Designing with Materials

Master Material Vault with Craftling

Learning target

Use test evidence to improve a material-based design.

Before you begin

Use the reference page and discussion prompts on their own, or open the optional browser adventure. No earlier lesson or physical kit is required.

For online play: use an internet-connected current browser with local storage enabled. Read the three-part Gemling briefing, answer the quick check, and apply the evidence at three checkpoints. Retry feedback supports review; results are not a secure test or gradebook.

Use for teacher-led review, science centers or partner practice. Independent readers may need support with the vocabulary below. The design target is grades 3-5; choose support based on the learner.

Vocabulary and concepts to discuss

Criteria; constraints; fair comparisons; reuse; improving designs

Open Master Material Vault - direct lesson link

Scan the QR code or use the clickable link. This guide is usable offline; the adventure runs on an external educational website.

Designing with Materials - key ideas

1. The first clues

Design criteria describe what a solution must do. Constraints are limits such as available material, size or cost.

2. How the clues connect

Compare prototypes using the same relevant test. Reusing material can reduce new demand when it still meets the design requirements.

3. Our evidence record

Our model bridge must hold a stated load using two sheets. Design A fails; a folded Design B holds the load with the same material. B better meets the supplied criteria and constraint.

Keep the science accurate

Compare properties through fair tests. Strength, hardness and flexibility are not interchangeable; no live electrical testing required.

Apply the evidence

Use a specific observation from this lesson to explain one choice. Point to a clue, then connect that clue to a scientific idea.

Curriculum reference: https://www.nextgenscience.org/dci-arrangement/2-ps1-matter-and-its-interactions

Talk through the evidence

1. What is a criterion here?

Expected answer: Hold the stated load

Reasoning: Our model bridge must hold a stated load using two sheets. Design A fails; a folded Design B holds the load with the same material. B better meets the supplied criteria and constraint.

2. What is the material constraint?

Expected answer: Two sheets

Reasoning: Our model bridge must hold a stated load using two sheets. Design A fails; a folded Design B holds the load with the same material. B better meets the supplied criteria and constraint.

3. Which design meets the test better?

Expected answer: Folded Design B

Reasoning: Our model bridge must hold a stated load using two sheets. Design A fails; a folded Design B holds the load with the same material. B better meets the supplied criteria and constraint.

4. What supports the improvement claim?

Expected answer: A comparable load test

Reasoning: Compare prototypes using the same relevant test. Reusing material can reduce new demand when it still meets the design requirements.

Guide the discussion

Ask learners to name the evidence that supports their answer. If an answer differs, revisit the matching key idea on page 2 and invite a revised explanation.

Online rewards: this lesson grants one fixed digital Expedition Discovery. Five saved digital Gemling friends become available only after all six distinct subject lessons are complete, in any order. Digital rewards do not establish physical ownership.