns are used to make textile materials.
- Some materials are made directly from fibres.
- All fibres have a set of properties which affect what they can be used for.

Fibres sources:

- Natural – plants, animals, insects
- Manufactured – synthetic, derived from coal, oil and petrochemicals
- Regenerated – part-natural, part-chemical

Natural fibres are:

- Sustainable – renewable, will grow back
- Biodegradable – will decompose (rot)

Manufactured (synthetic) fibres are:

- Unsustainable - sources will run out, finite
- Non-biodegradable – do not break down

Microfibres

- Can be natural and manufactured
- 100 times finer than a human hair
- Microfibres are engineered to include specific properties such as strength and crease resistance
- Sportswear, underwear and high-performance clothing are often made from microfibres

Natural Plant (cellulosic)

- *Cotton*: absorbent, cool to wear, strong, flammable, creases easily, shrinks, easy to care for
- *Linen*: absorbent, cool to wear, creases easily, flammable, hard wearing, strong, handles well
- *Hemp*: absorbent, anti-bacterial, anti-static, strong, lustrous
- *Jute*: highly absorbent, non-static, high tensile strength
- *Bamboo*: absorbent, soft, fine, lustrous, anti-static, antimicrobial, non-irritant, crease resistant, high tensile strength
- *Soya*: absorbent, soft, smooth, lustrous, crease and shrink resistant, lightweight, UV resistant, anti-bacterial

Natural Animal (protein)

- *Wool/fleece*: absorbent, warm, good elasticity, crease resistant, low flammability
- *Animal fibres include*: mohair, cashmere, angora, alpaca, camel (hair), llama

Natural Insect (protein)

- *Silk*: absorbent, lustrous with natural sheen, comfortable to wear, cool or warm to wear, creases, strong when dry

Manufactured

- *Polyester*: strong, flame resistant, thermoplastic, tough and hardwearing
- *Nylon (polyamide)*: strong, hardwearing, thermoplastic, good elasticity
- *Acrylic*: strong when dry, thermoplastic, resistant to mildew and acids
- *Polypropylene*: strong, crease resistant, thermoplastic, low melting point, hardwearing, resistant to chemicals
- *Elastane/Lycra*: strong, high elasticity and stretch, lightweight, hardwearing
- *Aramid*: engineered for high-strength and heat resistance, no melting point, 5 times stronger than nylon, resistant to abrasion

Regenerated

- *Viscose/rayon*: highly absorbent, breathable, lightweight, comfortable, quite strong, soft on the skin
- *Acetate*: creases easily, prone to static, drapes well
- *Lyocell*: strong, soft, absorbent, crease resistant

Specialist techniques

Pattern language

- Pattern language consists of a series of symbols which all sewers can follow to lay templates out and assemble products correctly.
- Failure to follow pattern language can lead to an inferior end product.
- Tailors' tacks are used to transfer critical placement points by hand.
- The straight of grain on a fabric runs parallel to the selvedge edge and runs the length of the fabric. Accuracy in applying this rule is critical if the end product is to drape or hang correctly.
- The strength in a fabric is along the straight of grain line.
- Bias cutting means laying the templates out diagonally on the fabric. This allows more stretch in the final product.
- The bias allows garments to hang or drape better, and fit is also improved. Lay plans can be wasteful.
- All fashion and textiles products are made from several shaped pieces. A lay plan maps out the most economical way to cut out all the pieces.
- On plain fabrics, templates can be placed in opposite directions to make best use of the fabric.
- On one-way patterns and pile fabric all templates must be laid in the same direction to avoid mismatching patterns and colour shading. More wasteful, but necessary.

Construction processes

Finishing edges

- Hems are used to finish the lower edges of garments including sleeves and trouser legs.
- Facings are used to finish shaped edges such as necklines.
- Binding conceals raw fabric edges and can also be used to join and finish a seam.
- Piping consists of a covered length of cord that is inserted into a seam or along an edge. It is both decorative and functional.

Joining seams

- Different fabrics require different types of seams to join fabrics together. Some seams are stronger than others.
- A plain seam is the most common seam type. The raw edges on the seam allowance need to be neatened, for example overlocked or a zig-zag stitch.
- The standard seam allowance in textiles is 1.5cm or 15mm.
- A French seam conceals all raw edges and should be used on sheer fabrics.
- Double-stitched seams are strong, and so should be used on heavy-duty products.

