**Textile fibres**

* Fibre is a long, thin thread that is used in the manufacture of other materials, fibres are twisted together to make yarns and fabrics
* Fabric is a cloth material made by weaving or knitting fibres together
* Classification:
  + Natural fibre
    - natural vegetable
    - natural animal
    - natural mineral
      * asbestos
  + Man-made fibre
    - regenerated manmade fibre
    - synthetic
    - other

**Plant fibres**

* Cotton
  + It is a seed fabric, produced in the USA, India, China, Brasil
  + + strong, soft, easy to clean, keeps body cool in hot weather, absorbs moisture
  + – wrinkles, fades, shrinks, dries slowly
  + Can be washed, bleached, ironed, dry-cleaned
  + Use:
    - Clothing – shirts, socks, underwear
    - Home furnishing – rugs pillows, bed sheets
    - Cosmetics and medicine – cotton wool, pads, Q-tips
* Flax
  + Oldest fibre
  + Comes from the stemp of flax plant
  + Produced in Belgium, Ireland, Poland, Slovakia
  + When made into fabric - Linen
  + + absorbant, smooth, stronger than cotton, dyes well, coolest fibre
  + – not elastic, wrinkles, not very tough
  + Can be washed, bleached, ironed
  + Use:
    - Clothing – suits, blouses, summer pants
    - Home furnishing – tablecloths, towels, bed sheets
* Jute
  + Long, soft and thin fibre extracted from the bark of Jute plant
  + It is a partially textile and wood fibre
  + + cheapest plant fibre, comfortable, biodegradable, strong, antistatic
  + – will rot, fades, is brittle
  + Can be hand washed or dry-cleaned
  + Use:
    - Bags, wrapping material, ropes, carpets, rugs
    - Geotextiles
* Bamboo
  + Comes from bamboo plant, that grows very rapidly
  + + soft, cheap, cool in summer, warm in winter, biodegradable, anti-bacterial
  + Can be hand washed or dry-cleaned
  + Use:
    - Bath towels, underwear or socks
    - Face masks, toothbrushes
    - Bedsheets, tablecloths
    - Hygiene materials, napkins, pads
    - Alternative to plastic

**Animal fibres**

* Silk
  + Produced by silkworm, fed on mulberry leaves, it produces liquid silk to form its cocoon
  + + soft, smooth, elastic, dyes well, resist wrinkles, luxurious in appearance
  + – expensive, decomposes in sun and moisture
  + Can be dry-cleaned or hand washed
  + Use:
    - Scarves, ties, hair accessories
    - Luxurious dresses, evening gouse, pyjamas, pillows, draperies, wall coverings
* Wool
  + comes from fleece of sheep, raised in Australia, China, New Zealand, Russia
  + + warmest fibre, comfortable for wear, strong, dyes well, durable, biodegradable, elastic, absorbent, natural heat insulator, fire resistant
  + – itchy, can be damaged by insects, some people are allergic to wool
  + Can be dry-cleaned or hand washed
  + Use:
    - Scarves, hats, coats, sweathers, socks, active sportswear
    - Rugs, carpets, blankets
    - Cosmetic pads
    - Thermal and acoutic insulation

**Man-made fibres**

* Are created by a process called POLYMERIZATION
* Scientists can make man-made fibres in a lab
* 3 categories:
  + Synthetic
    - Polyester, nylon, elastane
    - Are made from chemicals
  + Regenerated
    - Viscose, rayon
    - Are made by transforming natural polymers through chemical-based process
  + Inorganic
    - Fibreglass
    - Are made from raw materials (carbon, petrochemicals)
    - Are cheaper to produce compared to plant fibres
* Polyester
  + Is a thermoplastic polymer
  + + lightweight, strong, weather resistant, easy to wash, resistant to stretching, shrinking, wrinkles, recycable
  + – stains are hard to remove, melts at high temperature
  + Can be washed, dry-cleaned
  + Use:
    - Clothing – belts, trousers, outdoor clothing
    - Home furnishing – curtains, pillows, upholstery
* Nylon
  + Second most used fibre
  + + lighweitght, stronger and softer than PES, elastic, shiny, water and stain resistant
  + – not recyclable, high temperatures melt nylon, it fades
  + Cold water wash, low temperature dying
  + Use:
    - Clothing – stockings, swimwear, raincoars
    - Parachutes, airbags, tents, ropes
    - Machine parts
* Acrylic
  + +lighweight, durable, soft, has warm and dry hand feel, greater insulating power than wool
  + – can form little balls on the surface (pilling)
  + Use:
    - Clothing – sweaters, sock, fleece jaskets, sportswear
    - Home furnishing – blankets, rugs, carpets, upholstery
    - Industrial use – car batteries, filtration materials
* Rayon
  + Semi-synthetic – made of cellulose and chemicals
  + Alternative to silk
  + + highly absorbent, comfortable to wear, dyes easily
  + – shrinks, not very durable, catches on fire easily
  + Need to be dry cleaned
* Inorganic
  + Metallic fibre – can be drawn from metals such as copper, gold or silver and extruded from nickel, aluminium or iron
  + Carbon fibre – the body of mobile phones
  + Optical fibre/fibreglass – comes from natural raw materials (quartz, silica)

