Designing the Drip

Trace how a model produces data for design decisions.

MS-ETS1-4 "Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved."

NAME ______________________________ DATE ______________

1 READ AND MARK

Read it twice

YOUR JOB Underline each part that tells what the team tested or changed. Circle each number that is data or a design goal, then number the tests 1 and 2 to show how evidence guided the next design.

A Garden Watering Model

1 At a school garden, a team wanted a simple system that would keep young plants watered during a three-day weekend. Their proposed design used a raised bottle with a tiny hole in its cap. Water would drip through a tube into the soil. Before building several systems, the team made a model. The model included a drawing of the parts and a table for predicting and recording how much water reached the soil each day. It let them test ideas safely and quickly.

2 For the first test, the model predicted that a 1-millimeter hole would deliver 300 milliliters per day. The team filled the bottle, placed it above a container, and measured the collected water after one day. The result was 450 milliliters, too much for the seedlings and outside their goal of 250 to 350 milliliters. This data showed that the hole size affected the flow. The team changed only the hole size to 0.7 millimeter for the next model test, so they could connect a new result to one clear change.

3 On the second test, the 0.7-millimeter hole delivered 330 milliliters. That result met the water goal, but the team also checked a constraint: after three days, at least 100 milliliters had to remain in the bottle. A model calculation using its 1,000-milliliter starting amount showed that 330 milliliters per day would leave only 10 milliliters after three days. The team planned another test with a larger bottle while keeping the successful hole size. Repeating tests, using data, and changing one feature at a time helped the team move toward an optimal system.

2 ANSWER WITH EVIDENCE

Use the passage

1. What two things did the team's model include, and what information could it help the team collect?

2. How did the first test result compare with the team's daily water goal?

3. Why did the team change only the hole size before the second test?

4. What did the second test and three-day calculation cause the team to plan next?

3 YOUR TURN

Your own words

Plan a model test for a lunchbox that must keep an apple at 10°C or colder for 4 hours, using an ice pack no heavier than 200 grams. Name the feature you will change, show predicted or measured results from two tests in a small table, and state which design you would choose or change next.

Designing the Drip

PART 1 · READ AND MARK

Underline each part that tells what the team tested or changed. Circle each number that is data or a design goal, then number the tests 1 and 2 to show how evidence guided the next design. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What two things did the team's model include, and what information could it help the team collect?	**It included a drawing of the parts and a table. The table helped predict and record how much water reached the soil each day.**
2	How did the first test result compare with the team's daily water goal?	**The first test delivered 450 milliliters, which was above the goal range of 250 to 350 milliliters per day.**
3	Why did the team change only the hole size before the second test?	**Changing one feature at a time let the team connect the new result to the hole size.**
4	What did the second test and three-day calculation cause the team to plan next?	**The 0.7-millimeter hole met the daily water goal, but only 10 milliliters would remain after three days. The team planned to test a larger bottle while keeping the 0.7-millimeter hole.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Model: a small cardboard lunchbox lined with foam. Feature changed: foam thickness. Test | Foam thickness | Temperature after 4 hours | Ice pack mass 1 | 5 mm | 12°C | 180 g 2 | 10 mm | 8°C | 180 g I would choose test 2 because it keeps the apple at or below 10°C and stays under the 200-gram ice-pack limit.

Accept any reasonable model, one changed feature, and two data results that can be compared to the temperature criterion and ice-pack constraint. The student's conclusion should use the data to justify a choice or a next modification.