Shaping techniques

- Various shaping techniques are used to shape and add fullness to products — essential in allowing garments to fit a body.
- Shaping methods include: darts, princess line seams, gathers, pleats, tucks, casings, elastic.

Machinery used in industry

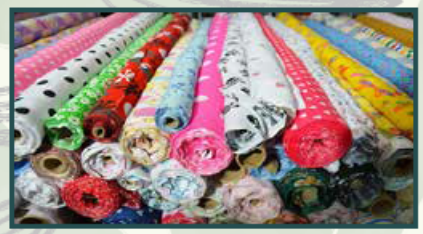
- Hot notch markers are used to transfer critical points on a template such as a pocket placement. They bore and seal a tiny hole through the fabric to mark the critical point.
- Fabric spreading machines automatically lay out several layers of fabric on long cutting tables.
- A lay plan designed using a CAD program is sent to the cutting table and is automatically cut out with laser cutters.
- Straight, round or band knives are used for hand cutting around templates where laser cutting is not an option.
- Automated die cutters are used to cut small complex shapes from several layers of fabric such as the small pieces found in a bra.
- Laser cutters can cut intricate shapes in fabric that cannot be done by hand. Laser cutters can also engrave designs onto fabric.
- Additive manufacture is used to print 3D shapes, layer by layer, to create a prototype product or finished products such as components and accessories.

CAD/CAM in Industry

- CAD — any form of digital design for overall styling, embroidery, laser cutters, print designs, lay-planning and pattern grading.
- CAM — automated operations including 3D printing, fabric printing, embroidery machines, fabric spreading and cutting machines, laser cutting.

Stock forms

- Textile fabrics and components are all available in *stock forms* which are readily available to designers, manufacturers and home sewers.
- For textiles fabrics, stock forms refer to the width of the fabric which is based on the width of the loom it was made on.
- Standard widths for textile fabrics are:
  - 90cm (for lining and interfacing)
  - 115cm
  - 150cm
  - 200cm
  - 240cm
- For crafting purposes, 'fat quarters' measuring 45cm x 55cm are readily available in bundles of complementary colours and prints.
- Common names for stock forms of textile fabrics include: denim, velvet, chambray, chiffon, corduroy, cotton poplin, satin, tweed, jersey to name only a few, but there are many more.
- For home sewers, textile fabrics are bought off the roll in metre lengths or in multiples of 10cm.



Textile fabrics are readily available off the roll.

Cost

- The cost of a length of fabric depends on its width, the fibre content and source, the type of weave and applied finishes (if any).
- Stock forms of fabrics and components simplify the cost of a product.
- In industry, fabrics and components are bought in bulk (huge quantities) so they are cheaper than what individuals can buy in a fabric shop.
- It is cheaper for specialist manufacturers to mass produce stock forms or standard sizes and designs of component parts.
- The cost of a product is based on the total cost of *all the raw materials*: quantity of fabric used and each component's part to include thread.
- When calculating the cost of material for a product you should consider:
  - The most economical width of fabric to use.
  - Bias cutting of templates increases waste.
  - Templates should be laid out in the same direction on pile and one-way print fabrics.
  - Pattern matching of checks, prints and stripes.

When laying out templates allow for pattern matching of stripes as shown on the T-shirt pictured. A mismatch of stripes on the side seam would spoil the appearance of the T-shirt.

Stock forms for components

Fastenings

- Zip fasteners: available in different lengths, weights, colours and materials e.g., nylon or metal and types- open-ended, two-way, invisible.
- Buttons: different sizes, colours, shapes, patterned or plain and different materials — wood, nylon or metal. Buttons can be 3D printed.
- Buckles: a secure fastening in different sizes, shapes, colours and materials such as brass, wood or plastic. They can be 3D printed.
- Velcro: a secure fastening where two sides of different textures interlock together.
- Eyelets: metallic or plastic rings inserted into the fabric. Ribbon can be threaded through to form a tie.
- Press studs: One side of a press stud simply clicks into the other side — easy to use.

Threads

Different threads exist for different purposes:

- To sew fabrics together — polyester thread is a strong thread which suits most purposes. A thicker thread is used for top stitching.
- For decorative purposes — glossier threads enhance decorative embroidery work.
- For functional reasons – conductive threads carry electricity.

Trims

- Trims can be decorative: lace, ribbon, braids, beads, sequins.
- Trims can be functional: tapes, cords, elastics, boning and LEDs (light emitting diodes).

Surface treatments and finishes

Dyeing

Fabric is fully immersed in water containing the dye which changes the fabric's colour.

