Name:_____ ID No.:_____ Date:_____
Section:_____ Score:_____

Preparatory Physical Science (PHSC001)

Experiment No. 9

Free Fall

Key Terms

Free fall Average velocity Instantaneous velocity

Experiment Objectives

- To investigate and analyze the motion of different free falling objects
- To compare the motion of different free falling objects
- To determine the acceleration of gravity as the object falls toward the earth's surface.

Theory

If an object is allowed to fall from the state of rest ***(u = 0)*** under the influence of constant gravitational field, it will perform a linear movement, i.e., it will fall downward. The equation of distance covered by mass is given by

$$s = ut + \frac{1}{2}at^2$$

In this case we can replace with ***h (s = h)***, where ***h*** is the height from which the object is falling and ***a*** is replaced by ***g*** (a = g), we get,

$$h = ut + \frac{1}{2}gt^2$$

Applying the initial conditions, initial velocity ***u = 0***, we can write

$$h = \frac{1}{2}gt^2$$

This is the equation of straight line. If we plot a graph between h and t^2 and determine slope of the line m. Then 1/2 of the slope of ***h*** vs t^2 graph gives us the value of ***g***.
We can determine ***g*** from the following relation.

$$m = \frac{1}{2}g \quad \text{or} \quad g = 2m$$

In this experiment, the student will measure the distance a free falling object has fallen and measure the time using a 6V A.C spark timing machine used in previous experiment. The acceleration due gravity is then found and compare to its standardized value 9.8m/s^2.

Materials and Equipment

- Three different small objects (spherical balls made of wood, copper, and aluminum)
- Recording tape

Procedure

- Release the steel ball form 10 cm and note the time at which ball hits the pan.
- Repeat the procedure for various heights starting from 10 cm up to 100 cm and note the time for each height.
- Do not forget to adjust the pan under the arrest switch each time by hand after each position.
- Record the height measured and its corresponding time (t) in the Table 1.
- Calculate corresponding t^2 and write in the Table 1.
- Use the data obtained in the Table 1 to plot height-time and height-time^2 graphs in the graphs provided in Figures 2 and 3.

Table A

(Aluminum ball)

Obs. No.	Height (h) (cm)	Time of fall (t) (sec)	Time-Square (t^2) (sec^2)	$g = \frac{2h}{t^2}$ cm/sec^2
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

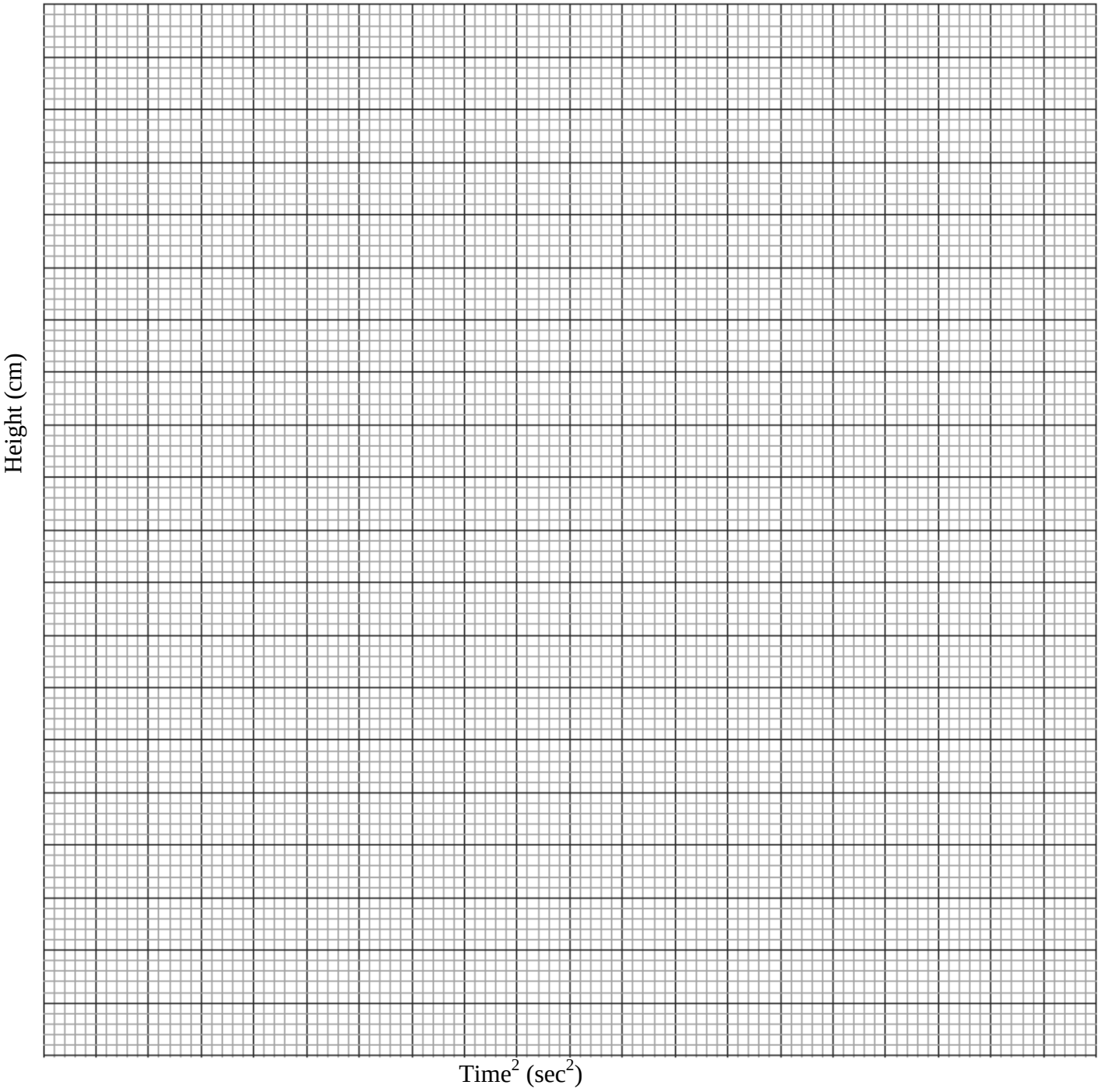
Height (cm)
Time^2 (sec^2)

