Waste Puzzle Plan

Use evidence to break a large design challenge into testable parts.

HS-ETS1-2 "Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the overall design problem, circle each smaller engineering problem, and number the evidence or constraint that explains why each part matters.

Redesigning Cafeteria Waste

1. At Riverview High, the cafeteria sends about 90 kilograms of uneaten food and packaging to the trash each school day. A student engineering team wants to reduce this waste without making lunch slower, less safe, or too expensive. They begin by defining the larger problem: lower cafeteria waste while meeting students' needs and school rules. The team does not assume that one new trash bin will solve everything. Waste comes from several sources, including unopened packaged items, oversized portions, spoiled ingredients, and containers that are hard to sort. Each source may need a different approach.

2. First, the team gathers evidence for one week. They weigh food scraps, count unopened items, and observe where students place waste. Their data show that many unopened milk cartons are discarded because some students leave before drinking them. Sorting errors occur because compost and landfill labels look similar from a distance. The team separates the big challenge into smaller engineering problems: how to offer milk only to students who want it, how to make sorting labels easier to notice, how to prevent ingredient spoilage, and how to choose portions that students will finish. For each smaller problem, they list criteria, constraints, and information still needed.

3. Next, the team generates possible solutions for each part. For milk waste, they consider a choice station, smaller milk deliveries, and a reminder on the lunch menu. A choice station could reduce unwanted cartons, but it must not create a long line or make it hard for students to get a drink. For label confusion, they sketch large color-and-picture signs and plan to test them with students who have not seen the signs before. The team can compare results, then combine compatible solutions into one cafeteria plan. Breaking down the problem helps them test causes and trade-offs before changing the whole system.

2 ANSWER WITH EVIDENCE

Use the passage

1. What is the team's overall design problem? Name two constraints the solution must meet.

2. What evidence led the team to create a smaller problem about milk waste? What evidence led to a smaller problem about sorting labels?

3. List the four smaller engineering problems the team identifies.

4. For the label-confusion problem, what solution does the team sketch, and how will the team test it?

3 YOUR TURN

Your own words

Choose a complex problem at your school or in your community, different from cafeteria waste. Write one overall design problem, four smaller engineering problems, one criterion and one constraint for each smaller problem, and one test for a proposed solution.

ANSWER KEY

Waste Puzzle Plan

HIGH SCHOOL · HS-ETS1-2

PART 1 · READ AND MARK

Underline the overall design problem, circle each smaller engineering problem, and number the evidence or constraint that explains why each part matters. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What is the team's overall design problem? Name two constraints the solution must meet.	**The team must reduce cafeteria waste while meeting students' needs and school rules. Two constraints are that lunch cannot become slower, less safe, or too expensive.**
2	What evidence led the team to create a smaller problem about milk waste? What evidence led to a smaller problem about sorting labels?	**Many unopened milk cartons were discarded because students left before drinking them. Sorting errors occurred because compost and landfill labels looked similar from a distance.**
3	List the four smaller engineering problems the team identifies.	**Offer milk only to students who want it; make sorting labels easier to notice; prevent ingredient spoilage; choose portions that students will finish.**
4	For the label-confusion problem, what solution does the team sketch, and how will the team test it?	**The team sketches large color-and-picture signs. They will test the signs with students who have not seen them before and compare results.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Overall problem: Reduce disposable water-bottle waste at Northside High while keeping drinking water easy to get. 1. Find why students buy bottles. Criterion: survey at least 100 students. Constraint: protect student privacy. 2. Improve access to refill stations. Criterion: a student can fill a bottle in under 30 seconds. Constraint: stay within the plumbing budget. 3. Reduce lines at busy stations. Criterion: fewer than five students wait at lunch. Constraint: hall space must stay clear. 4. Help students remember reusable bottles. Criterion: more students carry one after a month. Constraint: messages cannot interrupt classes. Test: Place a refill-station map near the cafeteria for two weeks and compare bottle purchases and wait times before and during the test.

Accept equivalent statements that accurately connect the passage evidence to the smaller engineering problems. For Part 3, accept varied problems and solutions if the response includes a clear overall problem, four manageable parts, a criterion and constraint for each part, and a realistic test.