Sunlight to Warmth

Read how a design changes energy and improves after a test.

P.4.6A.6 "Design a device that converts any form of energy from one form to another form (e.g., construct a musical instrument that will convert vibrations to sound by controlling varying pitches..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the energy change, circle two parts that help it happen, and number Nia's goal, plan, build, first test, and change from 1 to 5. Your marks will help you trace how she designed and improved her device.

Nia's Solar Warming Box

1. On a sunny morning, Nia wanted to warm a small cup of water without a plug. She set a goal: raise its temperature by at least 5°C in 20 minutes. She planned a solar warming box that would change energy from sunlight into heat. Her sketch showed a cardboard box lined with black paper, a clear plastic cover, and a foil-covered flap.

2. Nia built the box and set the cup on the black paper. The paper absorbed sunlight and got warmer. Heat moved from the paper and warm air to the water. The clear cover slowed the escape of warm air, while the foil flap reflected extra sunlight into the box. Nia checked the water with a thermometer before and after 20 minutes in the sun.

3. The water began at 20°C and reached 23°C, a rise of only 3°C. Nia had not met her goal. She noticed that the flap pointed away from the sun. She adjusted the flap to direct more sunlight onto the black paper. For a fair second test, she used the same amount of water at 20°C and waited 20 minutes in the same sunny spot. The water reached 27°C.

2 ANSWER WITH EVIDENCE

Use the passage

1. What did Nia want her device to do, and what energy change did she plan to use?

2. How did the black paper and foil flap help warm the water?

3. How did the first test show Nia needed to improve her box, and what did she change?

4. What did Nia keep the same for her second test, and did the improved box meet her goal?

3 YOUR TURN

Your own words

Design a device that changes energy from your moving hand into sound to signal a partner. In five or six sentences, state its job, name its parts and how you would build it, explain the energy change, tell how you would test it, and describe an improvement if the signal is too quiet.

ANSWER KEY

Sunlight to Warmth

GRADE 4 · P.4.6A.6

PART 1 · READ AND MARK

Underline the energy change, circle two parts that help it happen, and number Nia's goal, plan, build, first test, and change from 1 to 5. Your marks will help you trace how she designed and improved her device. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What did Nia want her device to do, and what energy change did she plan to use?	**She wanted to raise the water's temperature by at least 5°C in 20 minutes by changing energy from sunlight into heat.**
2	How did the black paper and foil flap help warm the water?	**The black paper absorbed sunlight and got warmer. The foil flap reflected extra sunlight into the box.**
3	How did the first test show Nia needed to improve her box, and what did she change?	**The water warmed by only 3°C, less than her 5°C goal. She adjusted the flap to aim more sunlight onto the black paper.**
4	What did Nia keep the same for her second test, and did the improved box meet her goal?	**She kept the amount and starting temperature of the water, the test time, and the sunny spot the same. The water warmed from 20°C to 27°C, so the box met her 5°C goal.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would make a clicker that tells my partner when to start a game. I would tape two bottle caps to the ends of a folded strip of cardboard. Pressing the strip would move the caps together, changing energy from my moving hand into sound when they strike. I would test whether my partner could hear three clicks from across the room. If the clicks were too quiet, I would try larger metal lids and test again.

For Part 3, accept other buildable designs if the response explains how hand motion produces sound and includes a test and a specific possible improvement. For the marking job, accept any two device parts that the passage explains.