Physics Lab Report Format

(Sample Report Attached)

**General Remarks:**

Writing a lab report is the only way your TA will know what you have done during the lab and how well you have understood the process and the results. Part of your lab experience should be learning how to organize and present your work in a scientific way. There is no framework that can be used as a “one size fits all”, therefore this sample lab report should only be used as an example.

Any lab report should have the following features:

* It should be concise but should also contain the necessary details and well-developed explanations.
* It should be organized. You should enable the reader to quickly find the information he or she may be interested in.
* It should contain all the relevant information and reasoning. You should enable the reader to validate your conclusion.

A possible way to achieve this is using the following framework:

* **Objective:** State what you want to achieve in this experiment. A formal way to do this is to state a question or hypothesis that you want to address.
* **Method:** You should include a summary of the lab procedure *in your words*; do not merely copy what is in the manual. This section should demonstrate your understanding of what exactly you measured and how you measured it.
* **Data:** In this section you should include the raw data you measured; generally, an estimate of the error should accompany all measured values. Be sure to present your data in an organized manner (e.g. a data table) and to include units.
* **Data Analysis:** In this section you will manipulate the data in order to help you address your question or hypothesis. Usually this entails performing calculations and/or creating graphs of the data.
* **Uncertainty & Error:** You cannot draw any final conclusions from your data until you think carefully about how well you can trust your data and what factors may have affected or biased it. Additionally, you must often propagate the error from your measurements through your calculations and graphs.
* **Conclusion:** Finally, after all this work, go back and answer the question you stated in the beginning. Does your data allow you to support or reject your hypothesis, or is the data inconclusive? Also do you have anything you can compare your results with (e.g. a value in the literature, a second measurement, a measurement with a different method, other lab groups)? How well does it compare to such a value?

(Cite references per the APA Format Guidelines)

**Physics Lab Report**

Instructor: \_\_\_\_\_\_\_\_\_ 1.  Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Course: \_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Newton’s Second Law: the Atwood Machine**

**Lab Report 3**

General Physics

Parker College of Chiropractic  
Dr. Tison  
Month xx, 2011

**Introduction:**

The purpose of this lab is to test Newton’s 2nd Law of Motion by utilizing an Atwood machine apparatus. The Atwood machine will be used to study the relationship between mass, acceleration and net forces, with the distribution of the mass between the two weights being the independent variable and the time the dependent variable within the experiments.

**Hypothesis:**

It is hypothesized that the acceleration of the object observed will be directly proportional to the net force acting on the object and inversely proportional to the total mass of the object.

**Theory:**

In an Atwood’s machine apparatus two sets of unequal masses are suspended from a string on either side of a pulley. The larger mass, m2, provides a net force, Fnet = (m2-m1)g, thereby causing both masses to accelerate according to Newton’s 2nd Law of Motion, Fnet = (m1+m2)a. Combining these 2 equations, the acceleration can be calculated by the equation, ac = [(m2-m1)/ (m1+m2)]g.

It is also possible to determine the acceleration of the 2 masses by measuring the time it takes for the masses to descend a distance y to the floor, using the equation, am= 2y/t2

**Experiment:**

There will be two experiment sets conducted here. The first involves a repeated operation of the machine with the addition of an equal amount of mass to weight hangers on each side of the pulley, with the weights starting at 70 g and 90 g and maxing out at 150 g and 170 g, respectively. The machine will be operated five times, with 20 g added to each side after each operation.

The second set starts where the first set left off (at 150 g and 170 g), and sees the weights moved from one side to the other: 20 g will be moved from m1 to m2 at every repeated drop of the machine until m1 reaches 70 g and m2 stops at 250 g.

**Data/Results: y = 80cm =0.80m**

Equations: ac = [(m2-m1)/ (m1+m2)]g am= 2y/t2 % error = (|ac-am|/ac) x 100

1. Increasing mass sum

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| m1 | m2 | ac | t | am | % error |
| 70 g | 90 g | 1.22m/s2 | 1.15 s | 1.21m/s2 | 0.82% |
| 90 g | 110 g | 0.98m/s2 | 1.29 s | 0.96m/s2 | 2.04% |
| 110 g | 130 g | 0.81m/s2 | 1.39 s | 0.83m/s2 | 2.47% |
| 130 g | 150 g | 0.70m/s2 | 1.55 s | 0.67m/s2 | 4.29% |
| 150 g | 170 g | 0.61m/s2 | 1.80 s | 0.49m/s2 | 19.7% |

2. Increasing mass difference

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| m1 | m2 | ac | t | am | % error |
| 150 g | 170 g | 0.61m/s2 | 1.50 s | 0.71m/s2 | 16.4% |
| 130 g | 190 g | 1.84m/s2 | 0.92 s | 1.89m/s2 | 2.77% |
| 110 g | 210 g | 3.06m/s2 | 0.72 s | 3.08m/s2 | 0.65% |
| 90 g | 230 g | 4.29m/s2 | 0.63 s | 4.03m/s2 | 6.06% |
| 70 g | 250 g | 5.51m/s2 | 0.53 s | 5.70m/s2 | 3.44% |

**Data Analysis:**

In the first experiment set, it became apparent that as the mass was increased on both sides by the same difference, it took the heavier side longer to touch the ground. This is because the lighter to heavier weight ratio increases to the extent that the heavier weight does not exert as much of a force as before. The gravitational force of the lighter weight increases due to the added mass, and the heavier weight compensates with added time.

In the second experiment, we found that an increasing difference between the weights shortened the time considerably. The ratio between the lighter and heavier weight is decreased, so the heavier weight has less of an opposing gravitational force to slow its descent.

In both experiments the % error calculations range from about 1% to 20%, with the highest % errors for the smallest values of acceleration. The absolute difference between each set of values ac and am is fairly consistent. The larger % errors are the results of dividing by a larger value of ac.

**Conclusion:**

By using Atwood’s machine, Newton’s law was successfully tested. With this experiment, the measurement of acceleration of the masses tested, a value for the acceleration of gravity was calculated. Though the data recorded was not completely accurate with the calculations conducted with Newton’s 2nd Law of Motion, the approximate values were within one standard deviation. Frictional force and stretching of the string both could have caused this variance. Thus, the hypothesis is accepted due to the acceleration of the object observed being directly proportional to the net force acting on the object and inversely proportional to the total mass of the object.

**Practical Applications:**

The Atwood machine has provided the design for many historical machines with the most obvious being the elevator. The elevator uses a counterbalance, which relieves the driving motor from the load of holding the elevator. This causes it to overcome the difference in weight and inertia of both of the masses. Additionally, this same principle is used in railways to connect cars on inclined tracks

**References:**

Dr. J. Tison, Physics Lab 3, Spring, 2011.

Giancoli,Douglas C. © 2005,*Physics*,Prentice Hall, 6th edition.