**Blends**

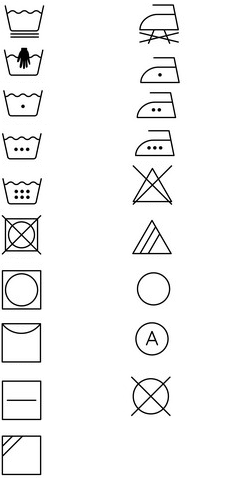
* Fabrics containing two or more fibres to combine the best qualities of each fibre
* Example: Polyester-Cotton blend contains the moisture absorbency of cotton and the strenght and wrinkle-resistance of polyester

**Yarns and fabrics**

* Fibres are the raw materials from which yarns are made. This process is called spinning
* Yarns are converted to fabrics by weaving (on looms) or knitting (by hands or machines)
* 3 main types of fabrics:
  + Woven fabrics – from yarns
  + Non-woven fabrics – from fibres
  + Knitted fabrics – from yarns
* Fabric finishes
  + Coloring
  + Flame-resistant
  + Permanent or durable press
  + Stain resistant
  + Waterproof
  + Water-repellant

**Laundry care symbols**

* Pictograms written on labels and attached to clothing
* Provide care instructions – how to take care of clothing and linen
* The international community uses five basic shapes for washing, drying, bleaching, ironing, dry cleaning
* An X through any symbol means – DO NOT DO THIS!



No steam

Iron low heat

Iron medium heat

Iron high heat

Do not bleach

Non chlorine bleach

Dry clean

Dry clean – any solvent

Do not dry clean

Machine wash – gentle cycle

Hand wash

Not above 30°

Not above 50°

Not above 95°

Do not tumble dry

Tumble dry

Hang to dry

Dry flat

Dry in shade

**Buying a suit**

* A suit consists of jacket and a pair of trousers made of the same material
* Off the rack means ready-made suit
* Custom or made to measure (MTM) means it’s made by a tailor to fit your measuerements out of different pre-cut pieces
* The most important measurements include:
  + Shoulders
  + Chest
  + Waist
  + Length of the entire jacket
    - Sleeves
    - Trousers
  + Man’s height and weight
* 10 suit buying rules
  + Decide the occasion
    - Special events
    - Everyday office use
  + Set your budget
  + Choose the fabric
    - Tweed or cashmere
    - Wool
    - Blend of wool with synthetic fabric
    - Synthetic fabric (Polyester)
  + Choose the colour
    - Navy
    - Charcoal
    - Gray
  + Choose function over fashion
    - Buttons (two buttons – great classic look)
    - Type of lapel (nothed lapel) – the edges that point to the shoulders
  + Get the right fit and cut
    - Smooth across your back and comfortable in the shoulder area
  + Suit jacket sleeves length
    - The sleeve should go to your wrist-bone and show the shirt cuff when your arms are extended out in the front of you
  + Suit jacket’s length
    - The jacket should fall right around the middle of your hand
  + The trousers’ length
    - You can choose trousers of 4 types
      * No break
      * Quarter break
      * Half break
      * Full break
  + Match your shoes
    - The black Balmoral Oxford shoes are the most formal shoe style (closed lacing)
* Most modern suit nowadays



