Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Partners: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Acceleration due to Gravity Lab

Purpose: To analyze position vs. time and velocity vs. time graphs for motion with constant acceleration.

Materials: - 100/200g mass

- Spark time with timer tape (approximately 2.0 metres)

- Millimetre ruler

Experimental Procedure:

1. Set up the materials as shown in class. \***make sure the timer is set at 60Hz.**

2. Attach the mass to the spark timer.

3. Turn on the spark timer, making sure to hold it securely in place.

4. Drop the mass.

5. Allow the mass to fall until the timer tape is through the timer.

7. Carefully remove the timer tape from the car and remove the mass from the tape.

8. **Write your names on the back of the tape and DO NOT LOSE IT.**

9. Put the mass and timer away neatly.

Data Collection Procedure:

1. Locate the first clear point on the tape and mark it. This should be as close to the ‘blotch’ of spark markings at the beginning of the tape as possible. This will be your **origin**. That means it counts as the zeroth dot and the dot next to it the first dot.

2. Count to the 6rd dot from the start and mark it. Then mark the 3rd dot, the 6th dot, the 9th dot, the 12th dot and so on until you reach the point when the car stops accelerating, or you complete the table.

0th 6th 12th 18th

3rd 9th 15th

3. For each marked dot measure the distance (in cm) **from the origin** to the dot and record in the data table. Give measurements to the nearest millimetre.

4. Complete the time column of the table.

Data Table 1:

|  |  |  |
| --- | --- | --- |
| **Dot** | **Displacement** (cm) | **Time** (s) |
| 0 | 0 | 0 |
| 3 |  | 0.05 |
| 6 |  | 0.10 |
| 9 |  | 0.15 |
| 12 |  | 0.20 |
| 15 |  |  |
| 18 |  |  |
| 21 |  |  |
| 24 |  |  |
| 27 |  |  |
| 30 |  |  |
| 33 |  |  |
| 36 |  |  |
| 39 |  |  |
| 42 |  |  |
| 45 |  |  |
| 48 |  |  |
| 51 |  |  |
| 54 |  |  |
| 57 |  |  |
| 60 |  | 1.0s |

Data Analysis (Part 1):

1. Plot a graph of **Position** vs. **Time**.
2. Describe the shape of the curve formed using proper terminology.
3. Draw a tangent line to the curve at 0.45s.
4. Find the slope of the tangent line found in 3.
5. What is the physical significance of the slope found in 4?

Data Table 2:

For this table you will determine the average velocity of the falling mass for each ***time interval***. To do this you will need to first find the displacement for each interval. Then you will divide by the time for each interval. The time intervals are set out below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Time interval (s)** | **∆t (s)** | **∆d (cm)** | **vavg (cm/s)** | **t (s)** |
| 0-0.1 | 0.10 |  |  | 0.05 |
| 0.1-0.2 | 0.10 |  |  | 0.15 |
| 0.2-0.3 | 0.10 |  |  | 0.25 |
| 0.3-0.4 | 0.10 |  |  | 0.35 |
| 0.4-0.5 | 0.10 |  |  | 0.45 |
| 0.5-0.6 | 0.10 |  |  | 0.55 |
| 0.6-0.7 | 0.10 |  |  | 0.65 |
| 0.7-0.8 | 0.10 |  |  | 0.75 |
| 0.8-0.9 | 0.10 |  |  | 0.85 |
| 0.9-1.0 | 0.10 |  |  | 0.95 |

Data Analysis (Part 2):

1. Draw a graph of average velocity vs. time. (Using the last two columns of Table 2)
2. Describe the shape of the curve formed, using proper terminology.
3. What is the instantaneous velocity at 0.45s, as found in Data Table 2?
4. Compare your result from Part 2 number 3 to Part 1 number 4.
5. Find the slope of the line. Clearly indicate the points used on the graph. Write the co-ordinates of the points and show the full slope calculation including units in the space below.
6. What is the acceleration of the mass?