

Slope Solution Showdown

Use criteria, constraints, and evidence to compare designs.

MS-ETS1-2 "Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem."

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each criterion, circle each constraint, and number the team's comparison steps in the order they occur. These marks show how evidence led to a design choice.

Holding the Garden Slope

- ① After a storm, students at Riverbend Middle School noticed that rainwater washed soil from a bare slope beside the garden. The engineering team needed a way to slow runoff and keep soil in place. Their criteria were to reduce erosion, allow water to reach plants, and be safe to walk near. Constraints mattered too: the project could cost no more than \$180, use materials available locally, and be installed by students and one adult during a Saturday workday.
- ② They compared two designs. Design A used a thick layer of wood chips held by short logs across the slope. Design B used native grass plugs in rows with small rocks around each plant. Before choosing, the team made a decision chart. They listed each criterion and constraint, then gave every design a score from 1, poor, to 4, strong, for erosion control, water flow, safety, cost, materials, and installation time. They also wrote evidence beside each score.
- ③ Tests showed that wood chips slowed water quickly, but a heavy rain could move some chips downhill. The chip design earned strong scores for erosion control and fast installation, yet its \$195 price broke the budget constraint. Grass roots would hold soil more strongly over time, and spaces between plugs let water soak in. Design B cost \$160, used plants from a local nursery, and could be planted in one day. Although it controlled erosion less at first, it met every constraint and had the higher total score. The team chose Design B.

2 ANSWER WITH EVIDENCE Use the passage

1 Name two criteria and two constraints the team used for the slope project.

2 What did the team write beside each score on its decision chart? Why is that useful when comparing designs?

3 What was one strength and one weakness of Design A, the wood-chip design? Include evidence from the passage.

4 Why did the team choose Design B even though it controlled erosion less at first?

3 YOUR TURN Your own words

A coach needs a way to move at least 40 soccer balls from storage to a field. Propose two designs, list three criteria and two constraints, then give each design 1 to 4 scores with evidence. Choose one design and explain your choice in 2 or 3 sentences.

PART 1 • READ AND MARK

Underline each criterion, circle each constraint, and number the team's comparison steps in the order they occur. These marks show how evidence led to a design choice. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	Name two criteria and two constraints the team used for the slope project.	Criteria included reducing erosion, allowing water to reach plants, and being safe nearby. Constraints included a cost of no more than \$180, local materials, and installation by students and one adult in one Saturday workday.
2	What did the team write beside each score on its decision chart? Why is that useful when comparing designs?	They wrote evidence beside each score. Evidence gives a reason for each rating, so the comparison is based on the same information for both designs.
3	What was one strength and one weakness of Design A, the wood-chip design? Include evidence from the passage.	A strength was that it slowed water quickly and was fast to install. A weakness was that it cost \$195, which exceeded the \$180 budget, and heavy rain could move some chips downhill.
4	Why did the team choose Design B even though it controlled erosion less at first?	Design B met every constraint, including the \$160 budget, local materials, and one-day installation. It also had the higher total score and would hold soil more strongly over time.

PART 3 • YOUR TURN (SAMPLE ANSWER)

Criteria: carry at least 40 balls, roll safely over grass, and fit through a 32-inch door. Constraints: cost no more than \$120 and use no electricity. Design A, a folding wagon: capacity 4, safety 3, door fit 4; it carries 50 balls, has a brake, folds to 24 inches wide, and costs \$95. Design B, a motorized cart: capacity 4, safety 3, door fit 3; it carries 50 balls and is 30 inches wide, but costs \$240 and needs charging. I choose Design A because it meets both constraints and has a total score of 11. Design B has a total score of 10, but it breaks the cost and no-electricity constraints.

Accept equivalent criteria, constraints, scores, and evidence when they are logical for the proposed designs. For the open task, look for a consistent comparison process, evidence for ratings, and a choice that considers both criteria and constraints.