Yanbu University College

Gene ral Physi

cs I (PHYS 101)

Lab. Exercise No. .....

Velocity and Acceleration

Name: _____ ID No. _____

PERFORMANCE OBJECTIVES

Upon completion of this laboratory exercise the student will be able to:

- Analyze the motion of an object to study velocity and acceleration
- Plot and interpret the *distance-time*, *velocity-time*, and *acceleration-time* graphs
- Explain what is distance, velocity, and acceleration

MATERIALS AND EQUIPMENT

Car, recording timer, recording tape, holding pin, slotted weight 1 g (3 pieces) and 50 g, weight holder, movable pulley, measuring tape, fish line, connecting cord, power supply 3-12 V (2 A), track, adhesive tape, and scissors

THEORETICAL CONCEPTS

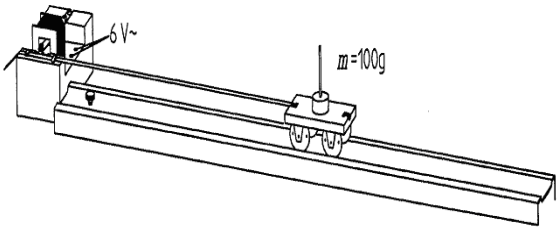
Consider a moving object that covers a distance (*s)* in time (*t)*. The velocity and the acceleration of that object can be described by the following equations.

Instantaneous velocity $v = \frac{\Delta s}{\Delta t}$ Equation 1

Instantaneous acceleration $a = \frac{\Delta v}{\Delta t}$ Equation 2

SETTING-UP THE APPARATUS

1. Position the track such that at one end the track a recording timer (6V, AC) whereas at the other end a pulley is attached.
2. Put the recording tape through the guides such that paper side is down.
3. Place a 50 g weight on the pan of the car and attach a tape with an adhesive tape at the middle.
4. At the other end of the car attach 90 cm line and hang over the pulley with weight holder.



EXPERIMENTAL PROCEDURE

1. Arrange the apparatus as shown in the Figure. The detailed procedure has been described above.
2. Attach a piece of line on the car and hang the weight of 3 masses (1 g each) and a weight holder (1 g). This will make a total of 4 gm on a loop at the other end.
3. Hold the car in place.
4. Turn the recording timer on and let the car slide slowly.
5. As the car reaches the other end, press the off button on the timer and remove the tape.