Natural dyes work well on natural fibres but synthetic fibres need chemical dyes.

Dyes need to include a mordant e.g., salt, to ensure the dye fixes to the fabric permanently.

- Piece – a length of fabric is dyed one colour.
- Dip – part of the fabric is dyed leading to a graduated effect.
- Random – small sections of the fabric or yarn are dyed or coloured. No regularity to the design.
- Tie and dye – fabric is tied or knotted and secured with string or elastic to prevent or **resist** dye penetrating to all parts of the fabric.
- Batik – hot melted wax is applied in a pattern to fabric and then immersed in dye. The wax **resists** the dye to leave a pattern on the fabric.

Painting

- Felt tip – specialist felt pens to draw directly on fabric. Needs to be heat fixed.
- Fabric paint – specialist paints used directly on fabric. Needs to be heat fixed for permanency.
- Silk paints – paints for silk fabrics, which give a watery effect. Can be used with a gutta outliner which creates a barrier that the paint cannot pass through.
- Dimensional – paint applied through a piping tube to give a raised effect.

Printing

Printing is about applying patterns or images to textile materials.

- Screen printing involves the use of screens to apply a pattern to fabric. These can be flat or cylindrical with each screen applying a different colour to the fabric.
- Roller printing is similar to screen printing, but the circular rollers are engraved with a design leaving an imprint on fabric.
- Discharge printing works with screen printing but a bleaching agent is used to destroy some colour leading to a paler design on the fabric.
- Block printing uses a relief block to stamp a print onto fabric.
- Stencilling requires a design to be cut from card or acetate with paint or dye pushed through the holes to create a design on fabric.
- Digital printing works with a CAD program where the design is sent directly to print on fabric.
- Inkjet transfer also referred to as heat transfer printing and is used to transfer an image onto fabric. Works in the same way as an ordinary printer but with specialist paper.

The background on the cushion has been splattered painted with fabric paint. Fabric felt pens are used to colour the cow.

Embroidery

- Hand embroidery requires skill to apply each stitch to material. Different stitch types exist.
- Machine embroidery takes different forms:
  - decorative stitches, on most machines
  - embroidered motifs, on computerised machines
  - free machine embroidery.
- Appliqué consists of fabric pieces stitched onto a background fabric. Designs can be built up with colours, patterns and textures as shown in the picture of the puffin opposite.

- Patchwork is made up of several pieces of fabric sewn together to form larger pieces. Designs can form an organised pattern or be more random. This is a good way of using up scraps of material.
- Beadwork includes stitching beads, sequins and diamanté onto fabric as shown in the picture opposite. Beadwork can enhance plain products or can be used to further embellish other decorative work.

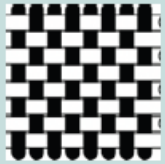
- Laser engraving is used in conjunction with a design program to transfer a design onto fabric. The laser burns the design into fabric but does not cut it.

Woven, knitted and non-woven textiles

- **Weaving** and **knitting** are the two main methods of fabric construction. Both have subtypes.
- Woven fabrics have more structure and are more stable.
- Knitted fabrics have the ability to stretch.
- The properties of woven or knitted fabric change depending on the tightness of the construction.

Woven construction

- Weaving is the interlacing of two sets of yarns at right angles.
- **Warp** yarns run the length of the fabric.
- **Weft** yarns run across the fabric.
- Made on a loom.

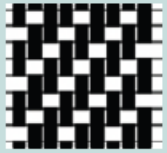


Plain weave:

Most common type; strong and stable.

Twill weave:

A strong weave identified by diagonal lines. Herringbone is a version of this weave with zig-zag lines.



Satin weave:

Has a very shiny side caused by the warp yarns floating over the weft yarns; drapes well but snags easily.

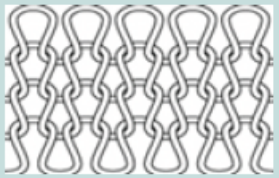
Pile weave:

Has a raised surface caused by loops or tufts of yarn that stand up. These can be cut to create plush fabrics.

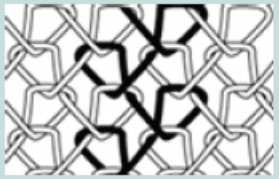
Pile weave has a 'nap'.

Knitted construction

- **Weft** knitting is formed by continuous rows of loops interlocking *horizontally* across the fabric.
- Made from one continuous yarn.
- It unravels easily.
- Ladders or runs if cut.
- It stretches easily but can lose shape.
- Made by hand or machine.



