The scientific method is a procedure by which experiments are performed. It includes the following steps:

1. Observation – you notice something that causes you to ask a question
   1. Qualitative (observable) vs. Quantitative (measurable)
2. Hypothesis – you think of a possible explanation for the observation
3. Experiment – you perform an experiment or test to find out if your explanation is valid
4. Conclusion – you determine, from your results, whether the hypothesis was valid

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Sample Problem: The lawnmower does not work.

* 1. Hypothesis - If I change the gas, then the mower will work.
  2. C:\Users\Caddy\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\AMVS95MX\MC900015238[1].wmfExperiment - I drained the old gas and replaced it with new gas with the correct mixture
  3. Conclusion- The lawnmower did not work properly and thus it was not the gas that was the problem. Must modify hypothesis.
  4. Hypothesis 2 - If I change the spark plus, then the mower will work.
  5. Experiment - I took out the old spark plugs and replaced them with new ones.
  6. Conclusion - The mower still does not work and thus the spark plugs were not the problem. Must modify the hypothesis.
  7. Hypothesis 3 - If I adjust the choke, then the mower will work.
  8. Experiment - I manually adjusted the choke lever on the mower engine.
  9. Conclusion - The mower works. The problem was the choke lever (or possibly a combination of the above problems.

**C:\Users\Caddy\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\AMVS95MX\MC900350434[1].wmf**For each of the problems listed, go through the steps of the scientific method until you are able to find a solution. (state 3 hypothesis for each problem)

**Problem 1:** The fish in your tank are dying

Hypothesis 1: (Remember to use if / then)\_If I change the water, then the fish will live

Experiment: Change the water

Conclusion: The fish are still dying

Hypothesis 2: If I keep the water temperature close to 23°C, then the fish will live

Experiment: Use a heater that controls the temperature in the tank

Conclusion: The fish are still dying

Hypothesis 3: If I feed the fish a little more food, then they will live

Experiment: Fed the fish more food

Conclusion: The fish are no longer dying and the problem was the food (or possibly a combination of the above problems.

Problem 2: The plant is not growing like it should

Hypothesis 1: If I give the plan more sunlight, then it will grow properly

Experiment: Place the plant in a place such that it receives more sunlight

Conclusion: The plant is still not growing as it should \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Hypothesis 2: If I give the plan more water, then it will grow properly

Experiment: Give the plant little more water than before

Conclusion: The plant is still not growing as it should

Hypothesis 3: If I change the soil, then it will grow properly

Experiment: Change the soil of the plant

Conclusion: The plant is now growing as it should

**Variables -** *Factors* that can change the outcome of an experiment

* + **Independent Variable (Experimental Variable)**: the factor that you purposely change.
  + **Dependent Variable**: factor that is being observed.
  + **Controlled Variables**: the factors that are not changed and remain the same throughout experimentation.

After watching the “Ants that Count” video, answer the following questions.

1. What do you think was the one experimental (independent) variable being tested in this video? **Ant leg length ( kept one ant’s legs the same, lengthened and shortened the other two ant’s legs)**
2. What was the dependent variable (what is being affected by the experimental variable) in the video?

**Length of stride (NOT # of steps**)

1. List what you think would be 3 important controlled variables for the “Ants that Count” experiment.
   * **All the insects were ants (same kind)**
   * **Same distance from food to house**
   * **Number of steps (remain at 10)**
2. What was concluded about the ants and counting**? That ants have internal pedometers and will change their stride to reach their destination**

**Read the paragraphs describing an experiment and answer the questions.**

1. Ms. Wagner loves to eat tomatoes. She wants to plant a garden and is trying to figure out how to grow plants with more tomatoes. She plants three different pots of tomato plants and gives the 1st plant no fertilizer, 2nd plant 50 grams of fertilizer and the 3rd 100 grams of fertilizer. She keeps everything else the same (the amount of water, the amount of soil, amount of sun the plants get). For one month, she records how many tomatoes each plant produces.

Independent Variable: **different amount of fertilizer**

Dependant Variable:­ **# of tomatoes each plant produces**

Controlled: **amount of sun, soil and water**

Hypothesis: **If I give tomato plants different amounts of fertilizer, then I will get different # of tomoatoes on each plant.**

1. A dog owner wants to test how exercise affects how his dog sleeps. He was careful to give his dog the same amount of food on the days he did the experiment. His results are in the table.

|  |  |
| --- | --- |
| **Amount of Exercise** | **Amount of Sleep** |
| 2 hours | 4 hours |
| 4 hours | 5 hours |
| 6 hours | 6 hours |

Independent Variable: **Amount of exercise**

Dependant Variable:­ **Amount of sleep**

Controlled: **amount of food**

Hypothesis: **If my dog has more hours of exercise, then the number of hours he sleeps will increase because he used more energy exercising**.

**Watermelon Power -** SpongeBob loves to garden and wants to grow lots of watermelons for his pal Sandy. He bought a special watermelon fertilizer to see if will help plants produce more melons. 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.

**He changed three variables: amount of sunlight, one with fertilized water one without & watering interval different. You can only change one variable in an experiment to ensure its reliability.**

(2) What should SpongeBob do to test the effectiveness of watermelon fertilizer?

**Store the plants in the same location, water every day and the only difference is the type of water given (one fertilized the other without)**

**Crabby Patties**

Mr. Krabbs wants to make Bikini Bottoms a nicer place to live. He has created a new sauce that he thinks will reduce the production of body gas associated with eating crabby patties from the Krusty Krab. He recruits 100 customers with a history of gas problems. He has 50 of them (Group A) eat crabby patties with the new sauce. The other 50 (Group B) eat crabby patties with sauce that looks just

like new sauce but is really just mixture of mayonnaise and food coloring. Both groups were told that they were getting the sauce that would reduce gas production. Two hours after eating the crabby patties, 30 customers in group A reported having fewer gas problems and 8 customers in group B reported having fewer gas problems.

(3) Which people are in the control group? \_\_\_**Group B**

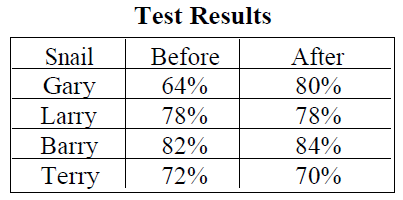
(4) What is the independent variable? \_\_\_\_\_**New Sauce**

(5) What is the dependent variable? \_\_\_\_\_**Amount of Gas**

(6) What should Mr. Krabs’ conclusion be? **The new sauce appears to work as it reduced the amount of gas**

(7) Why do you think 8 people in group B reported feeling better? \_\_\_\_**Placebo effect**

**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 this 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 create smarter snails!

(8) 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.**

**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.

(9) Write brief description of an experiment to test the bubble power of the bubble gum brands and help Patrick win the contest.

**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.**