Lesson 32

engineering

Build a strong, stable tower

Lesson at a glance

Open by holding up one sheet of newspaper and the test weight and posing the challenge: tallest free-standing tower that holds a small weight. Groups sketch and label base, strong shapes and weight platform on the Investigation Journal page before kits open, then build from limited materials. Parallel stations measure height in cm, check free-standing, and load the same weight. Each group makes one improvement from the test evidence and shares the design choice that helped most.

Learning objectives

- Plan and build a free-standing tower from limited materials
- Test height, stability and whether it holds a small weight
- Make one improvement and explain the design choice that helped most

Before the bell — prep

Pack one kit per group of 3–4 the day before: newspaper, tape, straws and small card pieces. Set identical test weights and at least one metre stick per two groups. Pre-cut card squares for top platforms if time is tight. Keep kits closed until plans are labelled.

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Materials

Item	Qty	Per	Source	Low-cost substitute
newspaper sheets	6	group	classroom	scrap A3 paper or old worksheets taped into larger sheets
masking tape roll	1	group	classroom	ordinary sticky tape used sparingly
drinking straws	10	group	classroom	tightly rolled paper tubes from scrap paper
card offcuts	4	group	classroom	cereal-box card cut into small rectangles
test weight (small bean tin or about 200 g mass)	1	group	classroom	small sealed bags of rice or dried beans of matching mass
metre stick	1	group	classroom	a tape measure or a ruler used end to end with care
Investigation Journal page	1	pupil	provided printable	plain paper with headings for plan sketch and test results

Safety watch-point

Everyone stands well back for load tests; no faces close to towers. Hands away from eyes if a tower buckles. Clear straws, tape scraps and bags from floors as you go.

Teaching moves

- **Getting Started:** Keep the opener short: hold up one newspaper sheet and the test weight, but do not hand out kits. Take a quick show of hands on whether height, base or inside shapes matter most — do not settle the answer. Invite one or two ideas about rolled or folded paper feeling stiffer than a flat sheet, then move on.
- **What makes a tower strong?:** Board only free-standing and stable now; save prototype and improvement for later. Capture class ideas in three lists — base, middle/shapes, how to hold the weight — without ranking them. Gesture hands-off on a standing tube: free-standing? tipping? Not stable. Head off 'more tape always equals stronger'.
- **Plan your tower:** Hand out Investigation Journal pages; kits stay closed until sketches are labelled. Agree success aloud: free-standing, as tall as possible, holds the weight. State constraints: only table materials, no taping to desk or wall, no holding during the test. Circulate asking where the wide base, tubes or triangles, and weight rest are. If a group cannot agree, give 30 seconds to pick a wide base plus one strong shape.
- **Build the tower:** Issue kits to every group at once. Circulate with three checks: base wider than top? tubes or triangles? place for the weight? Spot floppy walls (roll or fold first), tipsy bases (spread feet or add a card foot), and tape used all at once (save some for the improve step). Five- and two-minute warnings; early finishers check free-standing gently and tidy, not start a second tower.
- **Test height, stability and load:** Model the fair order once: measure height table-to-top in cm, hands off five seconds, official measurer places the same weight gently centre-top, watch five seconds. Building group stands well back; watchers record height, free-standing yes/no, held weight yes/no. Between towers, 10-second thumbs predicts on base width — no separate desk task. Cap each test near 90 seconds if stations slip; stop on the timer so improve keeps its full slot.
- **Improve your tower:** One change only — wider base, triangle brace, better top platform or stronger joins — no full rebuilds. Ask: what did the test show was weak, and does this change fix that? Re-check free-standing and weight if a station is free; if testing overran, free-standing only.
- **Share what helped:** Fast one-sentence share per group: what was weak, what changed, which choice helped most — base, shape or joins. Link briefly to real structures using wide bases and triangles (pylons, bridges). Recycle newspaper, collect tape and straws, clear every floor scrap.

What it should show

Many first towers are tall but tippy, or steady but short; a few hold the weight. Wider bases, rolled tubes, triangles/diagonal braces and a flat top platform usually outperform skinny flat-sheet stacks. A tower that collapses under load often has a narrow base or loosely rolled tubes — useful evidence for the one improvement, not failure.

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Misconceptions & interventions

- **More tape always makes a stronger tower.** — Point at a floppy flat wall still flopping under heavy tape: tape only joins pieces. Ask them to roll or fold the paper into a tube or triangle brace and feel the stiffness change.
- **Taller no matter what wins — even if it falls when hands come off or the weight goes on.** — Restate the three success criteria aloud: free-standing, tall, and holds the weight. A collapsed tall tower fails; record the fall as data and plan one fix aimed at the weak part.
- **The tower can be taped to the desk or held during the test and still count.** — Gesture at the free-standing board word and the constraint card: hands off, no furniture tape. Re-run the five-second hands-off check before any load.

Differentiation

Emerging	Developing	Proficient
• Sit with the group to lock one labelled plan: wide base plus one rolled tube, and a card square on top before build starts. • Offer a partly pre-rolled tube as a starter piece so joining and base-spread become the focus.	• After the first test, prompt one targeted fix only — e.g. 'spread the feet' or 'add one diagonal brace' — and re-check free-standing. • Ask them to compare their base width with the neighbouring group's and predict which will hold.	• Challenge a fair-test critique: was every weight placed the same way, and how would a better platform change the load result? • Stretch the share sentence to name which single design choice (base, shape or joins) helped most and why, linking to triangle braces in real structures.

Cross-curricular hook

Tie to Maths Measures: pupils read height in cm on the metre stick and compare class results for tallest stable tower.