- **Warp** knitting is formed by yarns interlocking vertically along the length of fabric.
- Difficult to unravel.
- Does not ladder if cut.
- Has stretch or elasticity but holds its shape well.
- Lies flat when it has been cut.
- Can only be made on a machine.



Non-woven fabrics

Non-woven fabrics are made directly from fibres. They are:

- Cheap to manufacture
- Cheaper to use as there is no grain
- Do not fray when cut
- Weaker than knitted or woven fabric

Felted fabric

Felted fabrics are made from wool.

The scales on wool fibre matt together when exposed to heat, moisture and mechanical action.

- Needle felts consist of synthetic fibres matted together mechanically using barbed needles.

Technical textiles

Bonded Fabrics

- Bonded fabrics have a top fabric that is laminated to a thin layer of lightweight woven fabric.
- Adhesive is used to hold the layers together.
- *Faux* leather is an example of a bonded fabric.

Laminated fabrics

- Laminated fabrics consist of two or more layers of fabric.
- The layers are held together either by adhesives or a thin layer of thermoplastic film that is heat set to fix the layers.
- Gore-Tex is a laminated fabric that includes a breathable hydrophilic membrane.
- Gore-Tex is used for high performance clothing as it lets moisture out but repels rain and wind.

Geo-textiles

- Geo-textiles are permeable woven or bonded, natural or synthetic textiles.
- **Used with soil to support drainage and protection** against erosion.
- Also used in agriculture and civil engineering.

Aramids

- **Kevlar** has excellent resistance to heat, corrosion and high tensile strength.
- Can withstand extreme conditions, is bullet proof and resistant to knife attack.
- **Nomex** will withstand extreme conditions.
- It is resistant to heat and flames.

Blended and mixed fibres

Staple and continuous filament yarns

- Staple fibres are short fibres.
- All natural fibres are staple fibres, except silk.
- Filament fibres form long continuous lengths.
- Filament fibres are manufactured or synthetic fibres.
- Silk is a continuous filament fibre.

Blended and mixed fibres

- Fibres are *blended* together during spinning to combine the best properties of both fibres.
- The suitability of fabrics made from blended yarns is increased to include a wider range of uses.
- Most modern fabrics include fibre blends.
- A *mixture* refers to fabrics where yarns of different types are used in the fabric construction, for example cotton warp yarns and polyester weft yarns.
- Popular blends and mixes include: polyester and cotton; silk and viscose, wool and acrylic, hemp and cotton.

Reasons for blends and mixes include:

- reducing the cost of the fabric
- improving aesthetics, for example a better appearance – colour, texture, tone
- improving functionality – better handle or draping qualities; wider range of uses
- making fabrics easier to care for.

Yarns

- Yarns are created by spinning (twisting) staple or filament fibres together.
- Filament yarns, made from filament fibres, are smooth and are therefore not good insulators.
- Staple yarns, made from staple fibres, are hairy which means they are good at trapping air making them good insulators.
- The number of twists in a yarn affects its strength – tighter/more twists leads to a stronger yarn.

Fancy and novelty yarns

- Fancy yarns can be made from staple or filament fibres, or combinations of these.
- Fancy yarns add interesting textures to fabrics.

This woven fabric is made from fancy yarns of varying textures, thicknesses and colours creating a more interesting effect.

- *Bouclé* is a fancy yarn and is also the name of the resultant fabric.
- *Bouclé* comes from the French word for curly. This is a good description of this yarn.
- A *slub* yarn has varying thickness along its length.
- This is created during the spinning process and adds texture to a fabric.
- *Chenille* yarn is soft and fluffy with fibres sticking out from a central core.
- Fabrics made from *chenille* are very soft and warm to wear.

Bonded Fabrics

- Bonded fabrics are made up of a top fabric that is glued to a thin lightweight second fabric.
- Bonding fabrics adds stability and strength to the main fabric.
- Foam is often bonded to fine knitted or woven fabric as it can be difficult to work with on its own.
- Faux leather is created by bonding woven cotton to plastic or polyurethane (PU) to create a fabric that looks like leather.
- For example, PVC is a coated fabric made by applying polyvinyl-chloride to cotton. It is then heat set to form the coated fabric.

Quilting

Quilting consists of 3 layers of fabric stitched together:

- Top layer or facing layer.
- Middle spongier layer, usually wadding.
- Lightweight inner layer.

