

Models Under Pressure

Compare what scientific models can show and what they can miss.

8.2.A "identify advantages and limitations of models such as their size, scale, properties, and materials;"

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each statement that tells an advantage of a model. Circle each statement that tells a limitation, then number the model features involved: size or scale, properties or materials, and data or rules.

Testing a Riverbank Plan

- ① Engineers planning a riverbank project often build models before changing the real river. One team made a tabletop floodplain from sand, clay, and clear plastic. Its channels, houses, and levee were built at one one-hundredth of the real size. Water released from a tank showed where water could flow when the levee was low. Because the model was small, the team could move a levee quickly and repeat a test without disturbing an actual neighborhood. The setup fit on a lab table.
- ② The tabletop model had useful limits. Sand could erode, so it represented one way loose soil may wash away. Clay stayed together more than sand, but real riverbanks contain mixtures of soil, rock, roots, and buried pipes. Plastic houses did not absorb water or break apart like some real buildings might. Also, water does not move through a model at exactly the same rate as it moves through a large river, so the team could not use the model alone to predict an exact flood depth.
- ③ Next, the team used a computer model with measurements of rainfall, land height, and river flow. The computer model could test a storm larger than the tabletop tank could hold and compare many possible levee locations. However, its results depended on the data and rules entered by people. Missing rainfall records or an incorrect soil value could produce misleading results. By comparing both models with observations from past floods, the team gained stronger evidence. Each model was useful because it simplified the river in a different way, not because it copied every property perfectly.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 What advantage did the tabletop model's small size give the engineers?

2 Name one limitation caused by the materials in the tabletop model. Explain why it is a limitation.

3 What could the computer model test that the tabletop model could not? What limitation did the computer model have?

4 Why did comparing both models with observations from past floods give the team stronger evidence?

3 YOUR TURN _____ Your own words

Choose a real-world problem that could be investigated with a model, such as reducing runoff in a school garden. In 4 or 5 sentences, describe the model, state one advantage, and explain two limitations connected to its size, scale, properties, materials, or data.

PART 1 • READ AND MARK

Underline each statement that tells an advantage of a model. Circle each statement that tells a limitation, then number the model features involved: size or scale, properties or materials, and data or rules. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	What advantage did the tabletop model's small size give the engineers?	Its small size let the team move the levee quickly and repeat tests without disturbing a real neighborhood.
2	Name one limitation caused by the materials in the tabletop model. Explain why it is a limitation.	Plastic houses did not absorb water or break apart like some real buildings might. Therefore, they did not represent all real building properties during a flood.
3	What could the computer model test that the tabletop model could not? What limitation did the computer model have?	It could test a storm larger than the tabletop tank could hold and compare many levee locations. Its results could be misleading if the entered data or rules were missing or incorrect.
4	Why did comparing both models with observations from past floods give the team stronger evidence?	The models simplified the river in different ways, and past-flood observations could help check whether their results matched real conditions.

PART 3 • YOUR TURN (SAMPLE ANSWER)

To investigate runoff in a school garden, I would build a tray model with soil, small plants, and a spray bottle. Its small size would let me test different plant arrangements quickly without changing the real garden. The tray would not include the full scale of a real storm or the school's sloping ground. Its soil and plastic plants would not have all the properties of real soil, roots, and drainage pipes.

Accept any realistic model that clearly connects one advantage and two limitations to specific model features. Limitations may involve size, scale, materials, physical properties, data, or simplified rules.