

## 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 CO<sub>2</sub>, methane and other greenhouse gases contributes towards **global warming** which raises the earth's average temperature

**Finite resources** are ones that have 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



**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.

	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

### 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.



# 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

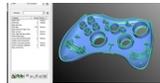
### Planned obsolescence

This means that products are only designed to last a certain amount of time e.g. 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

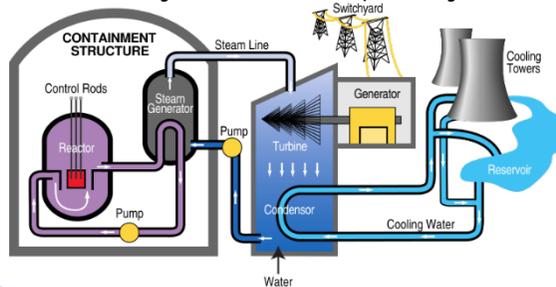
- \* Shape memory alloys The wire has a pre-set shape that it returns to
- \* Polymorph softens and mouldable when heated
- \* Thermochromic inks change colour with a change of temperature

## 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.

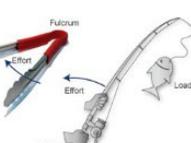
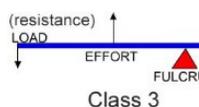
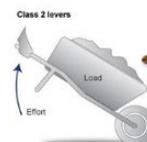
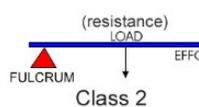
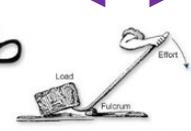
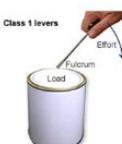
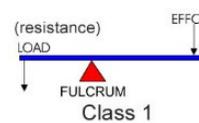
**Kevlar** High tensile strength to weight ratio. Withstand heat and impact. Used in body armour, bullet proof vests, motorcycle clothing and extreme sports equipment.

**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

**Textiles**  
Rolls yarns fibres  
Categories include:

NATURAL

SYNTHETIC

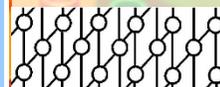
WOVEN

NON WOVEN

KNITTED

## 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

## 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

### Felling

Is the term used for cutting down trees. Traditionally this was done by hand using an axe or a very long saw. They are now felled using chainsaws and machinery.

# MATERIALS & THEIR WORKING PROPERTIES

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