Table B

(Steel ball)

Obs. No.	Height (h) (cm)	Time of fall (t) (sec)	Time-Square (t^2) (sec^2)	$g = \frac{2h}{t^2}$ cm/sec^2
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Calculations

1. ***The slope of graph A:***

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2. Calculate the acceleration due to gravity using the relation g = 2m

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1. ***The slope of graph B:***

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2. Calculate the acceleration due to gravity using the relation g = 2m

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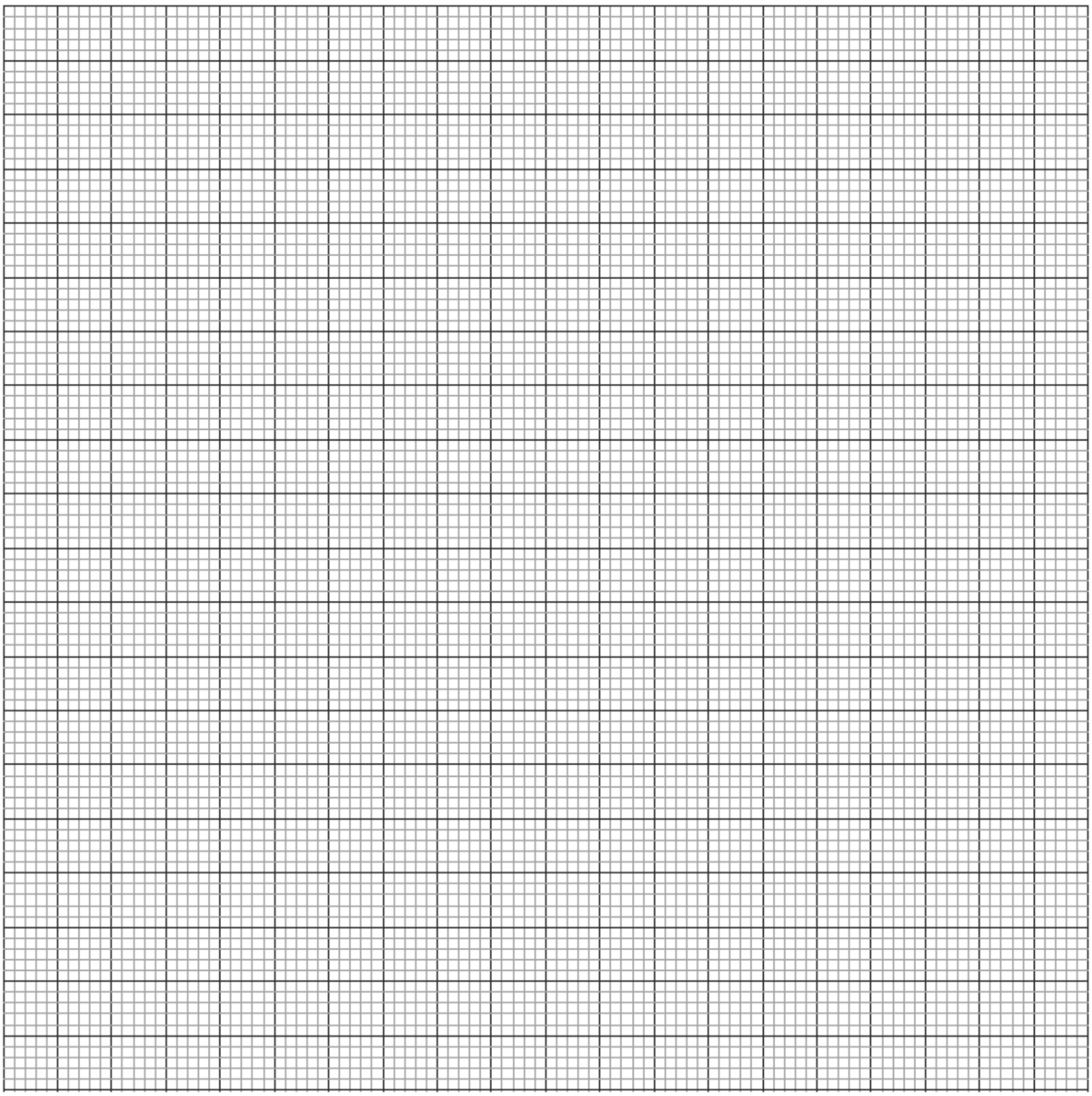
Height (cm)



3. Compare the value obtained with the value of acceleration due to gravity

*Value of **g** obtained from graph*	*Constant value of **g***

Questions

From the calculated slope value and the constant value of g = 9.8m/s^2 (or 980 cm/s^2) calculate the experimental error by using the following formula.

1.

$$Experimental\ Error = \frac{|Calculated\ value - Constant\ value|}{Constant\ value} \times 100$$

2.

$$Experimental\ Error = \frac{|Calculated\ value - Constant\ value|}{Constant\ value} \times 100$$

End of the lab exercise