

Recall from memory

- Use mnemonics to help your brain store complex information
- Use read-cover-write-check-correct
- Close your notes and write down as much as you can
- Use flash cards to make notes then use them for quizzes
- Try memory stacking

Visual variety

- Colour code your notes, use different colours for different topics
- RAG your notes with what you know/know some/don't know yet
- Draw diagrams, pictures and symbols next to your notes
- Use up to 10 post it notes around your house as reminders

Reduce it

- Turn 100 words into 30. Turn a sentence into a word
- Make a mind map but only write the key facts/words
- Make flash cards using key words for prompts
- Learn key words for each topic

Practice questions

- Complete a practice question or exam paper
- Answer questions within a time limit
- Check your answers using a mark scheme/revision guide or knowledge organizer
- Think-pair-share
- Create a quiz for yourself on the information you know some of or do not know yet

Sustainability and the environment

We must take responsibility for how we dispose of our products. They could be recycled or end up in landfill.



Waste materials can have positive effects including: Less raw materials required, cost of materials partly regained through selling recyclable waste, energy to heat and power business may be generated

Designers and manufacturers must ensure they try to reduce the amount of pollution they produce by making products. Creating CO₂, methane and other greenhouse gases contributes towards **global warming** which raises the earth's average temperature

Continuous improvement is the process of improving products, services and processes. It is often viewed as a circular process of planning, implementation, measuring results and taking corrective actions if results don't represent an improvement.

Finite resources have a limited supply or cannot be reproduced e.g. oil / gas / coal

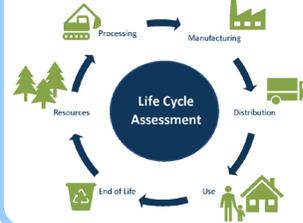


Non-finite resources are ones that have huge supplies or can be reproduced easily or fairly quickly e.g. Trees for paper & timber / wind & solar power



Life cycle assessments

(LCA) is a way for a company to assess the environmental impact of a product during different stages of the products life.



Technology

| | Positive impacts | Negative impacts |
|------------|--|--|
| Technology | Use material from managed sources | Overuse of finite and non-recycled materials |
| | Renewable or low energy for production | Use components that cannot be repaired |
| | Recycled or recyclable materials, fewer components | Use of fossil fuels to power manufacture |
| | Design to be reusable, repairable, recyclable | Products that have built in obsolescence |
| | Products are sourced, produced and sold locally | Parts have travelled long distances and shipped globally |

LEARNING STRATEGIES

Industry and enterprise

Fairtrade is about better prices, decent working conditions and fair terms of trade for farmers and workers in less economically developed countries.

- Bananas
- Cocoa beans



Automation and the use of Robots



Tesla production line

Crowd funding

is a way for designers to gain investment to help develop a product. It is usually internet based on websites such as Kickstarter.com. People who think the idea is good invest in the product which can help the product make it to market

Greater demand for products meant more people got jobs making things. Now, with robot production lines, fewer people are needed in factories. The human jobs tend to be highly skilled engineers

Virtual Marketing & Virtual Retail

This is when you use web sites, social media, email and banner adverts to promote a product. Facebook and YouTube are platforms to promote new products.



People, culture and society

Technological push is when a new technology is developed and then pushed into market creating new products.

Market Pull is when there is a problem identified by a consumer group driving new technology to be used to solve with a product.

Products **evolve** over time due to:

- ✓ New technology
- ✓ Fashion/style
- ✓ Consumer need
- ✓ New materials
- ✓ New manufacturing



Changing job roles

Due to increased automation, there are far fewer manual labour jobs. Rather than creating mass unemployment, people will 'upskill' to do higher value jobs and those that robots can't do such as creative jobs

Anthropometrics

Is the measurements of the human body



Ergonomics

Is about how a product interacts with a user. Physically, mentally and cognitively

Informing design decisions

Planned obsolescence

This means that products are only designed to last a certain amount of time eg sofas for 10 years, headphones 2 years, a pen for 6 months. If a product was designed to break quickly it would be a waste of energy and resources, if it was designed to last forever would mean companies would go out of business.

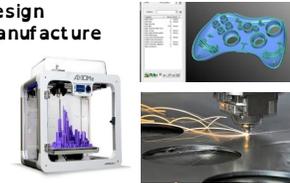
Production techniques and systems

CAD - Computer Aided Design

CAM - Computer Aided Manufacture

Just in time production

Manufacturers respond to customer demands, an order triggers the production process and the manufacturer makes the product specifically to meet the order. Enables them to save money.