**Leather, footwear and fur**

* Leather
  + A material from the skin (hide) of animals. It is usually processed from animals which were bred for meat production
  + The most common domestic animal sources:
    - Cow
    - Pig
    - Sheep
    - Goats
  + The most common wild animal source:
    - Kangaroos
    - Stingrays
    - Crocodiles
    - Snakes
  + Properties of leather:
    - Flame resistant
    - Long lasting
    - Extremely durable and flexible
    - Some types are water resistant
    - Natural insulator
  + Skin (leather) has 3 layers
    - Epidermis, dermis, hypodermis
    - For leather manufacturing – the top layer epidermis is removed
  + Types of leather
    - Only three kinds of leather are generally considered good quality
    - Full grain leather
      * The best quality, no imperfections
      * Luxurious accessories are made of it
    - Top grain leather
      * Second highest quality
      * Has a velvety surface
    - Split leather
    - Semi-aniline leather (leather jackets)
    - Pigmented leather (car upholstery)
    - Aniline leather – luxurious accessories, bags, wallets
    - Nubuck leather – jacket, bags, shoes
    - Suede – gloves, jackets, shoes
    - Kidskin – gloves
* Leather processing
  + Preservation (Salts are used for curing the leather)
  + Rewetting (Water makes the skin soft)
  + Dehairing (Hair is removed using lime and other chemicals)
  + Tanning (Vegetable and chrome tanning)
  + Drying for several days
  + Roll pressing (Mechanical process to shape and smooth the leather)
  + Finishing (Chemical treatments to colour, soften and apply a surface finish to the leather)
* Tanning
  + Chemical process that converts animal hides and skins into leather (removing hair, proteins and fats, impregnation and finishing phase)
  + Tanning materials:
    - Vegetable (extracts from the bark and wood of trees) – chrome-free leather
    - Mineral (chrom salt) – chrome tanned
    - Combination of vegetable and chrome – latigo leather
* Leather products
  + Sports articles – balls for football, rugby
  + Watch straps
  + Belts
  + Military equipments – holsters for fire arms
  + Stationary articles – writing pads, book covers, camera cases, spectacles cases, jewel cases, mobile phone holsters
  + Travel goods – suitcases, travel bags, sport bags
  + Pocket or small leather goods – wallets, purses, key pouches, pen cases
  + Handbags

**Footwear**

* Refers to garments worn on feet
* Boot and shoe factories usually locate close to leather-producing areas
* 3 main parts of shoe:
  + Upper – top of the shoe – leather, rubber, synthetic material
  + Lining – inside part – wool, polyamide fabric or sheepskin
  + Sole – rubber or plastic
  + Sometimes laces – horsehair or synthetic fibres
* Shoe size- US: 8.5, UK: 7.5, EU: 42, 26,0 cm
* Classification of footwear:
  + Men’s shoes
  + Women's shoes
  + Unisex shoes
  + Children shoes
  + Sports footwear
  + Working footwear
  + Special footwear (diabetes, orthopedic)
* Leather haberdashery
* Gloves
* Bracelets
* Key chains
* Phone cases
* Pen cases
* Handbags
* Care for leather
  + Keep leather away from direct sunlight
  + Always keep leather away from indoor heating appliances
  + Use soft cotton cloth, avoid using chemicals
* Synthetic/vegan leather
  + Polyurethane PU leather
    - Is blend of artificial chemicals and it resembles natural leather
  + Polyvinylchloride PVC leather
    - It does not contain natural leather at all
* Evaluation of leather
  + Different countries have different norms, standards
  + Evaluation between real and fake leather
    - Subjective
      * Senses
        + Eyesight
        + Touch
        + Smell
    - Objective
      * Laboratory
        + Moisture test – real leather absorbs moisture
        + Fire test – it smells of burnt hair

**Fur**

* Fur clothing is made of furry animal hides
* Pelts are obtained from fur farmers of hunters
* People use fur to make hats, jackets, coats, rugs or carpets
* Charecteristics of fur:
  + Durable, long lasting
  + Soft, fragile
  + Excellent insulating properties
* Types of fur
  + Beaver – very durable - hats
  + Fox – needs regular cleaning - coats
  + Mink – the majority of pelts, very durable
  + Chinchilla – the softest and most luxurious fur
  + Muskrat – used for making fur hats
  + Rabbit – affordable, average durability
  + Stroat – used for royall fur coats
  + Seal – very warm and nearly waterproof, used for coats
  + Wild animals – coyotes, wolves, bobcats, lynxes
* Fur processing
  + Means obtaining fur from animals
  + Making of furs into garments is called furriery
  + Much of the process is done by hand
  + It contains of 2 steps:
    - 1. Preservation
      * Air drying, salt and brine curing
    - 2. Fur dressing
      * Includes washing, tanning, drying, cleaning, finishing)
* Fur products
  + Coats, Parkas, Vests
  + Ski mittens, Gloves
  + Stoles, Scarves
  + Purses, Wallets
  + Boots, Slippers
  + Bags, Hats
  + Accessories
  + Rugs
* Evalutation of fur
  + Technical norms provide us with requirements on quality of fur used for clothing
  + When evaluating we have to consider
    - Overall appearance
    - Quality of pelts
    - Length and density of hairs
    - Flexibility, colouring etc.
  + Real fur
    - Pointed ends
    - Animal skin base
  + Faux fur
    - Blunt ends
    - Woven fabric base
* Environmental impact
  + Various chemicals are used in leather and fur industries
  + Huge carbon footprint of cattle rearing
  + Synthetic chemicals pollute water, soil
  + Odours and gas emissions pollute air
  + Possible solutions
    - Use of environmental friendly chemicals
    - Recycling and reuse of waste water
    - Conversion of solid waste into useful products