Quilted fabrics add:

- aesthetic appeal – can be very decorative
- strength – thicker fabric, also gives more protection
- insulation – several layers trap air making it warmer to wear.

Quilting: 3 layers of fabric held together with an embroidery stitch which adds interest.

Designers

Airbus

Airbus is primarily known for aircraft but also works on helicopters, military equipment and space travel.

Airbus' largest aircraft is the A380 carrying up to 800 passengers. It was built using lightweight composite materials to overcome weight issues. The wing design is based on the shape and structure of eagles' wings – wing tips were installed otherwise the wingspan would be too big for most airports. This is an example of *biomimicry* – nature solving design problems.

CAD technology is used during the development of aircraft for example 3D printing of parts in different materials, including titanium because of its excellent strength to weight ratio.

Apple

Innovation and design are important factors in Apple's success. Designs are sleek, with consistent colours, shapes and materials that are easily recognisable. Aesthetics plays an important role in the company's design philosophy.

Jonathon Ive was the designer responsible for the styling of the first iPod and iMac.

Apple pioneered the use of graphical user interfaces (GUIs). Apple computers were the first to use icons to represent files/folders and a cursor controlled by a mouse which is still in use today.

Apple are often criticised for developing products with planned obsolescence in mind and software updates that do not work on older devices.

James Dyson

James Dyson is known for innovative products using new technology and engineering principles to improve existing products. One of his earliest products, the ball barrow, spread the load allowing it to move over soft ground easily.

He revolutionised vacuum cleaners by introducing cyclonic technology to collect dust instead of a bag.

The DC01 vacuum cleaner went through 5127 iterations with rigorous testing over 10 years before gaining market approval and eventual success.

Bethan Gray

Welsh furniture designer Bethan Gray is known for using luxurious materials such as brass, marble, solid wood and leather in her work.

She uses a mix of highly skilled traditional craft skills and modern manufacturing techniques in her work.

Design inspiration comes from the forms and architecture gained from world-wide travel.

She is a founder-member of the Ruby Tree Collection which aims to support traditional Islamic craft skills.

Shigeru Miyamoto

Shigeru Miyamoto created some of the best-known video game characters including Donkey Kong and Mario and Luigi when working at Nintendo.

He created a better user experience by allowing greater control over characters in the games for example, in *The Legend of Zelda*.

He is responsible for developments in game controllers — shoulder buttons on the NES controller and the thumb operated joystick on the N64.

Orla Kiely

Orla Kiely is known for her print designs inspired by her early childhood – the colours of the countryside and her home.

Kiely's design work lends itself to CAD for its repetitive style. Her original work was hand painted using gouache paint. 'Stem' is her most iconic print which consists of simple graphic strength – clean, measured and bold.

Kiely believes her work is never finished and can be re-worked several times until she is satisfied with the end result.

Stella McCartney

Sustainability is at the forefront of the Stella McCartney brand. She does not use fur or leather in any of her collections and uses recycled materials where possible.

Her signature style consists of tailored garments alongside feminine lingerie inspired clothing. She feels strongly that women feel comfortable in the clothes she designs.

She has proved that high-fashion styling is possible but with a much-reduced environmental impact.

Laura Ashley

Print has been at the forefront of the Laura Ashley brand since it was first established when Laura Ashley started printing her own designs for head scarves.

She went on to design dresses for social wear at the end of the 1960s. Her popular long Victorian-inspired dresses became known as the 'Laura Ashley look'.

The business expanded into coordinated ranges of furnishing fabrics using natural materials such as cotton and recycled paper for wallpaper.

Fabric finishes

Finishes are applied to textile fabrics to:

- enhance aesthetic qualities
- prolong the fabric life
- improve the functionality of the fabric.

Finishes are applied mechanically or chemically.

Finishes that enhance aesthetic qualities

- *Colouring and surface decoration* are physical finishes that change the appearance of a fabric – dyeing, printing or painting.
- *Calendering* is a mechanical finish that smooths and flattens fibres as it passes through rollers to give a more lustrous appearance.
- *Embossing* is the same process as calendering but leaves an engraved design on the fabric.
- *Glazing* is similar to calendering, but resins or stiffeners are added for a more permanent finish.
- *Mercerising* is a chemical finish which causes the fibres to swell and shrink leaving a lustrous smooth fabric. This is only used on natural fibres.
- *Brushing* is a mechanical finish where the fabric is exposed to wire brushes that raise the fibres to give a fluffy appearance. Doing this improves insulation.
- *Stain resistance* is a chemical finish that prevents stains from permanently discolouring and spoiling fabrics. Teflon and Scotch-guard are stain resistant finishes. This finish also prolongs fabric life.

