(M1-1) Free Fall

Aim of experiment

Determination of the acceleration due to gravity (g).

Apparatus

The instrument of Electromagnet Attracting Ball, 1-, Steel Ball, 2,- Main Body, 3-Photo-Electric Switch G_1, 4-Photo-Electric Switch G_2, 5- Rack for getting the Ball, 6-Regulating Screw for fixing the legs, 7, *figure 1* .

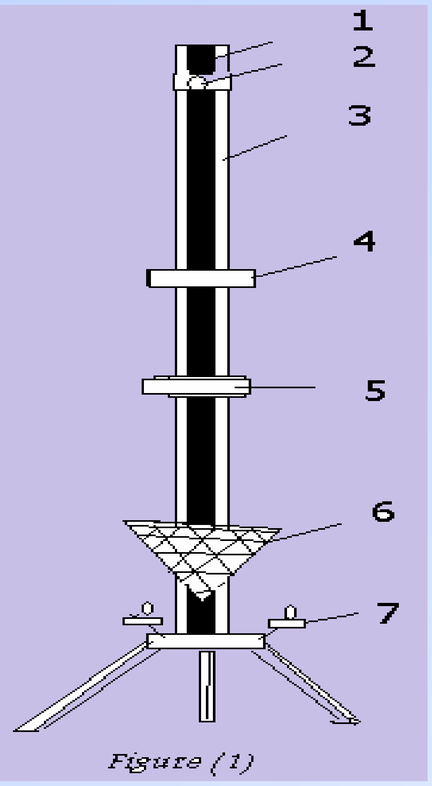

Figure (1)

Theory of experiment

The free fall apparatus is shown in *figure 1*. It can be combined to use with simple Digital Timer instrument

The regular motion of the freely falling ball can be observed qualitatively by using the freely falling instrument. For a freely falling motion of a body with initial velocity v_0, and according to Newoton's equation of motion, the distance travelled along y-axis is given by:

$$y = v_o t + \tfrac{1}{2} g t^2$$

If the body starts motion from rest, $v_0 = 0$, then the equation of motion is given by

$$y = \tfrac{1}{2} g t^2$$

where *y* is the elevation, *g:* gravity and *t*: time. So the acceleration due to gravity can be given by

$$g = 2y/t^2$$

Procedures

1. Place the photo gates G_1 and G_2 such that the distance between them is 10 cm
2. The instrument and the simple digital timer are connected. Switch on power of the timer counter.
3. The electromagnet attracts the steel ball. Press "Clear ". "000" will be displayed in digital-LED of the timer.
4. Press "Attract-Release" button to cut off the power of the electromagnet the steel ball will fall down freely. The timer counter counts the time of fall between G_1 and G_2 respectively.
5. Repeat the previous steps at G_1-G_2 distances of 30, 40, and 50, 60, ……., 100 cm, respectively.
6. Tabulate your results as shown in *table 1*.
7. Plot a graph between *y* on x-axis and t^2_{av} on Y-axis.
8. A straight line, as shown in figure (2), should be obtained. Then calculate the slope and determine g as g =2/slope

Results

y(cm)	t (s)			$(t_{av} \pm \delta t)$	$(t^2_{av} \pm \delta t^2)$
	1	2	3	s	s^2
10					
20					
30					
40					
50					
60					
70					
80					
90					
100					

Slope =…….

g = 2/slope = ……..cm/s^2

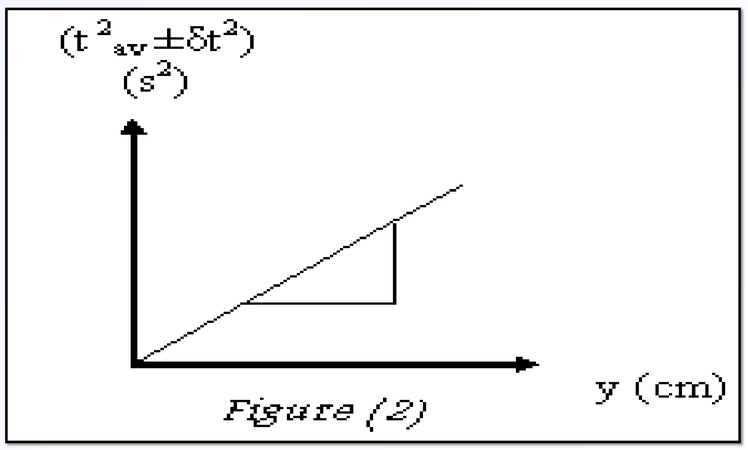

Figure (2)

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