Design Within the Energy Budget

Grade 12 | Engineering | Task cards | 40 minutes

Learning target

Enumerate feasible integer designs and optimize a stated objective under multiple constraints.

Prerequisites and materials

Integer inequalities and systematic enumeration. Provide pages 2-3, pencil, and a calculator if needed. These are paper-based analyses of fictional data; no physical experiment is required.

Teaching sequence

5 min: Introduce the model and vocabulary.

10 min: Partners rehearse the four card tasks.

15 min: Each learner records calculations and reasoning.

7 min: Compare methods and revise one response.

3 min: Explain one assumption or limitation.

Assessment and access

12 points: 3 per response. Keep calculations, units, and reasoning visible. Allow oral rehearsal, annotate variables, and supply a calculator or worked example with different values during practice. For assessment, clarify directions without giving answers.

Extension

Express cost as 12 + 2l and yield as 8 + 2l; use these to justify the enumeration result.

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PREVIEW - first two pages only. Full package includes responses and answer key.



Lesson reference

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Select fictional solar-module packages for a display model. Each small package costs 3 credits and yields 2 model energy units; each large package costs 5 credits and yields 4 units. Select exactly four packages with a budget of at most 18 credits. These numbers are classroom assumptions, not real product performance.

Vocabulary	Meaning
feasible	Meeting every stated constraint.
objective	The quantity to maximize or minimize.
tradeoff	An improvement in one feature that costs something in another.

Reference data

Variable	Meaning / rule
s	Number of small packages; nonnegative integer
l	Number of large packages; nonnegative integer
Count	s + l = 4
Cost / yield	3s + 5l <= 18; E = 2s + 4l

Rules and assumptions

Enumerate l = 0, 1, 2, 3, 4 and use s = 4 - l. Choose the feasible design with the greatest E; fractional package counts are not allowed.



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