

1.3 Developments in New Materials Revision Mat – Year 10 Product Design

Key Terminology	Definition
Modern Material	A material that has recently been developed for specific applications.
Smart Materials	A material that changes its properties in response to changes in its environment.
Composite Materials	A material that combines the properties of the materials that were used to make it.
Technical Textiles	Materials and products that are manufactured for their technical and performance properties.
Microencapsulation	Very thin fibres hold chemicals in tiny capsules, which break open releasing chemicals.

Key points

- Graphene is a modern material that is very light and strong.
- Materials can be protected using a Polymer coating using either powder coating or dipping.
- Teflon gives a non-stick coating on pans.
- Corn starch polymers biodegrade better than oil based polymers.
- Smart materials change their properties in response to changes in their environment.
- Thermo chromatic paint changes colour at specific temperatures.
- Shape memory alloys (SMA's) return to their original shape when heated.
- Photo chromatic materials change colour in different light intensities.
- Composite materials combine the properties of the materials used to make them.
- Kevlar is a very light and strong material.
- Gor-tex is a material used in the manufacture of outdoor clothing as it is breathable and waterproof.

Modern Materials

Material	Properties	Uses
Graphene is a material made from a single layer of carbon atoms arranged in a hexagonal lattice.	Light Strong Biodegradable good heat transfer Can be moulded into any shape.	Protective cycle clothing, heat sinks for computer, electrically conductive paint, foldable screens, etc.
Metal foams are like a metal sponge in texture and construction.	Strong Lightweight Thermally conductive Very porous Good sound absorption Excellent energy absorption.	Soundproofing. Crash protection in vehicles. Body armour. Cycle protective clothing. Prosthetics.
Titanium usually alloyed with other metals to enhance its properties.	Titanium can be easily polished to a mirror finish. It has a high strength-to-weight ratio. It can be easily formed and welded. It is hypo-allergenic. Rust proofing.	Pure titanium is used in orthopaedic implants such as hip replacements, because it does not react with the human body. It is used for aircraft, spacecraft and sports car parts.
Coated metals <ul style="list-style-type: none"> • Anodised aluminium • Nickel-plated steel • Polymer coating 	Thick layer of oxide to protect materials. Uses electrolysis to add the nickel to a relatively cheap material such as steel. Created by dip coating or powder coating the material.	Surface protection and colourful coating. This can be for corrosion resistance or aesthetics. Polythene is often used to coat products such as tool handles or dishwasher racks.
Liquid crystal display is made of laminated material of two layers of glass with a liquid crystal core.	When voltage is applied, it lets light through. It blocks it when the voltage is switched off.	Digital watches Flat screen TV's Computer Screens Writing tablets.
Nanomaterials exist on an atomic or molecular scale.	Nanoparticles are added to materials to use their properties.	Sports equipment to add strength. Clothing and food equipment for antibacterial properties. Food preparation equipment. Paints and surface coatings to stop dirt from sticking.
Teflon is the trade name for a polymer coating of PTFE.	Creates a nonstick surface coating.	Coating food equipment to Added to fabric for clothing to stop dirt sticking.
Corn Starch Polymers have been developed to replace oil-based plastics.	They have biodegradable properties.	Disposable canteen cutlery and food packaging.



Graphene Shoes



Material	Properties	Uses
Thermochromic pigments	React to a change in temperature	Food product for children Colour changing mugs
Photo chromic pigments	Reacts to a change in UV light intensity.	Sun glasses Clothing fabrics Nail varnish
Shape Memory Alloys	Return to their original shape when heat or and electrical charge is applied.	Frames for glasses Braces for teeth



Technical textiles

Material	Properties	Uses
Conductive Fabrics	Can conduct electricity.	Sports fencing jackets Medical use, conductive electrodes
Nomex	Lightweight Thermally insulating Fire resistant Breathable	Fire fighters clothing
Kevlar	Impact resistant High tensile strength (stronger than steel) Chemical resistance	Bullet proof vests Helmets Motor cycle clothing
Micro fibres	Breathable Crease resistant Durable	outdoor clothing Sports clothing
Micro-encapsulation	Anti-bacterial Insecticides	Fabric that repels mosquitos and other biting and stinging insects Scented fabrics used for clothing and soft furnishings. Medical dressings



Composite Materials

Material	Properties	Uses
Concrete (particle composite)	Strong in compression if stones are added. Good tensile strength when steel rods are added.	Building structures Fence posts Pathways and kerb stones
Glass Reinforced Plastic (GRP)	Lightweight Strong tensile strength Impact resistant Corrosive resistance	Boat building Sports cars Water tanks Seating
Carbon Reinforced Plastic – Carbon Fibre (CRP)	Lightweight Good tensile strength Poor compressive strength	High end sports equipment (bike frames, racquets, golf clubs, etc.) Sports car bodies Prosthetic limbs

