**Free Fall Experiment Report**

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January 16,2023 – Change to your completion date

IGCSE Mathematics

TianEn Academy

Your name here

Deadline: Feb 16

1. Objectives

Acceleration is the rate at which the velocity of an object changes over time. An object’s acceleration is the result of the sum of all the forces acting on the object, as described by Newton’s second law. Under ideal circumstances, gravity is the only force acting on a freely falling object. In this lab, you will measure the displacement of a freely falling object, calculate the average velocity of a falling object at set time intervals, and calculate the object’s acceleration due to gravity. The objectives of this experiment are as follows:

* to measure the displacement of a freely falling object,
* to test the hypothesis that the acceleration of a freely falling object is uniform,
* to calculate the uniform acceleration of a falling object due to gravity, g.
1. Theory

The instant when the ball is released is considered to be the initial time t = 0. The position of the ball along the ruler is described by the variable y. The position of the ball at a time t is given by

$$y\left(t\right)=y\_{0}+v\_{0}t+\frac{1}{2}yt^{2}$$

Likewise, the relationship between the instantaneous velocity and time can be measured by the equation:

$$v\left(t\right)= v\_{0}+at$$

1. Accepted Values

The acceleration due to gravity varies slightly, depending on the latitude and the height above the earths surface. In this experiment the change in height of the falling object is negligible and can be approximated as 0 km for its entire descent. The standard gravitational acceleration on Earth is:

$$g=9.81m/s^{2}$$

1. Methodology

**Min 50 words**

**[Function]: Describe how you set up the experiment and collected data**

Include the following information:

1. Apparatus (What are the essential materials for this experiments? How is the experiment set up? What equipment did you use?)
2. Data collection (How did you collect your data? Please include your instruments and data collection procedures.)

Use past tense for what you have done for your data collection.

1. Data

**[Function]: Represent the collected data**

Make sure you copy all your data from excel to word to complete the report. You may extend the table to include all your data.

|  |  |  |  |
| --- | --- | --- | --- |
| Time(s) | Distance(m) | Delta x(m) | Velocity (m/s) |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
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|  |  |  |  |

1. Analysis
2. using a spreadsheet software (preferable), or using plotting paper according to the methods described in the tutorial video, make a distance-time plot of the points in the first and second columns of the table. Assign distance (y) to the vertical axis, and time (t) to the horizontal axis. **Include the scatter plot in the report.**
3. make a fit of the plotted data to a straight line using either the spread- sheet software or excel plotting function, as shown in the tutorial video
4. Note that a general function is given as

$$y=ax^{2}+bx+c$$

The gravitational acceleration is calculated as:

$$2a$$

**Make sure the function is included in the report.**

Likewise, according to the methods described in the tutorial video, make a velocity-time plot of the points in the first and fourth columns of the table. Assign velocity (y) to the vertical axis, and time (t) to the horizontal axis. **Make sure the graph is included in the report.**

1. make a fit of the plotted data to a straight line using either the spread- sheet software or excel plotting function, as shown in the tutorial video
2. find the slope and the intercept of the best fit straight line. A general straight line is given by

$$y=ax+b$$

The gravitational acceleration can be directly found as

$$a$$

 **Make sure the function is included in the report.**

1. calculate the percent difference between the value you obtained for g and the accepted value $9.81m/s^{2}$
2. Error Reporting

[Function]: Report errors generated in the experiment, data collection and data analysis.

State minimum 3 errors generated during the experiment. You may consider how the experiment was conducted. How data are collected. How data are analyzed.

Minimum 30 words.

1. Conclusion

**[Function]: Summarize the whole study briefly and highlight the contributions.**

**[How]**

1. Summarize the whole study in one or two sentences;
2. State clearly the significance of your study;
3. Propose areas for further research (areas for further research should be related to your limitations).

Minimum 100 words.