**Glass**

* An amorphous solid material – in between the crystalline and the liquid state
* Its molecules are arranged in irregular pattern
* Pros:
  + Visible transmittance
  + Optically transparent
  + Weather and rust resistant
  + Dustproof and waterproof
  + Safe packaging material
  + Insulator of eletricity
  + Colour availability
  + Recyclable
  + UV stable
* Cons:
  + Brittleness
  + Heat transparency
  + Fragile
* Raw materials
  + Major
    - Quartz/sulica sand
    - Soda ash
    - Limestone
  + Minor
    - Dolomite
    - Crushed/recycled glass (cullet)
    - Boric acid, lead oxide, sodium oxide (to get coloured glass)
* History of glass
  + The first manufactured glass material appeared 6000 years ago
  + 1st Century B.C. – glass blowing begins (blow pipe was developed)
  + By the 16th Century – glass was made all over Europe
* Glass processing
  + 3 steps
    - Fusion of raw materials
      * The raw materials are weighed and mixed together to form the BATCH. Later broken glass is added to lower the temperature. The batch is melted in a furnace.
      * The furnaces are usually electrical, gas-fired, or oil-fired. The temperature varies from 1500°C to 2800°C according to the type of product.
    - Working with molten glass
      * Blowing (automatic blowing – bottles, lamp bulbs, traditional hand blowing)
      * Casting (large pieces of glass – mirror)
      * Drawing (Windows – thin sheets of glass)
      * Pressing (glass bricks, lenses)
      * Rolling (wired and plate glass)
    - Annealing
      * Annealing of glass is a process of slowly cooling down hot glass objects after they have been formed (glass will break when cooled suddenly)
      * In glass manufacturing, a special type of furnace, a Lehr is used for this process
      * Glassware moves through the oven’s zones on a conveyor belt
      * After annealing the glass can be cut, drilled, sized and polished for use
    - Finishing
      * Cleaning
      * Griding
      * Polishing
      * Etching
      * Engraving
      * Sandblasting
      * Cutting
      * Painting
    - Coloured glass
      * Red colored glass can be obtained by adding selenium sulfide
      * Blue glass can be obtained by adding copper oxide
      * Milky glass can be obtained by adding alumina or phosphate
    - Types of glass
      * According to the melting point
        + Soda glass – soft glass - melting temperature of batch is 1300°C, bottles, windows
        + Quartz glass – hard glass - melting temperature of batch is 1500°C, wine glasses, electrical bulbs
        + Pyrex glass - melting temperature of batch is 1700°C, baking Jena dish, laboratory glass ware
      * According to chemical composition
        + Silica glass
        + Soda-lime glass – bottles
        + Flint glass (lead glass) – optical lenses
        + Borosilicate glass – glassware in kitchens and laboratories
        + Alumo-silicate glass – screen of smartphones
      * Decorative and technical glass
        + Lead crystal glass – it sparkles, expensive glass ware
        + Technical

Chemical – glassware in laboratories

Optical – cameras, lenses, glasses

Building – windows

Safety – car glass, wired glass

Glass fibers – surfboardsk, helmets, canoe

* + - Future of glass
      * Functional integration of glass that can become an ideal substrate for OLED lighting, touch screens, etc.
      * Bioactive glass – include the original bioactive glass, bioglass, implant materials in the human body to repair and replace diseased or damaged bones
      * Smartphones – bendable glass, scratch resistance
      * Special coatings for buildings: Smart mirrors and highly insulating glass windows
    - Testing
      * Impact testing
      * Thermal schock resistance
      * Physical inspection
      * Stress testing