A. Distance-Time Graph

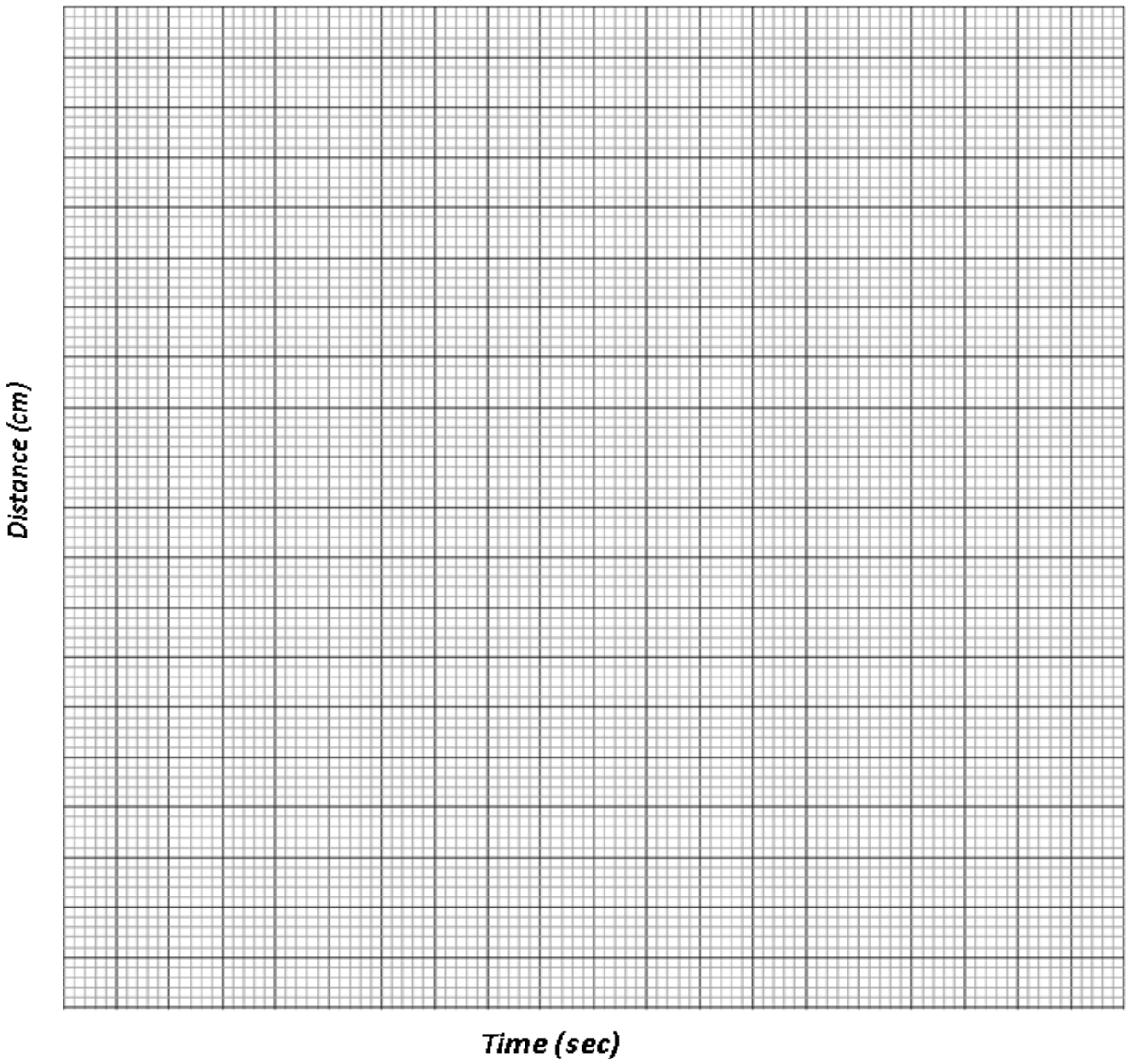
1. Follow the procedure and complete a measurement. Use the recording tape to measure the distance.
2. Choose the first recognizable dot as a starting point or zero point.
3. Count from zero, 20, 40, 60, 80, 100, 120 and mark the points as 1, 2, 3, and so on.
4. The time interval between each successive dot is 0.017 Sec (since the frequency of the main supply is 60 Hz, the period becomes 1/60 ~ 0.017 sec). The time for 20th dot becomes 0.33, for 40th 0.66 and so on. Calculate the values of time for remaining points and write in the last column of Table 1.
5. Write these calculated times against each point in the Table 1.
6. Measure the distance from zero to each of the points and write in the Table 1
7. Plot a *distance-time (s-t)* graph using the data obtained in Table 1. (The graph is provided in Figure 3)

Table 1

[05 Marks]

Measuring points	***S (cm)***	***t (sec)***	***ΔS (cm)***	***Δt (sec)***	$v_{av} = \frac{S}{t}$ ***(cm/sec)***	$v_{ins} = \frac{\Delta S}{\Delta t}$ ***(cm/sec)***
20						
40						
60						
80						
100						
120						

