EXPERIMENT 1:

ACCELERATION ON AN INCLINED PLANE

Object: investigate the motion of an object with constant acceleration

Equipment: steel ball, meter stick, masking tape, ramp, stopwatch, books, graph paper

DATE_____

AUTHOR _____

PARTNER _____

PARTNER _____

BACKGROUND

The average velocity of an object moving in a straight line interval **t** is : **Vav = ΔX/t** .
ΔX is the displacement of the object **X2-X1** .

If the object has a constant acceleration **a** then we have the following relationships:

- **a = ΔV/ t = V2 – V1 / t**

V2 is the final velocity
V1 is the initial velocity

- Or **V2 = V1 + a t**
- Also, since the velocity increases at a constant rate **a** then **Vav = (V1+ V2)/2**
- **ΔX= V1 t + ½ a t²**

If an object, like a steel ball, is in free-fall, the acceleration is constant and is equal to g=22mph/s or g=9.8m/s/s. Every second your speed increases by 22mph every second. This is if we neglect air resistance. If the ball rolls down an inclined plane, the gravity is " diluted" but is still constant. We can show that the acceleration is **a = g sin(Θ)** where g= 9.8m/s/s and Θ is the angle the inclined plane makes with the horizontal.

In this lab we are going to compute the acceleration of a ball on an inclined plane and we are going to plot displacement **ΔX** versus time. There is no initial speed so V1 (t=0) =0

PROCEDURE

1. Use the meter stick and masking tape to mark a starting line (0cm) on the ramp followed by marks 15, 30, 45, 60, 75, 90, 105, 120, and 135 cm from the start
2. Position the ramp so that its upper end is between 6 to 9cm above the table.
3. Measure: Place the steel ball at the top of the ramp and release it Use the stopwatch to time how long it takes the ball to reach the 15cm mark. Record your measurement in Table 1.
3. Repeat step 3 for each of the remaining distances marked on the ramps.
4. Calculate: for each time measurement that you made, sue the following formula to calculate average velocity **Vav** and final velocity **V2**. We have V1 =0
   Vav = ΔX/t
   since **Vav =(V1+V2)/2** and **V1 = 0** then **V2 = 2 Vav**
5. calculate acceleration for each time measurement by using the following formula :
   a = V2/t since **V1 =0**
6. measure the angle between the plane and the horizontal = _____
7. raise the ramp to steeper angle, so that it is between 10 and 12 cm above the table.
8. Repeat steps 3-6, but this time record your results in Table 2.
9. Make graphs of distance vs time for the data you recorded in Table 1 and Table2.
10. Make graphs of final velocity vs time for the data you recorded in Table 1 and Table 2 don't connect the dot but trace the best fit line. (ask me)
11. measure the angle between the plane and the horizontal = _____

OBSERVATIONS

Table 1: Acceleration – Low ramp

Distance (cm)	Time(sec)	Average velocity (cm/sec)	Final velocity (cm/sec)	Acceleration (cm/sec)
0				
15				
30				
45				
60				
75				
90				
105				
120				
135				

Table 2: Acceleration – high ramp

Distance (cm)	Time(sec)	Average velocity (cm/sec)	Final velocity (cm/sec)	Acceleration (cm/sec)
0				
15				
30				
45				
60				
75				
90				
105				
120				
135				

RESULTS:

1) For low ramp data:
   The graph velocity versus time shows that the velocity increases at a constant _____.
   The slope of the line represent this rate of change = acceleration of the ball.
   Compute the slope = _____ cm/s/s
   This is your measured value of the acceleration.
   The accepted value is a = 980 sin (Θ) where Θ is the angle between the plane and horizontal. Accepted value is therefore _____ cm/s/s

   Compute the percent discrepancy _____ %
   or (accepted – measured)/ accepted x 100

2) the graphs distance versus time is a _____ (line ? Parabola ?)
   How do changes in distance compare for equal time intervals ?

3) What effect did the steeper ramp have on acceleration ? Why ?

4) For higher ramp data:
   The graph velocity versus time shows that the velocity increases at a constant _____.
   The slope of the line represent this rate of change = acceleration of the ball.
   Compute the slope = _____ cm/s/s
   This is your measured value of the acceleration.
   The accepted value is a = 980 sin (Θ) where Θ is the angle between the plane and horizontal.
   Accepted value is therefore _____ cm/s/s
   Compute the percent discrepancy _____ %
   or (accepted – measured)/ accepted x 100

CONCLUSION:
Was the purpose of this lab accomplished ? Why or Why not ?
(your answer to this question should show thoughtful analysis and careful, through thinking)