The Innovation Lab · Teacher sheet

GCSE D&T · AQA 3.1.3 developments in new materials · application lesson · 50 minutes · works solo

The idea

Each student works in a product innovation lab. Companies bring product problems that ordinary materials cannot solve. Students choose a modern, smart, composite or technical textile material from the catalogue, name its category, explain what it does and why that solves the problem, and reject one alternative.

Print (per student)

- New Materials Catalogue (page 2). Can be shared or laminated.
- Project Board (pages 3–4), double-sided.
- Lab Report (pages 5–6), double-sided.

Running it

1. **5 min:** PowerPoint to the worked example (a mug that shows when the tea is hot; not on the Project Board).
2. **30 min:** students work alone: at least two Bronze projects first, then any order. Platinum projects combine three materials.
3. **10 min:** students mark their OWN report in green pen using the answer slides.
4. **5 min:** totals and ranks. **The Audit:** anyone claiming Lead Innovator or Head of R&D brings their report to you.

Fees

Bronze £100 · Silver £200 · Gold £300 · Platinum £500. **Full fee** = right material + its category + what it does + why that solves the problem (with **so…**) · **Half fee** = right material with weak reasons, or an accepted alternative · **£0** = wrong material · **+£50** = sensible rejected material with a reason.

Ranks

£0–399 Lab Assistant · £400–899 Researcher · £900–1,599 Lead Innovator · £1,600+ **Head of R&D**

Catalogue ratings (1–5) are simplified for comparing materials in class.

New Materials Catalogue

Scores out of 5 (darker = higher). **Lightness 5** = very light. **Cost 5** = very expensive. **Reacts to** = what makes a smart material change.

Material	Category	What it is	Strength	Lightness	Cost	Reacts to	Key facts
Graphene	Modern materials	A sheet of carbon one atom thick	5	5	5	–	Extremely strong, flexible, nearly transparent; conducts electricity and heat very well; very hard to make in quantity
Metal foam	Modern materials	Metal (often aluminium) full of gas bubbles	2	4	3	–	Light and stiff; crushes slowly to absorb impact energy; can float
Titanium	Modern materials	A light, very strong metal	5	3	5	–	High strength for its weight; does not corrode; safe inside the human body
Shape memory alloy (nitinol)	Smart materials	Returns to a 'remembered' shape when heated	3	2	4	Heat	Can be bent, then springs back when warmed (some even at body heat); very springy
Thermochromic pigment	Smart materials	Changes colour at a set temperature	1	4	2	Heat	Added to plastics, inks and paints; reversible
Photochromic pigment	Smart materials	Changes colour or darkens in UV light	1	4	2	Light (UV)	Added to lenses, inks and beads; returns when out of the sun
Carbon fibre reinforced polymer (CFRP)	Composites	Carbon fibres set in resin	5	5	5	–	Extremely strong and stiff for its weight; expensive; made in moulds by hand
Glass reinforced polymer (GRP)	Composites	Glass fibres set in resin	4	4	2	–	Strong, tough and waterproof; moulds into large curved shapes; much cheaper than CFRP
Conductive fabric	Technical textiles	Fabric with conductive threads woven in	2	5	3	Electricity	Carries electricity: touchscreen fingertips, heated panels, wearable circuits
Fire-resistant fabric (e.g. Nomex)	Technical textiles	Fibres that will not burn or melt	3	4	4	–	Protects the wearer from flames and heat; chars instead of burning
Kevlar	Technical textiles	Aramid fibres, very strong for their weight	5	5	4	–	Resists cuts, stabs and impacts; about five times stronger than steel by weight
Micro-encapsulated microfibres	Technical textiles	Tiny capsules attached to very fine fibres	1	5	3	Rubbing	Capsules burst when rubbed, releasing scent, moisturiser, insect repellent or antibacterial agents

Project Board

Do at least two Bronze projects first. Write the company's name on your report.

Bronze

BabyBites — BRONZE £100

“A weaning spoon that warns parents when baby's food is too hot to eat.”

SunSpecs — BRONZE £100

“Glasses lenses that darken by themselves when you walk outside into the sun.”

SafeHands Kitchens — BRONZE £100

“Gloves for chefs that kitchen knives cannot cut through, but still let fingers move.”

TouchWarm — BRONZE £100

“Winter gloves that still work a phone's touchscreen.”

Blaze Brigade — BRONZE £100

“A firefighter's suit that will not catch fire or melt onto the skin.”

Silver

FlexiFrame Optics — SILVER £200

“Glasses frames that spring straight back into shape if someone sits on them.”

Ocean Kayaks — SILVER £200

“A kayak hull: strong, waterproof, moulded into smooth curves, affordable for clubs.”

FreshStep — SILVER £200

“Socks that release a fresh scent and kill bacteria as you walk.”

MedTech Ortho — SILVER £200

“A hip replacement joint: very strong, never corrodes, and safe inside the body.”

SafeRide Cars — SILVER £200

“A crash zone in a car that absorbs the energy of a crash but adds little weight.”

Project Board (continued)

Gold

Velocity Cycles — **GOLD £300**

“A pro racing bike frame: the lightest and stiffest possible. Money is no object.”

FoldPhone — **GOLD £300**

“A bendable phone screen that conducts electricity, is see-through and very strong.”

HeartCare — **GOLD £300**

“A stent: inserted folded small into an artery, it opens out to full shape at body heat.”

School Racing Team — **GOLD £300**

“A car body shell for a school team: light, strong, moulds into curves, on a small budget.”

Platinum: three materials in one product

Mountain Rescue — **PLATINUM £500**

“Kit list: a very light stretcher frame, gloves that work on phone screens, a jacket that will not burn near a stove.”

SmartRide Helmets — **PLATINUM £500**

“A cycle helmet: a light liner that absorbs crash energy, a strap thieves cannot cut, a visor that darkens in sun.”

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Ranks: £0–399 Lab Assistant · £400–899 Researcher · £900–1,599 Lead Innovator · £1,600+ **Head of R&D**

Lab Report Name: _____ Mark in GREEN pen

Example: *What it does: changes colour when hot. So the product… warns you the drink is too hot to sip.*

Company	Material I chose	Category	What it does	So the product…	I rejected … because …	Fee £

Lab Report (page 2) Name: _____ Mark in GREEN pen

Example: *What it does: changes colour when hot. So the product… warns you the drink is too hot to sip.*

Company	Material I chose	Category	What it does	So the product…	I rejected … because …	Fee £

TOTAL EARNED: £_____ Rank: Lab Assistant · Researcher · Lead Innovator · Head of R&D (circle)