Design Technology – (Electronic Products)

AQA GCSE Design and Technology Revision Notes – Electronic Products Higher Tier

Disclaimer; I made this to help me revise when the exam comes around, but while I’ve tried to make this document as accurate as possible, I can’t guarantee that the information in this document is completely correct – I may have made mistakes.

# Materials, Processes and Practices:

## Plastics:

* There are two loose types of plastics; **Thermosetting** and **Thermoplastics**.
* Thermoplastics can be heated and shaped many times.
* Thermosetting plastics can he shaped once.
* The main properties of plastics are listed below:
  + Electrical insulator
  + Thermal insulator
  + Weather resistant
  + Chemical resistant
  + Corrosion resistant
  + Heat resistant
  + Many colours are available
  + Easily shaped and formed (via injecting, blowing or forming)
  + Self-lubricating
  + Impact resistant

### Types of thermoplastics:

* Acrylic (aka Perspex)
  + Hardwearing and doesn’t shatter, but easily cracks and shatters.
  + Can be cut using machines and drilled.
  + Often used for signs, aircraft windows and robot wars.
* HIPS (High Impact Polystyrene)
  + Light and flexible yet strong.
  + It’s easily cut, machined and moulded
  + Often used in cheap items such as toys and boxes
* ABS (Acrylonitrile Butadiene Styrene)
  + High resistance to impact
  + Easily moulded, but and drilled
  + Used in car components, handles and kitchen appliances.
* PVC (Polyvinyl Chloride)
  + Hardwearing
  + Used in pipes, window frames etc
* Nylon
  + Hardwearing
  + Self lubricating
  + Often used in gears and bearings.
* **In General:**
  + Hardwearing
  + Fairly light
  + Hard to shatter

### Types of thermosetting plastics:

* Glass Reinforced Plastic (GRP)
  + Polyester resin + hardener + glass fibres
  + Used in cars, boats and canoes
* Epoxy Resin
  + Resin + hardener
  + Used in PCB’s, surface coatings, and bonding materials together (aka glue)

## Timbers:

* Divided into:
  + **Softwoods**
  + **Hardwoods**
  + **Manufactured boards (e.g. plywood or MDF)[[1]](#footnote-2)**

### Main properties of timber:

* You can see the grain pattern
* The different timbers look different (colour, grain etc)
* The different timbers feel different (rough, soft)
* Some timbers are easy to work with, others less so
* Some timbers are weak (balsa wood) others are strong (oak)

### Types of timber:

* Pine wood:
  + Widely used
  + Easy to work with
  + PVA glue works well with it
* Plywood
  + Made of odd numbers (3+) of thin layers of wood that are glued together
  + More layers = more strength
  + Layers are arranged so their grain is running perpendicular to the layer below it this gives a uniform strength to the wood
* MDF
  + Popular for domestic uses (furniture etc)
  + It’s made by bonding wood fibres together using a resin based adhesive
  + Used for moulds in vacuum forming.

## Metals:

* Divided into:
  + **Ferrous metals** - contain iron and are so attracted to magnets
  + **Non-ferrous metals** – don’t contain iron and so aren’t attracted to magnets

### The main properties of metals:[[2]](#footnote-3)

* **Elasticity** (they can regain their original shape after being deformed)
* **Ductility** (they can be stretched without breaking aka stretchiness)
* **Malleability** (they can be relatively easily pressed and hammered into shape)
* **Hardness** (they are resistant to scratches and other annoying blemishes)
* **Brittleness** (they can be liable to break when bent)
* **Tensile Strength** (they can retain their strength while stretched)
* **Toughness** (they are resistant to breaking, bending etc)

### Ferrous Metals:

* Mild Steel:
  + Tough
  + Ductile
  + Malleable
  + It’s strong when stretched (tensile strength)
  + Poor resistance to corrosion
  + Can be joined by soldering, welding or screws etc, and can also be milled, drilled, forged, press formed
  + The outer layer can be hardened to make the outer layer hard, but the inner core soft (like an… egg)

### Non-ferrous Metals:

* Aluminium:
  + Soft
  + Ductile
  + Good at conducting heat and electricity
  + Fantastic strength to weight ratio
  + Expensive to extract from its ore (it’s high in the reactivity series)
  + Used in cooking foil, window frames, toys etc
* Copper:
  + Malleable
  + Ductile
  + Good conductor of heat and electricity (it’s a super conductor at or near absolute zero)
  + Excellent resistance to corrosion
  + Cheap
  + Used in plumbing and electrical components
* Duralumin:
  + An **Alloy** of aluminium (95%), copper (4%) and manganese (1%)
  + Stronger than aluminium
  + Used in aircraft
* Brass:
  + An **Alloy** of copper (65%) and zinc (35%)
  + Good conductor of heat and electricity
  + Hard
  + Resistant to corrosion
  + Used in plumbing and ornaments

### Smart Materials:

|  |  |
| --- | --- |
| Piezo transducer | Piezo electric movement **produces a small voltage when it is deformed my mechanical movement** (works both ways). |
| Smart cable | Uses the Piezo electric principle to **convert mechanical energy to electrical energy.** |
| Photovoltaic cell | Converts **solar energy** to **electrical energy.** |
| Optical fibre | Made of glass or plastic, it carries light signals. It has **less interference** than copper and isn’t as heavy. |
| Thermocolour sheet | Changes colour when heat is applied to it. It’s made by printing **thermochromic liquid** onto paper. |
| Liquid Crystal Display (LCD) | The display is made up of **shaped crystals.** When an electrical current passes through it, the crystal changes shape and absorbs light, so it seems darker. They emit no light of their own, so a backlight if often fitted. |
| Smart wire | A **Shape Memory Alloy (SMA)** that shortens in length when an electric current is passed through it. |
| Quantum Tunnelling Composite | When compressed, it changes from an insulator to a conductor.[[3]](#footnote-4) |

## Injection and blow moulding:

### Injection Moulding:

1. See *Types of Timber* [↑](#footnote-ref-2)
2. Different metals have different properties, for example some will have immense hardness (think stainless steel (it has to suffer being shoved into your mouth every teatime)) while others won’t (pure iron + hammer = massive dent). [↑](#footnote-ref-3)
3. I think it was used in old the iPod Nano. [↑](#footnote-ref-4)