Tips for Taking and Presenting Your Data

Once you have come up with a question and written down the steps for your experiment, you get to do the experiment. But if you do the experiment and don't write down what happened, you may have an answer to the question for yourself, but you won't have proof for anyone else! For each part of your experiment, it's important to write down

a) what you change
b) what you leave the same
c) what you measure and/or observe happening

In the example from the topic handout, the question was to figure out how the amount of air in a soccer ball affected how far the ball went. To do the experiment, you would need to write down what the air pressure was (independent) and how far the ball went (dependent) every time. For an example of some good ways to record data, check out the "How do I make a table?" section on the next page. You might want to write some sentences of description, too.

In science, it's a good idea to try everything more than once, to see if the same kind of thing happens every time. Repeating your trials makes your final results more likely to be reliable, and it helps make sure things outside your experiment don't affect the results too much. For example, maybe a gust of wind came through just when you were doing your first soccer ball test. But if you do that same test several more times, and use *all* the results, the effect of the wind in that one trial won't be very much.

So if you fill the soccer ball half full, you would want to measure how far at went in at least three trials. Then, to get one final number for how far a soccer ball generally goes when it's half full, you can average the distances for the three trials. For an example of averaging, check out "Tips for Making Sense of Your Data."

Data-Taking Checklist:

- I took detailed notes about my observations during my experiment.
  Remember that these can include both words and numbers!
- I made a table for recording my observations.
- I made all my measurements using the same methods.
  For example, if you want to see how far the soccer ball went, choose whether you will measure to the front of the ball, the middle of the ball, or the back of the ball, and do that every time.

How do I make a table?

In order to keep track of your data and to help you make sense of it later, it's important to record it in an organized way. A table is a great way to do this.

A table has two parts to fill out: the things you know before you start, and the things you find out when you're investigating or experimenting.

In the soccer ball example, for every trial, you will know how much air you put in the ball before you start, and you'll find out how far the ball goes after you send it down the slide. Your chart, which you can set up before you start, might look like this:

Air pressure (in PSI)	Trial 1 distance (in feet)	Trial 2 distance (in feet)	Trial 3 Distance (in feet)
2			
4			
6			
8			

Since you know the air pressure, you can fill that in. Since you know you want to have three trials for each air pressure, it makes sense to put spaces for those trials all in a line with the pressure. So when you pumped the ball up to 2 PSI, the first distance you measured would go in the spot next to the 2. When you repeated the same thing, the distance would go right underneath "Trial 2 distance."

In an example like we did after school, where you're trying to figure out something statistical, your table will probably be a little bit different. A statistical question usually begins something like "How likely is..." or "How many of..." or "What percent of..." An example of a statistical question is "What percent of galaxies have spiral arms?"

You would gather a random sample of galaxies (like the ones from GalaxyZoo), and you would need to do some counting. How many of them have spiral arms? How many do not have spiral arms? An easy way to keep track as you're counting is to make tally marks in each column.

Galaxies that have spiral arms	Galaxies that don't have spiral arms
5	25

Tips for Making Sense of Your Data

Once you have finished your experiments, you get to figure out what your observations mean! It's not enough just to take data and then put it in a table. You have to make sense of it all and turn it into a conclusion—the answer to your question.

Here is an example of results from the soccer ball experiment.

Air pressure (in PSI)	Trial 1 distance (in feet)	Trial 2 distance (in feet)	Trial 3 Distance (in feet)
2	5	6	5
4	6	6.5	6.5
6	7.5	7	6.5
8	9	8	8.5

First, if you did the same thing multiple times, you should take the average of the different trials. To do this, add them all together, and divide by how many of them there are.

For an air pressure of 2 PSI, you would add 5+6+5=16. Then, you would divide 16 by 3, because there were three trials. This is 5.3 feet.

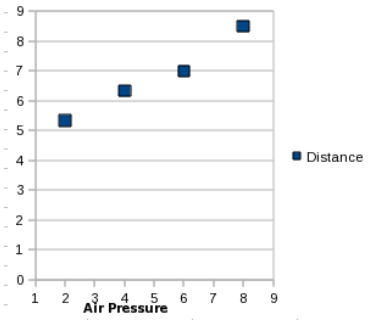
You can make a table with just the averages.

Air pressure (in PSI)	Average distance (in feet)
2	5.3
4	6.3
6	7
8	8.5

If your project involves statistics, you will need to calculate percentages. Let's take the galaxy data. There were 5 galaxies with spiral arms and 25 without spiral arms. That means there were 5+25=30 total galaxies. 5 out of 30 galaxies had spiral arms. That is the same as 5 divided by 30, or 5/30, which is 0.17. To make this decimal into a percentage, you just multiply by 100, or move the decimal point over twice. 17% of the galaxies have spiral arms. 25 out of 30 galaxies did not have spiral arms, which is the same as 25/30, which is the same as 0.83, which is the same as 83

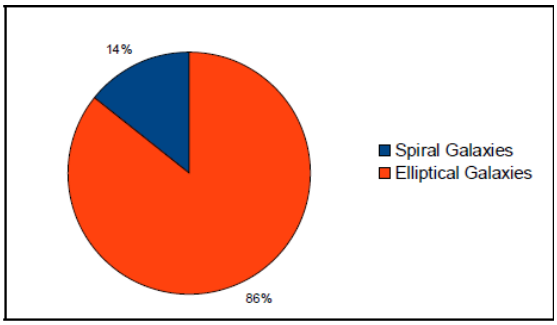
What kind of graph or chart should I use to display my data?

If your experiment involved changing one thing and measuring something else, with the idea that the "something else" would be affected by your changes, you should make a scatterplot or a bar graph. In the soccer ball example, we changed the air pressure and measured the distance. Here, the x-axis (the horizontal part) should be the thing you were changing (independent variable), and the y-axis should be the thing you were measuring (dependent variable). This will help you see *how* the dependent variable was affected.



Here, as the ball gets more full (as you go right along the horizontal axis), it goes farther (the points are higher up vertically). You can say that a ball under more pressure works best! Your conclusion should be about *why* that is true. You might have to do background research.

If your experiment involved seeing "how many" and/or calculating percentages, you should make a bar graph or a pie chart.



Here, you can see that there are many more elliptical galaxies than spiral galaxies. By doing background research, you might be able to figure out *why*, or at least make a guess.

If your experiment involved “yes or no”-type data/observations, a color-coded table is a good way to show your results.

Which objects were able to light up a bulb?

Potato	
Salt water	
Battery	
Marshmallow	

For your conclusion, you can try to figure out why some sources lit up the bulb and others did not.

Data Analysis Checklist:

- I made a table for organizing my data.
- If my experiment involved doing the same thing multiple times, I took the average of the trials' measurements. If my experiment involved gathering statistics (like the galaxy example), I turned my raw numbers into percentages.
- I made a graph or a chart to display the final results.
- I interpreted my graph by turning the numbers into words that explain what is happening.