

A LEVEL

**Materials, components
& application**

REVISION CARDS

Materials: Woods

-Natural woods

- Hardwoods:** beech, oak, ash, mahogany, teak.
- Softwoods:** Scots pine, spruce, Douglas fir.
- Sources:** Deciduous/Evergreen
- Structure:** Grain, knots, moisture content.
- Seasoning:** Kiln drying
- Defects:** Knots, splits, warping, bowing, twisting, cupping.
- Decay:** wet rot, dry rot, insect attack
- Conversion:** Slab sawn, quarter sawn
- Stock forms:** rough sawn, P.S.E (Planed Side Edge), 'FSC' (Forestry Stewardship Council)

-Man-made boards:

- Plywood:** Backs of furniture, drawer bottoms, flexible
- Aero ply:** Aircraft manufacture
- FlexiPLY:** Furniture, panelling
- Marine ply:** Marine and aviation applications
- Chipboard:** Flat-pack furniture, laminated work surfaces
- MDF:** Base for veneers
- Hardboard:** Backs of cupboards
- Laminates and veneers:** beech, ash, oak, walnut, paper
- Foil backed Laminates:** Formica' (coated printed paper or foil laminates)
- Applications:** *Decorative surfaces, flooring, flat-pack furniture etc.*

Biodegradable polymers & Elastomers

-Compostable polymers...

- Source:** cellulose/starch based
- (wheat, corn, potatoes, plant sugars)
- Biopol** (corn starch based polymers)
- Polylactide (PLA)**
- Applications:** *carrier bags, plastic bottles and detergent sachets*

-**Biodegradable** (break down with the aid of natural processes)

- Oxo-degradable** (heat, oxygen, moisture)
- Degradation** (deterioration)
- Bio-batch** additive mixed polymers
- Renewable**

-Absorbable/water soluble polymers...

- lactide**
- glycolide** (Lactel)
- Ecofilm**
- Applications:** *slow release medication, bone repair fixings, detergent washing liquid sachets*

-Thermoplastic Elastomers (TPE)

-**Applications:** *Electrical components, cable insulation*

-Thermoplastic Rubber (TPR)

-Liquid Silicone Rubber (LSR)

-**Applications:** *Covers for electrical connectors, seals, baking trays, spatulas.*

Materials: Smart

-Shape Memory Alloy (SMA)

-Nitonol (Nickel-Titanium alloy)

-Heat/movement

-Applications: flexible spectacles (superelastic wire), cable connectors, muscle wires, fire sprinkler control

-Thermochromic pigment

-Heat/colour

-Applications: thermometers, baby feeding products, kettles, steam irons, thermal warning patches, and hi-tech jewellery

-Thermochromic sheet:

-Heat/colour

-Applications: thermal warning patches, battery condition indicators, jewellery

-Photochromatic pigment:

-Light/colour

-Applications: sunglasses, anti-flash visors, sun-blocking products, radiation indicators

-Phosphorescent pigment:

-Applications: emergency exit signs, jewellery and toys

-Polymorph:

-Low melting point thermoplastic

-Applications: modelling grip prototypes

Materials: Composites

Types: Fibre-based, Particle-based, Sheet-based.

Fibre Reinforced Polymers...

- Glass (GRP):** Boat building
- Carbon Fibre (CFRP):** Racing bike, sports cars.
- Kevlar:** Body armour
- Fibre reinforced concrete**

Particle-based composites...

- Cermets:** Tungsten/Titanium carbide-Cutting tools
- Filament reinforced ceramics**
- Concrete:** Structural building components, garden ornaments.
- Tarmac**

Sheet-based composites...

- Plywood:** Backs of furniture/flexible
- Blockboard:** Table tops, furniture carcasses
- MDF (Medium Density Fibreboard)**
- Hardboard:** Backs of cupboards
- Chipboard:** Flooring, kitchen cupboards, worktops, veneered
- Sterlingboard:** Flooring, roofing and shuttering
- Hexaboard**
- Maplex**

Materials: Compliant

Paper...

- Layout paper
- Bleed proof
- Photo quality
- Cartridge
- Watercolour

Applications: design drawings, presentations, graphic products etc.

Card...

- Carton board
- Multi-sheet
- Laminated
- Corrugated
- Metal effects
- Mount board

Applications: model making, packaging etc.

Reflective films and holograms...

Applications: reflective/warning patches, jewellery, security holograms etc.

Polymer based sheet and films...

- Foam board
- Fluted translucent polypropylene sheet
- Acetate
- Styrofoam
- Modelling foam
- Low density polyethylene sheet
- Plastazote

Applications: packaging, point of sale displays, model making etc.

Materials: Modern

Metal based...

- Anodised aluminium sheet**
- Nickel plated steels** (vehicle suspension parts)
- Polymer coated aluminium**(food cans)
- Alu composite** (polythene cored aluminium sheet)
- Aluminium foam** (vehicle design, military blast protection)
- Titanium** (implants, surgical instruments, military equipment)

Wood based...

- Flexible MDF/Flexi-ply**
- Aircraft grade plywood,**
- Hexaboard**
- Paper backed veneers**

Composites...

