NILE UNIVERSITY OF NIGERIA

Faculty of Natural and Applied Sciences

Department of Computer Science

Physics Unit

PHY 107: Experimental Physics I (Mechanics)

Experiment 6: FREE FALL

Student Name:

Student ID:

Department:

Date of the Experiment:

Group:

Purpose:

- To determine the functional relationship between height of fall and falling time ($h = h(t) = 1/2gt^2$)
- To determine the acceleration due to gravity $g(ms^{-2})$.

Equipment Needed:

- Falling sphere apparatus
- Release unit
- Impact switch
- Digital counter, 4 decades
- Support base
- Right angle clamp
- Plate holder
- Cursors, 1 pair
- Meter scale, demo, l = 1000 mm
- Support rod, square, l = 1000 mm

Theoretical Background: If a body of mass m is accelerated from the state of rest in a constant gravitational field (gravitational force mg, it performs a linear motion. By applying the coordinate system in a way that the x axis indicates the direction of motion and solving the corresponding one- dimensional equation of motion, we get:

$$m\frac{d^2h(t)}{dt^2} = m.g$$

We obtain, for the initial conditions

$$h(0) = 0$$

$$\frac{dh(0)}{dt} = 0$$

the coordinate has a function of time.

$$h(t) = \frac{1}{2}gt^2$$

The height is directly proportional to the square of time.

Set-up and procedure:

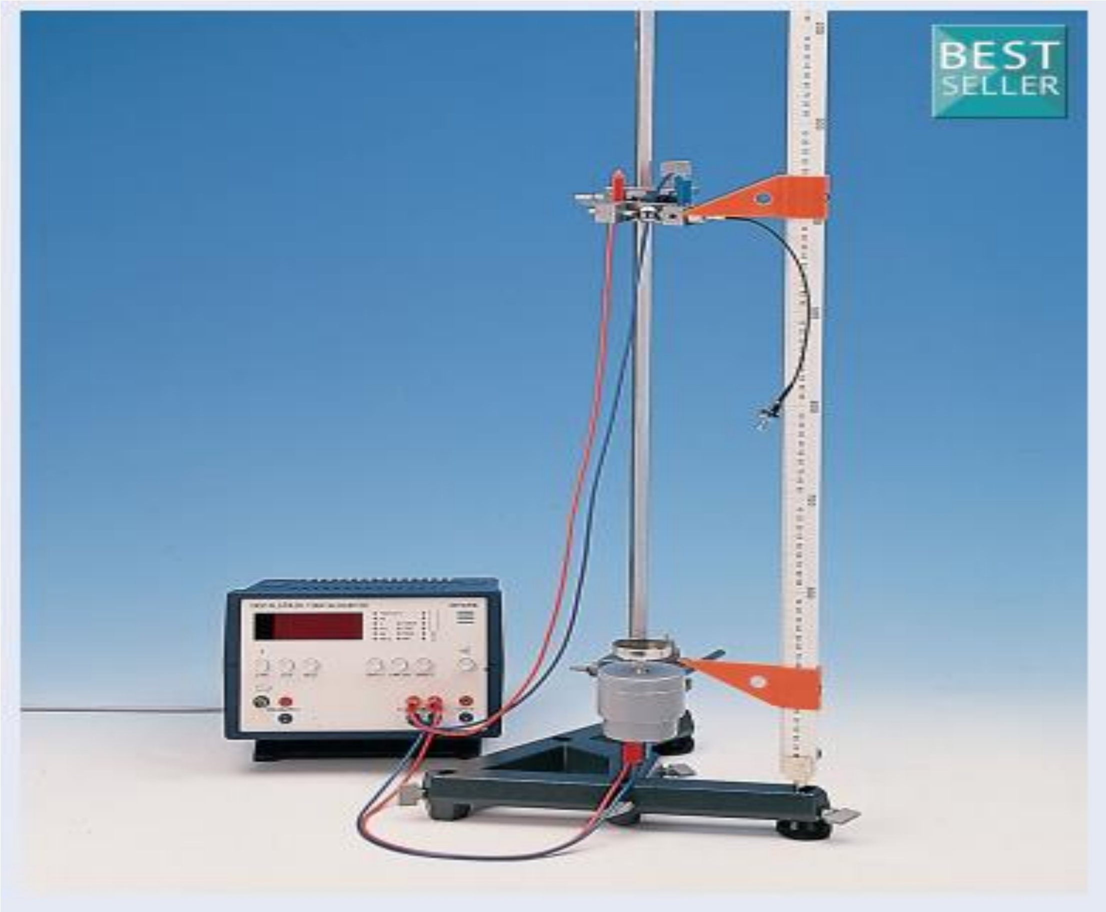

Fig. 1: Experimental set-up

- The set-up is shown in Fig. 1. The experiment is set up as shown above.
- Ensure that the impact switch is positioned at a height of 10cm from the surface.
- Place the release unit at a height h=20cm from the impact switch.
- Set the digital counter to timer and adjust the display to seconds.
- Position the electrically conducting sphere in the release mechanism which closes the start circuit.
- Raise the pan of the impact switch by hand and press START button of the digital counter.
- Release the sphere from the release mechanism and record the falling time of the sphere as displayed on the digital counter
- Repeat the procedure for values of h= 30, 40, 50, 60, 70, and 80cm respectively and record the corresponding time of fall.
- Plot a Graph of $h(t)$ vs. t and a Graph of $h(t)$ vs. t^2
- Evaluate the slot of the two graphs

NB: The aerodynamic drag of the sphere can be disregarded.

Data Sheet:

Data number	Height (m) $h(t_n)$	Time (s) t_n	Time square $t^2{}_n$	g m/s^2	Deviation $\delta g = \lvert g - g_{mean} \rvert$	Square $(\delta g)^2$
1						
2						
3						
4						
5						
6						
7						

Average Value for g g_{mean} =		Standard Deviation of the mean $\sum(\delta g)^2$ =

Instructor Signature and Date____

Note: the quantity $\sum(\delta g)^2$ is called the variance. To find the standard deviation, divide the variance by (N-1), where N is the number of measurements you made (10), and then take the square root. Standard deviation is a common measure of the uncertainty in a measurement. For "normally distributed data", 68% of the data should be within 1 standard deviation and 95% should be within 1.96 standard deviations

Title: **Scale:**

Title: **Scale:**

Precautions:
State the precautions taken to ensure accurate result.

Discursion of Result and Conclussion

Questions:
1. From your graph of h vs. t^2. What does the slope of the graph represent?

2. Using $h(t) = \frac{1}{2}gt^2$ and the slope of the graph of $h(t)$ vs. t^2 , deduce the experimental value of g and compare it with theoretical value.

3. Suppose you hold an object motionless about 120 cm above the ground and then let it fall to the ground without interference. How long does it take the object to hit the ground? (Use the equation and your graph of h vs. t and compare the two results.)