PART 1 - Variables

When performing an investigation, scientists want to make sure that it is fair. To do this, they identify all of the **variables** that might affect their results and make sure to only change one variable at a time. This way, they know that their results are caused by the variable they changed and not by any other variables.

Read the following story of how 3 friends did their investigation:

David and his friends Michelle and Tom want to test the strength of 3 brands of paper towel (“A”, “B” and “C”). They plan to use metal washers as weights to determine the strongest brand. David rips off one sheet from each of the three rolls of paper towels. Two of the rolls have sheets that are half-size, while the third roll has full-size sheets.

David fills a beaker with 25 mL of water and dips paper towel “A”, letting it soak up some water. He carefully unfolds the sheet and has Michelle hold two corners while he holds the other two corners over a sink. Michelle uses her thumbs and index fingers to grip the corners. David grasps the paper towel corners in his fist to hold them. Tom carefully stacks the washers one by one into the centre of the paper towel every 2 seconds and counts how many it holds until it rips. In a data table, he records this number.

David then dips paper towel “B” into the remaining water in the beaker. Again, he carefully unfolds it and lets Tom have a turn holding two corners while he holds the other two. This time, Michelle puts a washer onto the paper towel every 5 seconds, spreading them out in an even layer over the whole surface. After the paper towel rips, the number of washers that caused paper towel “B” to rip is recorded in the data table.

Michelle sees that there is no more water left in the beaker, so she fills up a 50mL beaker with water and dips paper towel “C” into it. This time, Tom and Michelle hold the corners of the paper towel while David puts a washer on every 5 seconds. Partway through, David runs out of washers and goes to ask another group if he can borrow some of theirs. This takes some time, and while waiting for David’s return the paper towel rips. In the data table, Michelle records the number of washers that caused paper towel “C” to rip.

List all of the things you can think of that David, Michelle and Tom did to make this an unfair investigation.

**Independent Variable**: What variable should be the only one that is changed in this investigation?

**Dependent Variable**: What is affected by changing the independent variable?

**Controlled Variables**: What things need to remain unchanged in the investigation so that they do not have an effect on the results?

**Part 2 – Experiment**

You will carry out an investigation on three different brands of paper towels. In the experiment you will test the strength of the 3 brands of paper towel. You will need to create a lab sheet to record information on. On that lab sheet you should have a material section, any **tables** required for recording data (**create a graph**), a section to **record observations** and your **own step by step procedures** for carrying out the experiment. Prior to the experiment you should also create your **own hypothesis** and include that on your lab sheet.

It is encouraged to create your own experiment/investigation using the 3 different brand of paper towels, but you need to check with teacher to that the procedures are reasonable.

**Example Procedure:**

1. Obtain three different types/brands of paper towels, A, B and C.
2. Ensure the paper towels pieces are of equal sizes.
3. Using a graduated cylinder, measure 25mL of water and transfer into a 100mL beaker. Dip paper towel A into the water until it absorbs all the water that it can. Remove from beaker.
4. Hold the 4 corners of the paper towel, careful not to rip it and over a container to catch the marbles.
5. Place the marbles, one at a time on the paper towel until it rips. Count the # of marbles it took to rip the paper. Record your results in a table.
6. Repeat step 3,4, & 5 to obtain another set of data for paper towel A. Then find the average of the 3 of marbles to rip the paper towel.
7. Repeat steps 3, 4, 5 and 6 for paper towel B and C.

**Part 3 – The investigation and write-up**

Your lab write-up must be **typed-up** and must contain the following elements:

* Your **full name and block**
* A **title**
* The following headings, with the required information written under each:
  + **Purpose /Question**
    - Explain what we are testing in this investigation.
  + **Hypothesis**
    - A question or prediction to create a cause-and-effect statement that can be tested (What is your prediction (in the form of a "If…, then… statement)?
  + **Materials**
    - Write a list of all the materials needed to perform the investigation.
  + **Procedure** 
    - Write a step-by-step description so that the investigation can be replicated by someone else.
    - Give details but not too many.
    - You may write “repeat steps \_\_ to \_\_\_ …” to make the procedure more efficient.
  + **Data and Observations**
    - Make a data table where you record your results (use a ruler!)
    - Create a graph using your data
  + **Conclusion** 
    - Involves a written explanation for the results of the experiment. Relates to what you observed and the results you obtained. Answers the original problem/purpose.
    - Is there anything that you would have or should have done differently?
  + **Discussion**
    - Describe how the new information you gained from doing your investigation relates to real-life situations. How can this information be used?
    - Errors that may have made the experiment biased.