Flexible manufacturing is using automated robots and machines on production lines. The machines can be reprogrammed to perform different tasks or the same repetitive task

NEW AND EMERGING TECHNOLOGIES

design technology: intelligent design using appropriate technology to make better solutions



Modern materials

Modern materials New materials or new ways of working with a material.

Corn starch polymers are biodegradable plastics made from corn or potato starch. Uses: Disposable cutlery, food packaging, pens, 3d printing

Flexible MDF has grooves cut in it. Architects and interior designers use it to create large natural curves.

Titanium does not react with the human body and so is used by the medical industry eg hip replacements, dental implants

Liquid crystal displays (LCD)
Low cost and low power method to display information.

Fibre optics are fibres that allow digital information to travel as pulses of light along thin glass strands at high speed.

Graphene Thinnest, lightest material, strongest compound, best conductor of heat and electricity

Atom Molecule Virus Bacteria Cell Period Tennis ball



Nanomaterial Material that is between 1-100 nanometres. This has helped miniaturisation.

Metal foams
Porous metal made by injecting gas into liquid metal. Usually made from titanium or aluminium. Lightweight, strong and conductive.

Smart materials

Smart materials change their properties to react to an external stimuli

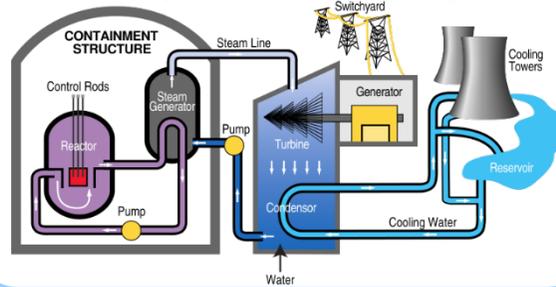
- * Shape memory alloys The wire has a pre-set shape that it returns to
- * Polymorph softens and mouldable when heated
- * Thermochromic inks change colour with a change of temperature

Energy generation

Can be done using Finite or renewable energy resources.

| Finite | Renewable |
|----------------------|---------------|
| Shale gas (fracking) | Wind |
| Oil (Drilling) | Solar |
| Coal (Mining) | Tidal |
| | Hydroelectric |
| | Biofuel |

Nuclear power A controversial method of producing energy. A nuclear reaction is created inside a controlled vessel to produce vast amount of heat. Control rods are moved in & out of the reactors core to regulate the amount of power it generates.



Systems approach to designing

System

Comprises of components that work together to control a task.
Open loop systems have no feedback and cannot make decisions. The input controls the output only.
Closed loop systems make decisions usually from a sensor.

Inputs are the parts of a system to help control it. You could use an input component like a switch or a sensor.
Outputs used as part of a system and give off stimulus like light, heat, movement or sound.

Light emitting Diode (LED)



Linear motion
Movement in one direction in a straight line



Rotary motion
Is a circular motion like a merry go round or washing machine drum



Oscillating motion
Similar to reciprocating but is along a curved line



Energy storage

Kinetic energy is the energy involved in motion. Any object in motion has kinetic energy – a ball thrown, a person walking or an object falling.

Electrical power can be stored in **batteries**. Batteries contain electrochemicals that react with each other to produce electricity

Composite materials

Materials that are combined to improve their properties

Glass Reinforced plastic (GRP) glass fibres combined with a plastic resin which sets hard. Uses: oat hulls, car and truck body parts, seating, helmets.

Technical textiles

Gore-tex Thin waterproof fabric which is windproof and yet breathable. Used in outdoor clothing, ski wear, walking boot and gloves.

Microfibre Synthetic fibres which are less than one denier thick.

Fire resistant fabric Developed to withstand high temperatures and naked flames. Such as fire blankets, firefighting clothes and racing drivers protection.

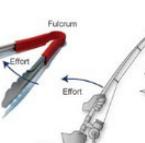
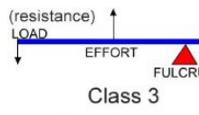
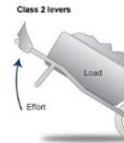
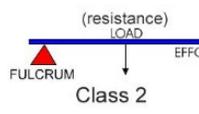
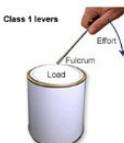
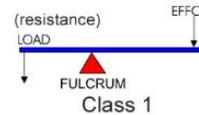
Kevlar High tensile strength to weight ratio. Withstand heat and impact. Used in body armour, bullet proof vests, motorcycle clothing and extreme sports equipment.

Micro-encapsulation Traps liquids or solids within the fibres of a fabric. When rubbed or heated the micro-encapsulated substance is released.

Conductive fabrics Known as e-textiles. Highly conductive threads. Can connect LED's, headphones, microphones and more within clothing.