Plot graph between the distance *(s)* and the time *(t)* **[01 Mark]**



Calculations: **[1.5 Marks]**

1. **Calculate the average velocity from the slope of the distance-time graph**

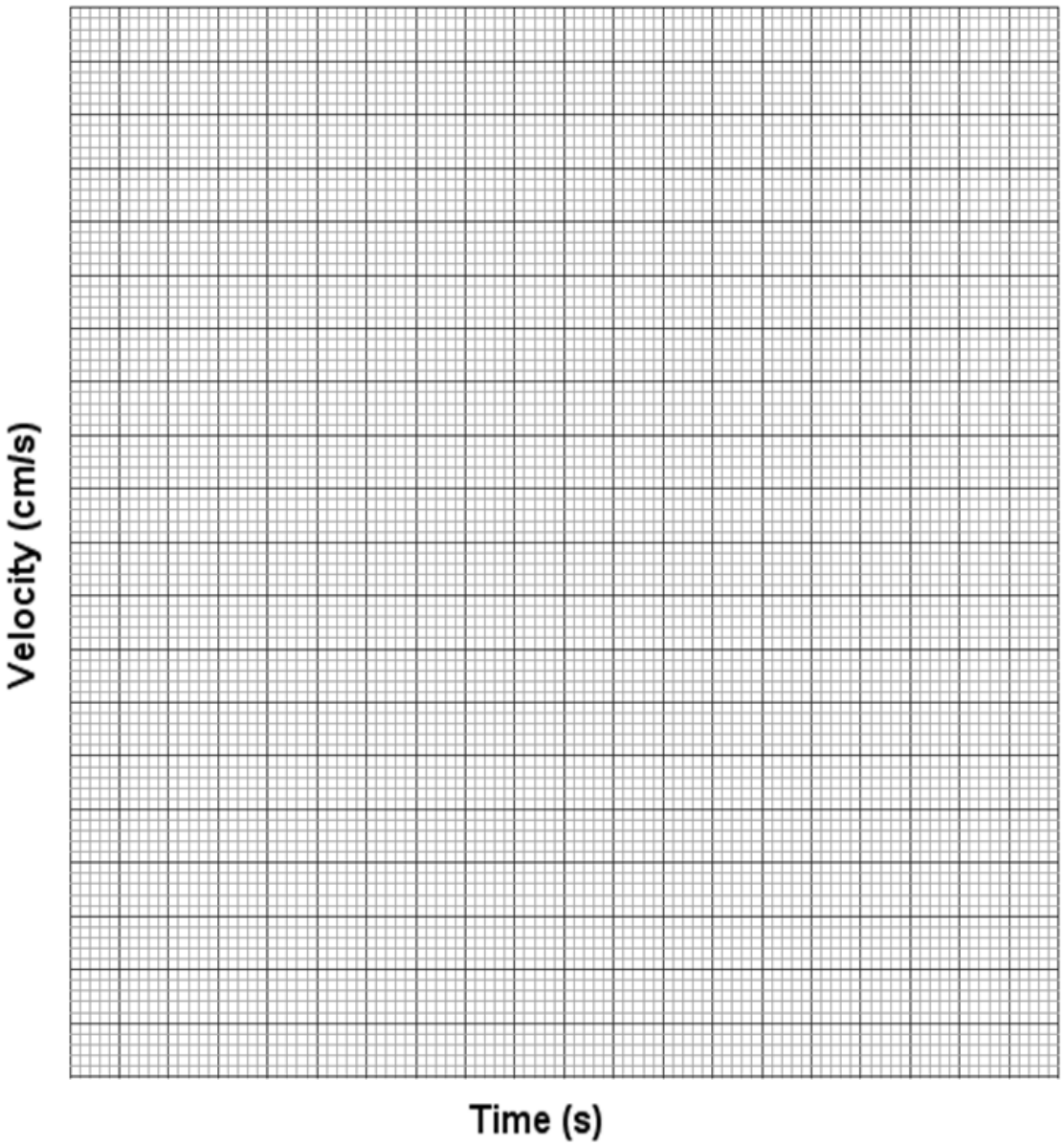
   Slope of the graph (average velocity) = $\frac{\Delta s}{\Delta t}$

   =

   = -------- cm/sec

2. **Compare the average velocity obtained from the table 1 with the slope of the above distance-time graph**

Plot graph between the instantaneous velocity *(v_i)* and the time *(t)* **[01 Mark]**



<u>Calculations:</u> **[1.5 Marks]**

1. **Calculate the average acceleration from the slope of the velocity-time graph**

   Slope of the graph (average acceleration) = $\frac{\Delta v}{\Delta t}$

   =

   = -------- cm/s^2

2. **Compare the average acceleration obtained from the table 1 with the slope of the above velocity-time graph**

<u>End of the Lab Exercise</u>