- Carbon fibre** (racing car, helmets, tennis racquets)
- Kevlar** (protective garments)

- Fibre optics:** Transmitting data, internet.
- Smart textiles**

Materials: Polymers

-**Polymer:** long chain molecule

-**Thermoplastic/Thermosetting plastic/Elastomers**

-**Properties:** insulator, corrosion resistance

-**Sources...**

-**Synthetic:** coal, oil, gas

-**Semi-synthetic:** animal/vegetable by-products

-**Thermoplastics (synthetic)...**

-**PETE(1)** polyethylene terephthalate

-**HDPE(2)** high density polyethylene

-**PVC(3)** polyvinyl chloride

-**LDPE(4)** low density polyethylene

-**PP(5)** polypropylene

-**PS(6)** polystyrene

-**Other(7)...**

-**ABS** Acrylonitrile Butadiene Styrene

-**PMMA** polymethyl methacrylate

-**Nylon**

-**Recyclability**

-**Thermosets (synthetic):** Epoxy resins, Polyester resins, Urea Formaldehyde and Melamine Formaldehyde

-**Improving properties:** fillers, flame-retardants, anti-static agents, plasticiser, stabilisers

-**Semi-synthetic:**

-cellulose (plant fibres, acetic acid)

-Casein (by-product of milk)

-**Biodegradable plastics:** Biopol, oxo-degradable polymer, water-soluble polymers

-renewable raw materials

-starch based (wheat, corn, potatoes)

Materials: Metals

-Ferrous/Non-Ferrous/Alloys

-Ferrous metals:

- Mild steel:** General engineering material
- High carbon steel:** Hand tools, chisels, plane blades
- Cast and wrought iron.**
- Source:** Ore...
 - iron-magnetite, haematite
- Properties:** Ductility, Hardness, toughness, brittle
- Structure:** Crystal, carbon content
- Stock forms:** sheet, bar, tube and angle

Non-Ferrous metals:

- Aluminium:** Ladder, drinks cans, food wrap.
- Copper:** Domestic pipes, wire
- Zinc:** Coating for steel
- Gold:** Jewellery, electrical contacts
- Silver:** High quality cutlery
- Titanium:** Surgical applications
- Source:** Ore...
 - copper-chalcopyrite
 - aluminium-bauxite
- Oxidation,**oxide
- Stock forms:** sheet, tube, ingot

Materials: Alloys

-Benefits...

- resistance to corrosion
- increased strength, hardness and ductility

-Ferrous/Non-ferrous alloys

-Ferrous alloys: stainless steel, high speed steel and die (tool steel)

-Stainless steel (chromium, nickel, magnesium) *Uses: Sinks, cutlery.*

-High speed steel (tungsten, chromium, vanadium) *Uses: Cutting tools, drills.*

-Tool and die steel (Chromium, manganese) *Uses: Press tools, extruder dies, blanking punches*

-High tensile steel (Nickel) *Use: Car engine components.*

-Non-ferrous alloys: bronze, brass, pewter, duralumin

-Duralumin (aluminium, copper, manganese, magnesium) *Use: Structural aircraft components.*

-Brass (copper, zinc) *Uses: Valves, taps, boat fittings, ornaments.*

-Bronze (copper, tin) *Uses: Statues, coins, bearings.*

-Nitinol (nickel, titanium) *Uses: Smart metal alloys – muscle wires, springs.*

Material applications: Metals

Ferrous metals...

- Mild steel (low carbon):** Nuts, bolts, washers, car bodies, cooker panels, white goods.
- Medium carbon steel:** Springs, gardening tools.
- High carbon steel:** Hand tools, centre punch, chisels, plane blades
- Cast iron:** Machine parts, brake discs, engines.

Non-Ferrous metals...

- Aluminium:** Saucepans, step ladder.
- Copper:** Domestic pipework, electrical cable, electrical contacts.
- Gold:** Jewellery
- Lead:** Fishing weights, rood flashing

Material applications: Alloys

Ferrous alloys...

- Stainless steel:** Sinks, cutlery, sanitary-ware
- High speed steel (HSS):** Cutting tools, drills
- Tool and die steels:** Press tools, extruder dies, blanking punches, hand tools
- High tensile steels:** Car engine components

Non-Ferrous alloys...

- Duralumin:** Aircraft components
- Brass:** Valves, taps, boat fittings, ornaments
- Bronze:** Statues, coins, bearings
- Nitinol:** Smart metals, springs, muscle wires

Material applications: Polymers

Thermoplastics	-PETE(1) polyethylene terephthalate	Soft drinks bottles, insulation tape
	-HDPE(2) high density polyethylene	Crates, bottles, buckets, bowls
	-PVC(3) polyvinyl chloride	Hose pipes, cable insulation
	-LDPE(4) low density polyethylene	Detergent bottles, toys, carrier bags
	-PP(5) polypropylene	Food containers, string, rope
	-PS(6) polystyrene	Packaging, disposable cups
	-ABS Acrylonitrile Butadiene Styrene	Kitchen products
	-PMMA polymethyl methacrylate	Illuminated signs, leaflet holders
	-UPVC unplasticized polyvinyl chloride	Window and door frames
Thermosetting	-Urea Formaldehyde	Electrical fitting, adhesives
	-Melamine Formaldehyde	Tableware, laminates for worktops
	-Epoxy resins	Surface coating, adhesives
	-Polyester resins	Casting, GRP, boat hulls

Adhesives & Fixings

- Natural/synthetic/mechanical
- Permanent/Temporary/Knock-down
- Dissimilar materials

-Natural adhesives...

- animal glues** (animal hide) for woods, fabrics, leathers
- natural resins** (gum arabic) for paper, fabric
- inorganic cements** (portland cement) for bricks

-Synthetic adhesives...

- Resin (Cascamite)**
- Solvent Cement** (Tensol 12) joining acrylic
- PVA** for wood and papers
- Contact Adhesive** (Evostik) for mixed materials i.e. laminate to MDF

-Synthetic adhesives continued...

- Epoxy resin** (Araldite) for mixed i.e. metals to woods
- UV hardening adhesive** (Superglue substitute)

Temporary joining methods...

- Screws (Machine/Wood)
- Nuts and bolts
- Self-tapping screws

Knock down fixing methods...

- Barrel nut/bolt
- Corner plates
- Block connectors
- Dowels