Mechanical devices

Reciprocating motion
Repetitive up and down or back and forth movement along a straight line



Electronic systems processing

There are many components that will process electronic signals and enable output devices to perform tasks. Most of these processes are controlled by integrated circuits (IC's). A modern IC example is called a microcontroller that can perform multiple tasks.

Microcontrollers perform multiple tasks and can be programmed on software which converts flow charts to appropriate code-saving you having to learn it.

Digital and analogue signals
The most common processes performed by electronic circuits are timing, counting and decision making. Inputs or outputs may give out or take one of two different types of signal:

Analogue-continuous with infinite range of values between minimum & maximum
Digital-Is either on or off. Like you would get with a switch.

A lever is a mechanism to gain mechanical advantage or lift things more easily

ENERGY, MATERIALS, SYSTEMS & DEVICES

design technology: intelligent design using appropriate technology to make better solutions



Papers and boards

Usually made from wood pulp but could include textiles such as cotton.

Common papers

Cartridge paper-thick with a slightly rough surface-completely opaque-pencil and ink drawings

Tracing paper-low opacity-takes most pencil and colours well-copy images-shows adaptations as overlays

Common boards

Corrugated cardboard-natural brown-strong, light weight, insulates-fluted middle-packaging boxes ad impact protection

Foil lined board-white card laminated with aluminium foil-foil reflects heat-oil and water resistant coating enables food to be contained-takeaway containers

Foam core board-smooth surface both sides-rigid-can crack and crease-expanded polystyrene centre-architectural models/prototyping, mounting photographs/art work

Metals and alloys

Ferrous metals

All contain ferrite/iron. Most magnetic and will rust if exposed to moisture without a protective finish

Low carbon steel
High carbon steel
Cast iron

Non ferrous metals

Not magnetic, do not contain iron, oxidise instead of rust

Precious metals (gold, silver, platinum)
Aluminium
Copper
Tin
Zinc

Alloys

Mixture of one pure metal and another element. Done to improve the working properties or aesthetics

Brass
stainless steel

Textiles

Animal (wool/silk/leather)

Plant (cotton/linen)

Polyester

Polyamide (nylon)

Elastane (lycra)

Interlocking loops

Most common way to produce fabric

Uses a loom to make it

Made of a warp and weft

Made straight from fibres not yarn

Bonded with heat or adhesive

Felt/interfacing

Weft knitting-loop across width-stretchy loses shape, warm

Warp knit-less likely to unravel, holds shape

NATURAL

SYNTHETIC

WOVEN

NON WOVEN

KNITTED

Textiles

Rolls yarns fibres
Categories include:

Natural and manufactured timbers

Hardwoods

Ash: Flexible, tough, shock resistant, laminates well

Sports, equipment and tool handles

Beech: Fine finish, tough and durable

Children's toys and models, furniture and veneers

Mahogany: Easily worked, durable and finishes well

High end furniture, joinery and veneers

Oak: Tough, hard and durable, high quality finish possible

Flooring, furniture, railway sleepers and veneers

Balsa: Very soft and spongy, very lightweight, can snap in thin sections

Prototyping, modelling, especially aircraft models

Softwoods

Larch: Durable, tough, good water resistance and surface finish

Exterior cladding, flooring, machined mouldings

Pine: Lightweight, easy to work, can split and be resinous near knots

Interior construction and exterior furniture and decking

Spruce: Easy to work, high stiffness to weight ratio, variable results when staining

Construction furniture and musical instruments

Manufactured boards

MDF: Smooth, dull veneered, hard to finish, rigid, stable, absorbent, tough

Flat pack furniture, toys, kitchen units, internal construction

Chipboard: Pale grey/brown, no grain. Frequently covered with laminate, edges chip easily, not water resistant, good compressive strength

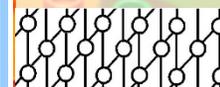
Flooring, low end furniture, kitchen units and worktops

Plywood: Layers glued together, stable in all directions

Furniture, shelving, toys and construction

Thermosetting

Thermosets are more rigid and cannot be reformed. Long polymer chains have many crosslinks. Harder and more brittle. They make excellent insulators and good resistance to heat and chemicals.



Epoxy resin, melamine formaldehyde, urea formaldehyde, polyester resin, phenol formaldehyde

Thermofforming

Thermoplastics have polymer chains which are loosely entangled with few cross links. Can be reformed multiple times. Used in vacuum forming, injection moulding and blow moulding.



PETE, HDPE, PVC, LDPE, PP, HIPS, PMMA

Can you name all of these polymers?

Polymers

MATERIALS & THEIR WORKING PROPERTIES

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