Finishes that prolong fabric life

- *Flame retardancy* is a chemical finish that prevents fabrics from burning or burning too quickly. The chemical Proban® is used in this process.
- *Moth proofing* uses a chemical process that repels moths and their larvae and stops them feeding off and destroying wool fibres.
- *Stain resistance* refers to comments under aesthetic qualities.

Finishes that improve functionality

- *Crease resistance* is a chemical finish where resin is applied to stop fabrics from creasing, making it easier to care for them i.e., limited or no ironing.
- *Water proofing* is a chemical finish where silicone is sprayed onto fabric to stop water from penetrating through the fabric. It is not a permanent finish. Coating fabrics with PVC, PVA or wax makes them moisture resistant.
- *Shower proofing* is a chemical finish but will only repel very light exposure to moisture.
- *Shrink resistance* is a chlorine-based chemical finish which stops fabric from shrinking. This finish stops the scales on wool fibres from locking together which cause wool to shrink.
- *Anti-static finish* is a chemical finish that makes fabrics more comfortable to wear by stopping the electrostatic charge that builds up through friction causing fabric to cling to the body.

Designers' and manufacturers' responsibility

Many of the processes used in the manufacture of fashion and textiles fabric include the use of hazardous substances such as chemical finishes. It is the responsibility of designers and manufacturers to make sustainable choices when developing new products.

Environment

- Cotton needs lots of water to grow, so it is diverted away from communities where it is already scarce.
- Harmful pesticides are used to protect cotton crops, but it can be grown organically.
- Large-scale sheep farming for wool can lead to soil damage. Chemicals used to treat sheep can also contaminate water supplies.
- Transportation of goods increases the textile industries' carbon footprint.

Working conditions

- In some countries, working conditions are poor with workers exposed to harmful toxins which results in poor health.

Exploitation

- In some countries, workers are often exploited – no rights, low pay and child labour is often used.

Recyclability and waste

- Chemicals used in finishing processes can affect sustainability at the end of a fabric's useful life.

Biodiversity

- Biodiversity and eco-systems are damaged by the harmful substances used in the manufacture and processing of textile materials and goods.

Manufacturing in quantity and fashion

Manufacturing in quantity

The scale of manufacture for fashion and textile products depends on the:

- quantity needed
- cost of the product
- timescale for production
- complexity of the product.

Job production (custom-made, bespoke, one-off)

- Unique products made for a specific individual by highly skilled, versatile machinists and technicians.
- Made-to-measure tailoring is an example of bespoke manufacture.
- Prototyping falls under one-off production as one product is made to test a concept.

Batch production

- Set numbers of identical products are made in batches in a given timescale, in a factory setting on a production line.
- Batches could be in 100s or 1000s.
- Seasonal products are produced in batches.

Mass production

- The largest scale of production for products that are in constant demand over long periods of time.
- Workers each complete one task before passing the work on which can be repetitive.
- Some factories operate 24 hours per day to meet demand.
- Some sections include automated manufacturing.

Progressive bundle production

- Bundle production is when product parts are organised in bundles which are passed along the assembly line. Different set-ups exist for the organisation of machinery.
- Each operative completes their set task in a bundle before passing it on to the next machinist or operative.
- Bundles could be organised according to size or colour-way.

Line production

- Machines are set up in a straight line. Work is organised in bundles and moves from one machinist to the next in line.
- Each machinist completes the same set task before passing the work on.

Cell production

- This is a sub-system that operates within another larger production line.
- Cells may produce the entire product or focus on specialist parts of a product.

Garment workers on a straight production line — product parts are organised in bundles for assembly by workers.

Fashion Industry

- *Street style*

  Street style comes from youth groups who are grouped according to culture, age, ethnicity, religion or social class. Styles reflect group identity.

- *Contemporary fashion*

  Contemporary fashion refers to trends that are currently fashionable and favoured by the masses.

- *Ready to wear (Prêt-à-Porter)*

  Small collections created by leading designers at affordable prices and sold at retail outlets. They are not exclusive.

- *Haute couture*

  One-off garments made to measure with the finest and most expensive fabrics and trims. These exclusive garments carry a very high price tag.

- *Role of designers*

  Fashions change because designers develop new concepts or 'looks'. Fashion shows are used to showcase new collections, ideas trickle down from these shows into mainstream fashion.

