

Free Fall

Objective:-

To measure the acceleration due to gravity **g**

Theory:-

Earth's gravity pulls all objects to the Earth's surface. If gravity is the only force acting on the object, the object's motion is called **free fall**. Free fall is an example of uniformly accelerated motion the acceleration is a constant **$g = 9.8 \text{ m/s}^2$ (downward)**. Since the acceleration is constant. If you ignore air resistance a falling ball accelerates (frictionless). Hence, the formula describing the

$$\Delta y = v_0 t - \frac{1}{2} g t^2$$

Where

$\Delta y = -h$ is the distance the body travels during the time t of the fall between the photogates (**m**)

v_0 is the initial velocity ($v_0 = 0$)

g is the acceleration due to gravity (**m/s²**)

$$-h = -\frac{1}{2} g t^2$$

$$t^2 = \frac{2}{g} h$$

$$g = \frac{2}{\text{slope}}$$

Apparatus: -

drop box	AC adapter	smart timer
control box	ball	meter



Procedures:

1. Timer Setup:

- a. Press the **Select Measurement** button repeatedly until Time is displayed.
- b. Press the **Select Mode** button repeatedly until the **two gates** mode is displayed.
- c. Press the **Start/Stop** button once you will note the star sign * appears on the timer screen to indicate that the timer is ready to take the reading.

2. Set **h**, the height from which the ball is drape. Measure the distance as accurately as possible and record the distance in the table. Press the reset button on the timer, and then Press the key control button to release the ball. It should hit in the center of the receptor pad.

3. Read the time on the digital display of the timer. This is the time it took the ball to fall a distance h.

4. To prepare to take another measurement, reposition the ball in the releasing device, and press the **Start/Stop** button to reset the timer.

5. Record the falling time for different values of height h and tabulate the results.

6. Graph the relation between the height **h** on the **x-axis** and the square of the time **t²** on the **y-axis** and **calculate the slope.**

7. Use the graph to calculate the **acceleration of gravity g.**