LESSON MAKER PRO

Water Under Pressure

Simulate how population and water affect native species.

HIGH SCHOOL · EN.ESS3.3

EN.ESS3.3 "Use computational simulations to illustrate changes in the relationships between natural resources, human populations, and biodiversity and their sustainability within Earth's systems.*"

NAME _____ DATE _____

UPDATE ONE YEAR AT A TIME

In this simplified yearly model, P is population in hundreds, R is stored water units, and B is the number of native species. Find new water first: new R = R + 10 - 2P. If new R is at least 20, add 1 to P and B; otherwise subtract 1 from P and 2 from B. Use the new values to run the next year.

WORKED EXAMPLE

Run the model for one year. Find the new P, R, and B.

STARTING VALUES

P	R	B
4	27	7

1. New R = 27 + 10 - 2(4) = 29.
2. 29 is at least 20, so new P = 4 + 1 = 5.
3. New B = 7 + 1 = 8.

Answer: P = 5, R = 29, B = 8

PRACTICE 4 problems

1 Start with P = 6 and R = 24. Find R after one year.

ANSWER _____

2 Start with P = 7, R = 23, and B = 12. Find P and B after one year.

ANSWER _____

_____

3 Start with P = 5 and R = 25. Find R after two years.

ANSWER _____

4 Start with P = 8, R = 31, and B = 16. Find P, R, and B after two years.

ANSWER _____

_____

APPLY IT Show your work

1 A town uses the model to compare two housing plans near a lake. Run each plan for two years. Which plan ends with more native species, and how many more?

STARTING VALUES FOR HOUSING PLANS

Plan	P	R	B
Fewer homes	5	24	18
More homes	7	24	18

ANSWER _____

2 A school nature club models its local creek, starting with P = 6, R = 29, and B = 15. After two years, how many native species remain? Does water stay at or above 20 in both years?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A city starts with P = 9, R = 33, and B = 13. It could raise yearly water refill from 10 to 14, changing only the 10 in the water rule. Simulate two years with each refill. Which refill keeps R at or above 20 in both years? Give year 2 R and B for each.

WORK SPACE AND ANSWER

ANSWER KEY

Water Under Pressure

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Start with P = 6 and R = 24. Find R after one year.	**R = 22**
2	Start with P = 7, R = 23, and B = 12. Find P and B after one year.	**P = 6, B = 10**
3	Start with P = 5 and R = 25. Find R after two years.	**R = 23**
4	Start with P = 8, R = 31, and B = 16. Find P, R, and B after two years.	**P = 8, R = 17, B = 15**

PART 2 · APPLY IT

1. **Fewer homes, by 3 species (20 versus 17).** Fewer homes ends with R = 22 and B = 20. More homes ends with R = 14 and B = 17.
2. **17 species; yes.** Year 1 gives R = 27, P = 7, and B = 16. Year 2 gives R = 23 and B = 17, so water meets the threshold both years.

CHALLENGE

Refill of 14 keeps R at or above 20 in both years. With refill of 10, year 2 R = 15 and B = 12. With refill of 14, year 2 R = 23 and B = 15.

For two-year simulations, accept work that uses each year's updated P and R in the next year. The model is simplified; answers should follow its stated rules.