- *Fashion forecasting*

  Market researchers who predict future trends years in advance of their popularity being realised.

- *Trend setters*

  Individuals with a strong sense of style and fashion who trigger new trends, celebrities for example.

- *Image makers*

  Image makers specialise in creating a 'look or style' for clients, who could be individuals, groups or companies looking for a corporate image.

Modern and smart materials

SMA – Shape Memory Alloys

- Shape memory alloys have a memory and can return to their original shape if heated.
- SMAs have excellent elasticity.
- Nitinol is one of the most common SMAs.
- Nitinol is an alloy of titanium and nickel.
- A product made from nitinol can be shaped and deformed. If it is reheated it will return to its original state.
- Nitinol is used in medical applications such as the wire on braces used to straighten teeth. The body's natural heat keeps the wires on the brace under tension.
- It is also used in bone staples and stents.

Polymorph

- Polymorph is a thermoforming polymer that is used as a modelling medium.
- Polymorph is supplied in granular form but becomes soft and pliable when heated in water to a temperature of about 62°C.
- It can be moulded by hand but solidifies on cooling.
- It can be shaped with hand tools.
- It can be reheated several times becoming pliable each time.
- Polymorph can be used with moulds for more complex shapes.

Photochromic

- Photochromic dyes change colour as a result of a change in light intensity or UV radiation.
- Sunglasses have photochromic lenses which turn from light to dark according to levels in UV radiation.
- Photochromic dyes can be applied to textile fabrics and clothing to add a fun element when going out in the sunshine.

Thermochromic

- Thermochromic dyes change colour in response to a change in temperature or heat.
- They can be engineered to react to a specific temperature or temperature range.
- Thermochromic inks can also be used on food packaging to indicate that an ideal chilled temperature has been reached.
- Thermochromic dyes can be used on sports clothing to indicate the intensity of a workout – intense colour could indicate which muscles have been worked the most.
- The 'nose' on the reindeer mug below changes colour when hot water is poured into the mug. The red nose indicates it's hot: a simple fun product.

COLD HOT

Micro-encapsulation

- Microscopic particles or droplets can be applied as a thin coating to materials such as card, paper, textiles, fabric and fibres.
- Microscopic particles could contain for example essential oils, antibacterial treatments, moisturiser or fragrances.
- The substances contained within the particles are released through friction or contact with the skin.

Biomimetics or Biomimicry

- Biomimetics is the study of the structure and function of living things.
- Biomimicry takes inspiration from the natural world in order to design sustainable solutions for new products and materials.
- Biomimicry could help to develop new materials and components, or the form, efficiency and function of products.
- The spurs on the burdock thistle have small hooks on the end that cling to fabrics. This was the inspiration for velcro.
- The inspiration for wingtips on aeroplanes came from an engineer who watched birds curl their wingtips upwards for greater lift.
- Wingtips on planes reduce drag in the air, making them more efficient by reducing fuel burn.

Modern and smart textiles

- **Smart materials** react to changes in their surroundings. Changes are triggered by external stimuli such as temperature, light or through friction.
- **Modern materials** are continually being developed and are engineered for specific purposes.

Smart materials

Thermochromic

- Thermochromic dyes change colour in response to changes in temperature.
- Thermochromic dyes can be used in products to act as a warning i.e., something is very hot, or when used in dressings a colour change could indicate infection.

Micro-encapsulation

- Microscopic particles containing essential oils, moisturisers, antiseptics or anti-bacterial chemicals can be applied or encapsulated onto fibres and fabrics.
- These substances are released through friction when in contact with skin.

Photochromic

- Photochromic dyes change colour in response to a change in light intensity, for example sunlight.
- These dyes can be applied to materials, threads and beads.

Interactive textiles

Conductive fibres and yarns

- Fine flexible conductive fibres and threads made from carbon, steel and silver can be woven into fabric.
- These fibres allow electricity to flow through them.
- Some conductive fibres are washable and won't impede future functionality.

Wearable electronics

- Electronic devices can be integrated into fashion and textile products.
- These devices rely on conductive fibres to carry electricity from a power source (battery) to activate them.
- These devices can communicate wirelessly with the user/wearer.
- Integrated devices include: mobile phones, heart rate monitors, GPS trackers, LEDs, heated panels, solar panels and performance trackers.

Biometrics

- Some electronic devices such as sensors interact with the biometric data of the wearer/user.
- Sensors can track changes, for example in respiratory function, breathing or heart rate.

Photochromic beads change colour after exposure to sunlight.

