WJEC AS D&T Product Design In-depth Knowledge & Understanding 2.3.5 (c)
The use of surface finishes and coatings

Surface finishing

A material can have a surface finish applied for two main reasons:

- **preservation and protection** - to prevent a material from corroding, fading, oxidising or being decayed, or to prolong life
- **improving aesthetics** - this might include colour, shape, form, texture, reflectivity, roughness, or adding details like decals, logo or branding.

Metals – surface finishing

Metal finishing is the final stage in the manufacturing process. For metals, this can reduce surface roughness for parts that must seal or join, and can include descaling, deburring and cleaning. Finishing metals can enhance electrical conductivity and provide higher electrical, chemical and tarnish resistance.

Plating - metal plating can improve durability, corrosion resistance and exterior appearance. When **galvanizing** metal, zinc plating provides a corrosion resistant and durable finish.

Heat treatments – provide characteristics to finished metal shapes like gears. **Hardening** uses a heating and quenching process to increase durability. **Case hardening** is used on shackles of padlocks to produce a surface resistant to mechanical attack.

Coating – water and oil-based **paints** can be used to provide inexpensive finishes protecting against corrosion. **Powder coating** involves UV or heat curing of dry polymer powder, to create a colourful, textured, matt or glossy finish.

Hot blackening – a thin layer of black oxide covers the surface of the metal to create a matt black finish which is highly abrasion resistant. This is a high temperature hot finishing process commonly used in automotive parts, tools and firearms.

Anodizing – **aluminium** is often anodized to provide corrosion resistance and enhanced aesthetics with a greater resistance to wear.

Enamelling – is the process of applying a thin coat of finely ground glass to the metal, heated to a high temperature until the glass melts and fuses with the metal.

Surface treatments for natural timbers

The type of timber will dictate the suitability of the coating or finish.

For example, **oak** is naturally resistant to biodegradation, but is prone to surface splitting, and this disrupts coatings, requiring frequent maintenance.

Softwoods like **pine** may have knots, which look attractive under translucent finishes, but with opaque finishes staining, resin bleed and surface defects can occur.

Coatings are applied for decorative reasons, but also to protect the timber against weathering, UV degrading and moisture absorbance.

Pressure treated timbers, for use in outdoor fences and sheds, is commonplace.

Manufactured Boards

MDF, plywood, hardboard and chipboard are all absorbent and need to be sealed before a finish can be applied. Veneers often provide a finishing layer to manufactured boards and timbers. These materials are more suitable for indoor use.

Natural timber finishes

There are various finishes applied to natural timbers.

- **Stains** – are used to colour the timber, but no film or protection is involved. The pigment enhances the timber colour, and will need to be re-applied annually, especially for products used outdoors.
- **Paints** - provide a thick film to protect and decorate timber in either solid colour (opaque) or translucent. Paints have a low pigment content allowing the surface grain to remain visible.
- **Varnishes** – can be applied to give a shiny appearance. Durability increases as the number of layers increase. Varnishes can be matt or glossy.
- **Shellac** – this a form of resin built up in layers by rubbing the polish into the timber. Popular with expensive furniture to provide a glossy finish, but easily damaged by moisture and heat.

Finishing polymers

Polymers formed in a mould or cavity are said to be self-finishing, meaning no further treatments are required, although logos, decals, branding and labels are sometimes added.

Polymers with cut edges need attention, and these often need to be sanded, polished and buffed in order to remove scratches from deforming or cutting processes.

Surface decorations can be machined into polymers, and it is common for vinyl details or surface printing to be added.