The Returns Desk · Teacher sheet

GCSE D&T · AQA 3.2.2 forces and stresses · application lesson · 50 minutes · works solo

The idea

Each student is a product failure investigator. Faulty products come back from customers. Students identify the force that caused the failure, explain why it failed, and redesign the part using a reinforcement method from the guide.

Material areas

Three cases (Bronze, Silver, Gold) for each of the six AQA areas, plus two multi-material Platinum cases. Students **start with the three cases in their own chosen area**, then do any others.

Print (per student)

- Forces and Fixes Guide (pages 2–3), double-sided. Can be shared or laminated.
- Case Board (pages 4–5), double-sided.
- Investigation Report (pages 6–7), double-sided.

Running it

1. **5 min:** PowerPoint to the worked example (a diving board that cracks; not on the Case Board).
2. **30 min:** students work alone: their own area's three cases first, then any others, Platinum last.
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 Senior Investigator or Chief Engineer brings their report to you.

Fees

Bronze £100 · Silver £200 · Gold £300 · Platinum £500. **Full fee** = right force + why it failed + a suitable redesign linked with **so…** · **Half fee** = right force but weak redesign, or an accepted alternative · **£0** = wrong force · **+£50** = a sensible rejected fix with a reason.

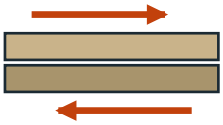
Ranks

£0–399 Trainee Investigator · £400–899 Investigator · £900–1,599 Senior Investigator · £1,600+ **Chief Engineer**

Accept any redesign that genuinely resists the force named; the answer key gives the expected ones.

Forces and Fixes Guide · 1. The five forces

Red arrows show the forces acting. Most failures are caused by one main force.

Force	Diagram	What it is	How things fail	Everyday examples
Tension		A pulling force that tries to stretch a material apart.	Stretches, tears or snaps	Rope, bag handle, guitar string
Compression		A pushing force that squashes a material.	Crushes, buckles or bulges	Table leg, stacked boxes, pillar
Bending		A force that makes a material curve; one side is squashed, the other stretched.	Sags, bows or snaps across	Shelf, diving board, lever
Torsion		A twisting force.	Twists, shears off or strips	Screwdriver, axle, key in a lock
Shear		Two forces sliding past each other in opposite directions.	Cut or sliced across	Scissors, bolt between two plates, rivet

Spot the force

- Something **stretched, tore or pulled apart**? Think tension.
- Something **crushed, squashed or buckled**? Think compression.
- Something **sagged, bowed or snapped across the middle**? Think bending.
- Something **twisted**? Think torsion.
- Something **sliced across**, or a frame **leaned sideways** (racking)? Think shear.

Forces and Fixes Guide · 2. Ways to fix it

Reinforcing and stiffening methods. Put material where the stress is.

Fix	How it works	What it gives you	Used in
Lamination	Thin layers glued together, often with the grain or fibres in different directions, or bent round a former.	Stronger and stiffer than one layer; holds a curve without short grain	Papers and boards, timber, polymers
Folding / bending	Fold or bend the edge of a sheet to make a flange, corrugation or box section.	Huge gain in stiffness for little extra material	Papers and boards, metal, polymers
Corrugation	Sheet formed into ridges or flutes (e.g. corrugated card).	Very stiff and crush-resistant for its weight	Papers and boards, metal, polymers
Webbing / ribs	Thin walls (webs) or ribs added across a part, often moulded in.	Stops bending and flexing without adding much weight	Polymers, metal, timber
Triangulation	Add a diagonal brace or corner block so the frame forms triangles.	Stops a frame racking (shearing sideways)	Timber, metal frames
Fabric interfacing	An extra stiffening layer sewn or fused inside fabric.	Holds shape and stops stretching (collars, cuffs, bags)	Textiles
Webbing tape and bar tacks	Strong woven strap and dense stitching at load points.	Spreads tension so stitching and fabric do not tear	Textiles
Bigger or better section	Thicker part, tube instead of rod, or a stronger/harder material.	More material where the stress is highest	All areas

Case Board

Do the three cases in YOUR material area first. Write the company's name on your report.

Papers and boards

ShopFit Displays — BRONZE £100	PaperBag Co — SILVER £200	PosterPost — GOLD £300
“Our flat card shelf in a shop display sags in the middle when products sit on it.”	“The handles on our card gift bags tear away from the bag where they are glued.”	“Our card poster tubes get crushed when boxes are stacked on top of them.”

Timber

ShelfLife — BRONZE £100	Pine & Co — SILVER £200	Rocking Ltd — GOLD £300
“Our pine bookshelf sags in the middle under heavy books.”	“Our table frame wobbles and leans sideways, then the joints split.”	“The curved rockers we cut from solid boards snap across the short grain.”

Metal

BracketBox — BRONZE £100	WashWell — SILVER £200	Saddle Up Bikes — GOLD £300
“Our steel shelf brackets bend downwards under heavy loads.”	“The thin steel side panels on our washing machines flex and drum when it spins.”	“The bolt clamping two plates of our seat post snaps clean across the gap between the plates.”

Case Board (continued)

Polymers

CrateMate — BRONZE £100

“The sides of our polypropylene bottle crates bow outward when crates are stacked.”

HangIt — SILVER £200

“Our moulded plastic coat hooks snap off at the corner where the hook meets the wall plate.”

ZoomToys — GOLD £300

“The plastic axles in our toy car twist and snap where the motor drives them.”

Textiles

TrailPacks — BRONZE £100

“Our backpack straps tear off at the stitching when the bag is full.”

SmartShirts — SILVER £200

“Our shirt collars go floppy and crease after one wash.”

CampOut — GOLD £300

“When it is windy, the guy ropes pull our tent fabric apart at the seams.”

Electronic and mechanical systems

Lever Life — BRONZE £100

“Our aluminium bottle opener lever bends in the middle when used.”

GearUp Toys — SILVER £200

“The push-fit gear on our motor shaft twists loose and slips.”

FixieCo — GOLD £300

“The pins in our bike chains shear when riders sprint hard.”

Multi-material: name a force and a fix for EACH part

SwingTime — PLATINUM £500

“A garden swing: the rope frays, the wooden seat sags, and the frame leans sideways.”

PackStool — PLATINUM £500

“A folding camping stool: the canvas seat tears, the legs splay sideways, and thin aluminium legs buckle.”

Full fee: right force + why it failed + redesign with **so…** · **Half fee:** weak redesign · **£0:** wrong force · **+£50:** a sensible rejected fix with a reason.

Ranks: £0–399 Trainee Investigator · £400–899 Investigator · £900–1,599 Senior Investigator · £1,600+ **Chief Engineer**

Investigation Report

Name: _____ My area: _____ Mark in GREEN pen

Example: *Fix: add a diagonal brace. So… the frame forms triangles and cannot lean sideways.* A quick sketch beside your answer earns no extra money, but examiners love them.

Company	Force acting	Why it failed	My redesign (fix)	So…	I rejected … because …	Fee £

Investigation Report (page 2)

Name: _____ My area: _____ Mark in GREEN pen

Example: *Fix: add a diagonal brace. So… the frame forms triangles and cannot lean sideways.* A quick sketch beside your answer earns no extra money, but examiners love them.

Company	Force acting	Why it failed	My redesign (fix)	So…	I rejected … because …	Fee £

TOTAL EARNED: £_____ Rank: Trainee · Investigator · Senior Investigator · Chief Engineer (circle)