

Scientific Method - Controls and Variables

ANSWER KEY

Write a definition for each:

Control - A part of the experiment that is not being tested and is used for comparison.

Variable - Any part of an experiment that can vary.

Independent Variable - The part of the experiment that is manipulated or changed by the scientists or person performing the experiment.

Dependent Variable - The part of the experiment that is affected by the independent variable.

measure + observed
SpongeBob and his Bikini Bottom pals have been busy doing a little research. Read the description for each experiment and answer the questions.

Krusty Krab Breath Mints

1. Which people are in the control group? The people who received the mint without the secret ingredient (Group B) would be the control group.
2. What is the independent variable? Secret ingredient in the breath mint
3. What is the dependent variable? Amount of breath odor (or bad breath)
4. What should Mr. Krabs' conclusion be? The breath mint with the secret ingredient appears to reduce the amount of breath odor more than half the time, but it is not 100% effective.
5. Why do you think 10 people in group B reported fresher breath? This may be due to the placebo effect.

Sponge Bob Clean Pants

6. What was the problem? SpongeBob's pants were not clean.
7. What is the independent variable? Laundry soap
8. What is the dependent variable? Amount of dirt left on the pants (or how clean the pants were)
9. What should Sponge Bob's conclusion be? Clean-O laundry soap does not appear to be effective in cleaning his pants.

Squidward's Symphony

10. What is the independent variable? Instrument
11. What is the dependent variable? Number of jellyfish
12. What should Squidward's conclusion be? The clarinet did seem to attract a large number of jellyfish, but the average number for the three trials also matched the average for the guitar. The flute attracted the least number of jellyfish, but the average for this category is still larger than the control. Music seems to attract jellyfish in greater numbers than when no music is played. Squidward's hypothesis that the clarinet attracts larger numbers of jellyfish than other instruments is not proven by this experiment alone.
13. Are the results reliable? Based on the limited amount of information provided, it is difficult to tell if Squidward's results are reliable. The description did not tell how long each break was between trials. Did he leave enough time for the jellyfish to "clear out" of the area? (NOTE: Accept other potential flaws that students can support.)

Super Bubbles

14. What did the Super Bubble ads claim? The ads claimed that the Super Bubble solution would produce bubbles that were twice as large as those made with regular bubble soap.
15. What is the independent variable? Type of bubble solution
16. What is the dependent variable? Size (diameter) of the bubble
17. a. Calculate the average diameter for each. Super Bubble = 15.1 cm Regular Soap = 11.5 cm
b. What should their conclusion be? The Super Bubble solution did not seem to produce bubbles that were twice as large as those made with the regular soap. Although the average for the Super Bubble solution was larger than that for the regular soap, it was not "twice as large" as the ads claimed. In fact, only two of the ten trials had results that would fit the ads claims.
18. Are the results reliable? Why or why not? The description does not say who blew the bubbles for each solution. There may be differences in bubble sizes due to the person blowing the bubble rather than the bubble solution. They might have considered having each person blow 5 bubbles with each solution. (NOTE: Accept other potential flaws that students can support.)

Scientific Method

Answer Key

Bikini Bottom Experiments

The Bikini Bottom gang loves science class and wanted to do a little research. Read the description for each experiment and use your knowledge of the scientific method to answer the questions.

Flower Power

SpongeBob loves to garden and wants to grow lots of pink flowers for his pal Sandy. He bought a special Flower Power fertilizer to see if will help plants produce more flowers. He plants two plants of the same size in separate containers with the same amount of potting soil. He places one plant in a sunny window and waters it every day with fertilized water. He places the other plant on a shelf in a closet and waters it with plain water every other day.

(1) What did SpongeBob do wrong in this experiment? Explain.

SpongeBob did not provide both plants with the same amount of water and sunshine. In order to test the fertilizer correctly, both plants should have been placed in the sunny window and watered every day with the same amount of water. The only difference between the two plants should have been the fertilizer - one plant would be watered with the water with fertilizer and the other would be watered with plain water.

(2) What should SpongeBob do to test the effectiveness of Flower Power fertilizer? Write an experiment.

Answers will vary. Experiments should address the problems in SpongeBob's experiment.

Super Snails

Gary is not the smartest snail in Bikini Bottom and believes he can improve his brain power by eating Super Snail Snacks. In order to test his hypothesis, he recruits SpongeBob and several snail friends to help him with the experiment. The snails ate one snack with each meal every day for three weeks. SpongeBob created a test and gave it to the snails before they started eating the snacks as well as after three weeks. Analyze the data in the chart and determine whether or not the Super Snail Snacks created smarter snails!

(3) Based on the data provided, do the Super Snail Snacks work? Explain your answer.

The Super Snail Snacks appear to have worked for Gary and Barry. Both of them increased their test results after eating the snacks for three weeks. Larry did not show any improvement and Terry scored lower on his second test. However, it is difficult to determine if the Super Snail Snacks are an effective way to increase a snail's brain power based on this experiment alone. The gains shown by Gary and Barry may have been due to the Super Snail Snacks, but further testing would be needed to make sure the results were not due to other factors.

Test Results

Snail	Before	After
Gary	64%	80%
Larry	78%	78%
Barry	82%	84%
Terry	72%	70%

Bubble Time

Patrick loves bubble gum and would like to be able to blow bigger bubbles than anyone else in Bikini Bottom. To prepare for the Bikini Bottom Big Bubble Contest, he bought five different brands of bubble gum and needs your help to find the brand that creates the biggest bubbles. Write an experiment to test the bubble power of the bubble gum brands and help Patrick win the contest.

Answers will vary. Students should make sure to perform the same test with each brand in order to obtain reliable results. Repeated trials would generate more data to analyze and help Patrick pick the best bubble gum brand for the bubble blowing contest.

Extension Idea: Provide an opportunity for the students to try their bubble gum tests!