

Test, Predict, Improve

Use evidence, variables, and design ideas to investigate physical science.

PS.1.a “asking questions and defining problems ask questions that require empirical evidence to answer develop hypotheses indicating relationships between independent and dependent variables offer simple solutions to design problems”

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline the empirical question. Circle each independent variable, draw a double circle around each dependent variable, number the hypothesis 1, and box the proposed design solution.

A Ramp Investigation

- ① During a class investigation, Elena noticed that a steel marble sometimes rolled farther after leaving a ramp. She turned her observation into an empirical question: How does the height of the ramp affect the distance the marble rolls across the floor? This question can be answered by measuring distances, not by opinions. Elena chose three ramp heights, used the same marble and floor each time, and planned several trials at each height. She would record the distance from the ramp's end to the marble's stopping point.
- ② Elena's independent variable was ramp height because she changed it on purpose. Her dependent variable was rolling distance because she measured its response. She wrote this hypothesis: If ramp height increases, then the marble's rolling distance will increase. The words “if” and “then” make a predicted relationship clear. To make the test fair, Elena kept the marble, release point, floor surface, and method for measuring distance the same. She repeated every height three times and compared the average distances.
- ③ After testing, the class found a problem with a toy-car launch track. Cars often flew off at the sharp turn near the end. Their design goal was to keep the car on the track without using a motor or changing the car. Elena proposed a simple solution: add a low cardboard sidewall along the outside of the turn. The sidewall could guide a moving car back toward the track. The class could test this solution by counting how many of ten launches stayed on the track before and after adding the sidewall.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 Write Elena's empirical question.

2 What are the independent variable and dependent variable in Elena's investigation? Explain why each has that role.

3 Write Elena's hypothesis. What relationship does it predict?

4 What simple solution did Elena propose for the launch track, and what evidence would show that it works?

3 YOUR TURN _____ Your own words

Choose a physical-science test or design problem of your own. Write one empirical question, name an independent and dependent variable, write an if-then hypothesis, and propose one simple solution to a related design problem.

PART 1 • READ AND MARK

Underline the empirical question. Circle each independent variable, draw a double circle around each dependent variable, number the hypothesis 1, and box the proposed design solution. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	Write Elena's empirical question.	How does the height of the ramp affect the distance the marble rolls across the floor?
2	What are the independent variable and dependent variable in Elena's investigation? Explain why each has that role.	The independent variable is ramp height because Elena changes it. The dependent variable is rolling distance because she measures it.
3	Write Elena's hypothesis. What relationship does it predict?	If ramp height increases, then the marble's rolling distance will increase. It predicts that greater ramp height will lead to greater rolling distance.
4	What simple solution did Elena propose for the launch track, and what evidence would show that it works?	She proposed adding a low cardboard sidewall along the outside of the turn. The solution works if more of ten launches stay on the track after the sidewall is added.

PART 3 • YOUR TURN (SAMPLE ANSWER)

How does the length of a paper helicopter's blades affect the time it takes to fall 2 meters? The independent variable is blade length, and the dependent variable is fall time. If blade length increases, then fall time will increase. To keep the helicopter from drifting into a nearby wall, place a tall cardboard shield beside the drop area.

Accept empirical questions that can be answered with measurements or observations, correctly identified changed and measured variables, and hypotheses that predict a relationship. Accept feasible simple solutions that address the student's stated design problem.