Before *After*

Modern materials

Heat storage materials – PCMs

- PCMs or phase changing materials change from one state to another by absorbing, storing and releasing heat over a small temperature range.
- They store energy in liquid form when it is hot and release energy on cooling and return to solid form.
- When used in clothing they help regulate body temperature.

Sun protective clothing

- Closely woven fabrics block out harmful UV rays as there are few gaps within the weave.
- Fabrics with a natural lustre or sheen reflect UV rays away.

Rhovyl

- *Rhovyl* is a synthetic fibre that is antibacterial, waterproof, crease resistant and quick drying.
- It does not retain odour.
- Ideal for use in sportswear.

Breathable materials

- Fabrics such as Gore-Tex that have a permeable membrane that manages the flow of moisture appear to be breathable.

Microfibres

- Extremely fine engineered fibres usually polyester or nylon.
- They are engineered to include specific properties for set purposes.
- Tactel, Modal and Tencel are all microfibres.

New and emerging technologies

Market pull/technology push

Products are developed as a result of a need or want or through developments in technology.

- *Market pull* – a new product or a revitalised one is developed as a result of market demand. Consumers want upgraded products with improved functionality.
- *Technology push* – developments in technology and materials, components and manufacturing can lead to new products being developed. In electronics, smaller components can be put into a wider range of products e.g., wearable technology.

Consumer choice

- Designers and manufacturers have to be sure there is a need from consumers for a specific new product to ensure it is successful. Technology often drives consumer choice.

Product Life Cycle

The 4 stages of a Product Life Cycle are:

- ♦ Introduction: product launched onto market
- ♦ Growth: sales steadily increase
- ♦ Maturity: sales reach their peak
- ♦ Decline: sales drop off.

- The product life cycle is a marketing tool to judge when to increase or stop manufacture or replace a product with a new or revitalised one.
- Obsolescence is when a product no longer sells or only sells at a discounted rate. It is no longer desired.
- Manufacturers can build in obsolescence. They intentionally replace a product with an upgraded or new product in a set time frame. Some products are not meant to last.

Global Production — effects on culture and people

Manufacturing affects society and people's moral and ethical beliefs.

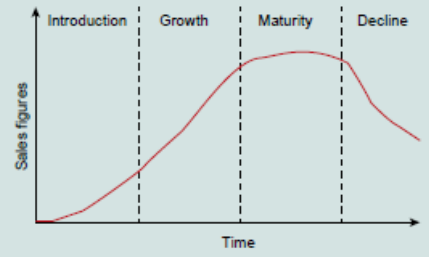
- Global manufacturing gives consumers a greater choice but at a cost to the environment, and jobs in Western societies.
- Communication technology and the internet facilitates globalisation and increases awareness of other cultures. People are better connected.
- Globalisation drives down prices for products but can lead to exploitation of people in developing countries.

Consumer Rights and Protection

The Consumer Rights Act 2015 states that all goods must be of a satisfactory standard, as described and seen when purchased, and fit for purpose.

- The law covers poor service, faulty and counterfeit goods, contracts and problems with builders (rogue traders).
- This law also covers online purchases, including digital downloads.
- You are entitled to a refund or repair if goods or services do not meet expectations or expected standards (in the case of faulty goods).
- Trade Descriptions Act — it is illegal to apply a false description to goods which mislead consumers.

The Product Life Cycle



Moral and Ethical Factors

- Not everyone in the manufacturing industry is treated fairly. Profit often comes before workers' wellbeing with many being exploited, including children, or they work in poor conditions.
- These businesses do not reveal manufacturing costs as it might reveal poor wages for workers.
- Some manufacturers take a more ethical approach and treat workers fairly with decent wages and working conditions.
- Socially responsible businesses also support environmental causes and openly disclose costs.

Sustainability

Manufacturers are increasingly using more sustainable approaches in product design – meeting todays needs without compromising future needs:

- Using recycled materials or reducing the amount used
- Using renewable sources for energy or using less energy
- Extending product life: increasing product efficiency; ease of repair; impact on disposal; potential recyclability.

CAD/CAM Advantages and Disadvantages

- Quality of design work is improved through CAD packages: 3D options; virtual reality; professional presentations; cloud-based technology.
- Designers need to be trained to use CAD packages. Initial ideas are often better presented by hand.
- CAM ideal for producing large volumes of identical products of equal quality – more efficient system.
- CAM machinery can be expensive, needs regular maintenance and can lead to job losses.