Worm Bin Challenge

Design, test, and improve a system that meets a human need

ZOO.4.8 "Enrichment: Use an engineering design process to design and construct a system to utilize flatworms, roundworms, or annelids to meet a human need.*"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the human need and the two success targets. Circle features of the worm bins, then number the test result and the planned redesign.

A Greenhouse Worm Bin

1. At a school greenhouse, lunch vegetable scraps fill a trash can each day. Students want to build a worm bin that turns some scraps into compost for seedlings. They choose red wigglers, annelids that thrive in decaying plant material near the surface, rather than parasitic worms. Their goal is to handle 600 grams of chopped vegetable scraps each week. A successful bin will have no more than 150 grams of visible uneaten scraps after seven days and no sour odor. The greenhouse has little floor space, so each bin must fit on one shelf.

2. To make a prototype, the students use two identical lidded tubs with small air holes, drainage holes, and trays to catch excess water. They add the same mass of red wigglers and dry shredded paper to each tub, then add 600 grams of chopped vegetable scraps. They leave out meat and oily foods, which can attract pests or cause odors. They change only the starting moisture of the bedding: tub A feels like a lightly squeezed sponge, while tub B feels wetter. Both stay on the same greenhouse shelf, out of direct sun. The students check both tubs daily without adding more scraps.

3. After seven days, the students separate and weigh the visible uneaten scraps. Tub A has 290 grams left and no sour smell. Tub B has 100 grams left, but its bedding is soggy and smells sour. Neither tub meets both success targets: A leaves too much food, while B develops an odor. The students stop feeding B until they replace its soggy bedding and improve drainage. For the next test, they plan to try a moisture level between A and B, while keeping the worm mass, food amount, tub size, and test length the same. Microbes also break down scraps, so lost mass is not all food eaten by worms.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do two features of the prototype help the students meet a need or limit described in the passage?

2. Why do the students keep the worms, food, tubs, and shelf location alike in their first test?

3. Does either tub meet both success targets? Use the results to explain.

4. How could the students test whether a middle moisture level works better? Name one condition they should keep the same.

3 YOUR TURN

Your own words

An apartment building needs to keep vegetable scraps out of its trash, but it has no outdoor space. In four to six sentences, design an indoor annelid system, name two design constraints, set a measurable success target, and describe a fair test and one change you would try if it fails.

ANSWER KEY

Worm Bin Challenge

PART 1 · READ AND MARK

Underline the human need and the two success targets. Circle features of the worm bins, then number the test result and the planned redesign. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do two features of the prototype help the students meet a need or limit described in the passage?	**The tubs fit on a shelf where floor space is limited. Air holes provide ventilation, which helps limit odors.**
2	Why do the students keep the worms, food, tubs, and shelf location alike in their first test?	**Keeping those conditions alike helps them judge whether starting bedding moisture caused a difference in the results.**
3	Does either tub meet both success targets? Use the results to explain.	**No. A has no sour odor but leaves 290 grams of scraps, more than the 150-gram limit. B leaves only 100 grams but smells sour.**
4	How could the students test whether a middle moisture level works better? Name one condition they should keep the same.	**Start a new tub with bedding wetter than A's but less wet than B's, then check its scraps and odor after seven days. Keep the food amount at 600 grams.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would put red wigglers in a lidded, ventilated tub with moist shredded paper to process the apartment's vegetable scraps. The tub must fit in a storage closet and must not smell sour. My target is no more than 100 grams of visible uneaten scraps seven days after adding 400 grams, with no sour odor. I would test two identical tubs with the same worms and food, changing only the bedding moisture. If the wetter tub smells sour, I would try less water in its next test.

Accept other bin features when students explain how they address a stated need or limit. For Part 3, accept a different measurable target or fair test if the design uses an annelid, addresses the indoor setting, and includes a specific redesign.