**Acceleration lab**

In this lab you will be measuring the time it takes an object to fall from various heights in order to measure its average velocity and acceleration.

**Purpose:** To determine the acceleration of a falling object.

**Hypothesis:**

**Materials:**

* Metre stick/measuring tape
* Timer (phone)
* Object

**Procedure:** In your groups of three or four, determine who will drop the object, who will time the fall, and who will record the data in Table 1.

1. Begin by dropping your object from a height of 0.5 meters and record the time it takes to fall to the ground. Be as accurate as possible.
2. Repeat this procedure 5 times and record data after each replicate.
3. Calculate the average time from all five replicates.
4. Next, calculate the average velocity over this distance for each replicate.
5. Finally, calculate the average of these velocities from the five replicates.
6. Repeat steps 1-5 for all displacements.
7. Use your average time and average Vaverage values to fill out table 2.
8. Calculate the acceleration during each distance interval.
9. Fill in your acceleration data into Table 3 and collect data from four other groups. Be sure to record group number.

**Data:**

Table 1:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Distance (m)** | **Replicate number** | **Time (s)** | **Vavg (m/s)** |  | **Distance (m)** | **Replicate number** | **Time (s)** | **Vavg(m/s)** |
| **0.5** | **1** |  |  |  | **2.0** | **1** |  |  |
|  | **2** |  |  |  |  | **2** |  |  |
|  | **3** |  |  |  |  | **3** |  |  |
|  | **4** |  |  |  |  | **4** |  |  |
|  | **5** |  |  |  |  | **5** |  |  |
|  | Average: |  |  |  |  | Average: |  |  |
| **1.0** | **1** |  |  |  | **2.5** | **1** |  |  |
|  | **2** |  |  |  |  | **2** |  |  |
|  | **3** |  |  |  |  | **3** |  |  |
|  | **4** |  |  |  |  | **4** |  |  |
|  | **5** |  |  |  |  | **5** |  |  |
|  | Average: |  |  |  |  | Average: |  |  |
| **1.5** | **1** |  |  |  | **3.0** | **1** |  |  |
|  | **2** |  |  |  |  | **2** |  |  |
|  | **3** |  |  |  |  | **3** |  |  |
|  | **4** |  |  |  |  | **4** |  |  |
|  | **5** |  |  |  |  | **5** |  |  |
|  | Average: |  |  |  |  | Average: |  |  |

Table 2:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |
| --- | --- | --- | --- |
| **Distance Interval (m)** | **ΔVavg**  **(m/s)** | **ΔTime (s)** | **Acceleration (m/s2)** |
| 0.5-1.0 |  |  |  |
| 1.0-1.5 |  |  |  |
| 1.5-2.0 |  |  |  |
| 2.0-2.5 |  |  |  |
| 2.5-3.0 |  |  |  |

Table 3:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Distance interval (m)** | **Group \_\_\_\_\_** | **Group \_\_\_\_\_** | **Group \_\_\_\_\_** | **Group \_\_\_\_\_** | **Group \_\_\_\_\_** | **aavg (m/s2)** |
| 0.5-1.0 |  |  |  |  |  |  |
| 1.0-1.5 |  |  |  |  |  |  |
| 1.5-2.0 |  |  |  |  |  |  |
| 2.0-3.0 |  |  |  |  |  |  |
| 2.5-3.0 |  |  |  |  |  |  |

**Results:** Graph your results from Table 3.

**Discussion:**

1. Research what acceleration you should have found and compare this value to your own value.
2. What is the significance of the acceleration value you looked up? Where does it come from?
3. Why might your result differ from your expected results?
4. Why were you asked to replicate each step and combine your results with the other groups’ results? Discuss the significance of replicates in science.
5. How could you redesign the lab for more accurate results?

**Conclusion:**

Write a three paragraph conclusion following the general outline. Paragraph one should restate your hypothesis and purpose, and should state whether your hypothesis is accepted or rejected by your data. Paragraph two should support the acceptance or rejection of your hypothesis by referring to your data tables and results. Explain your results the to best of your ability. The final paragraph should make a general scientific concluding statement, i.e. the theory the lab supported or demonstrated.

**Your formal lab report should include in this order with these headings**:

1. Purpose (restate the given purpose)
2. Hypothesis (form your own hypothesis)
3. Procedure (restate the given procedure)
4. Data (title your data tables and include all of the tables. Show a sample calculation for each calculation necessary in the table)
5. Results (graph your results from table 3: average acceleration vs. distance interval)
6. Discussion (answer the 5 discussion questions. If you prefer to answer the questions in paragraph form rather than individual questions, go ahead)
7. Conclusion (write your conclusion in the format described above)