

Station #4: Experimental Setup

1. Emily found a helium-filled balloon floating a few feet above the floor with its string dragging on the floor. She then did the following.

- I. She lifted the string of the balloon gently off the floor and noticed that the balloon started to rise.
- II. She said, "I think the balloon cannot lift the whole length of string. If I cut the string shorter, the balloon should rise."
- III. She cut the string very short.
- IV. Seeing that the balloon then rose, she said, "I think I was right."

At which point did Emily formulate a hypothesis?

- A. I
 - B. II
 - C. III
 - D. IV
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2. Emily now decides to setup an experiment to officially test her hypothesis. She begins by having an experimental group of 10 balloons with just enough helium so that their strings drag the floor. Her control group uses 10 balloons fully filled with helium resting against the ceiling with strings hanging down. She then cuts the strings of the balloons in the experimental group. Her science teacher looks at her plan and suggests she has made a mistake. What is her mistake?
 - A. She is using too many balloons in each group.
 - B. The balloons in the experimental group are only partially filled with helium.
 - C. The balloons in the control group have full strings.
 - D. The balloons in the control group are fully filled with helium.

Impact craters are formed when meteorites strike the surface of a planet. A researcher investigated some factors that might influence the formation of impact craters by either dropping marbles into a tray of sand or launching them from a slingshot into the sand. The results are shown in the table below.

Test Number	Mass of Marble (g)	Method of Crater Formation	Marble Speed (cm/s)	Crater Diameter (cm)
1	3	Drop from 2 m	626	5.0
2	6	Drop from 2 m	626	7.0
3	6	Drop from 10 cm	140	1.8
4	6	Drop from 2 m	626	6.5
5	6	Launch from 36 cm	3,000	11.0

3. Tests 1 and 2 were designed to test the effects of which of the following factors?
- The mass of the marble
 - The speed of the marble
 - The crater diameter
 - The method of crater formation
4. Which of the following statements best explains why the speed of the marble in test 5 is so much greater than the speed of the marbles in tests 3 and 4?
- It was dropped from the greatest height.
 - It was launched rather than dropped.
 - It produced the largest crater.
 - It was made of a different material.
5. The observed difference in the crater diameters in tests 3 and 4 is most likely due to which of the following factors?
- The mass of the marbles
 - The researcher's measuring technique
 - Whether the marble was dropped or launched
 - The height from which the marbles were dropped

6. Consider the results for tests 3, 4, and 5. Which of the following graphs best illustrates the relationship between marble speed and crater diameter?

