Sample Cover Page

Hawassa University

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

Department of Physics

LAB REPORT

Experiment

TITLE OF THE EXPERIMENT

Date of experiment: ______________________

Date of submission: ______________________

Group No: __________

Group members:

Name	*ID NO*
1.	
2.	
3.	

Title: The simple pendulum

Objective The aim of this experiment is to determine the acceleration due to gravity (g) using simple pendulum

Theory: The simple pendulum consists of a heavy particle of matter usually a sphere called a bob suspended from a perfectly rigid point of support by a flexible, inextensible string (see fig. 5)

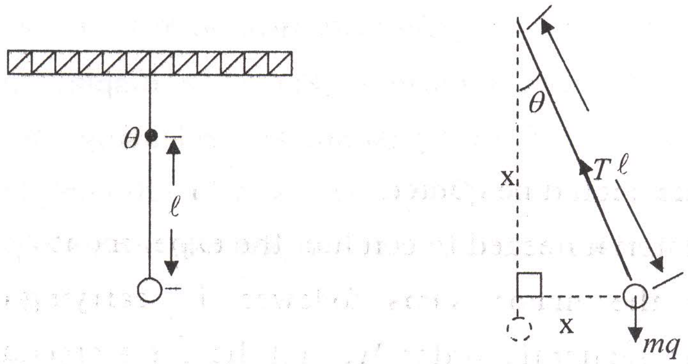

Fig. 5 Simple Pendulum

The external forces that act on the pendulum are its weight g and the tension T of the string. If the bob is displaced to be side making an angle θ with the vertical, the net force acting on the bob is mgsin θ. For small angles measured in sedans sin $\theta \approx \theta = x/e$ and thus from Hook's law of storing force,

$$-mgx/e = -kx, \text{ where } K \text{ is constnat}$$

The negative sign indicates the fact that the force acts in a-direction opposite to that of increasing X. The last equation shows that for small displacements X the motion of the simple pendulum is simple harmonic, whose period is:

$$T = 2\Pi\sqrt{m/k}, \text{ where } k = mg/\ell. \text{ Thus}$$

$$T = 2\Pi\sqrt{R/g} \text{ or } g = 4\Pi^2 \ell/T^2$$

This relation is used to determine g.

The graph of ℓ versus T^2 will be straight line whose slope is $g/4\Pi^2$

Materials:

A string of 3.5m long, a 1kg metallic spherical bob, a rigid support, a stop watch, supporting rod and a clamp are needed for this experiment.

Procedure:

The bob was connected to the string which was suspended from a calling. The pendulum string was clamped 50cm above the center of the bob so that it was capable of swinging from this point and not from the point where it was suspended as shown in Fig. 5. By displacing it about 5 to 8 degrees from its equilibrium position and releasing the bob was made to oscillate back and forth. The time taken for 20 complete cycles was measured using a stop watch. The above procedure was repeated for seven other different lengths.

Date and Analysis:

The measured values of time taken for 20 cycles and the corresponding lengths are shown on table I.

Table I

Length (m)	Time (20 vibration) (sec)	Period (Sec.)	T^2 (Sec.^{2})	Ratio (m/sec^2((ℓ/T^2))
50-	28	1.40	1.96	25/50
70-	34	1.70	2.80	24.20
90	39	1.95	3.80	23.68
110-	43	2.15	4.62	23.80
130	46	2.30	5.29	24.57
150	48	2.40	5.76	26.04
170-	51	2.55	6.50	26.15
350-	74	3.70	13.69	25.57

According to the theory the value of g is given by

$g = 4\Pi \ell / T^2$ Therefore, the ratio ℓ / T^2 was calculated for such set of observation, the results are tabulated.

The mean value of ℓ / T^2 is

$$\ell / T^2 = \frac{1}{8}\sum_{1}\left(\ell / T^2\right) = 24.94\ cm/\sec^2$$

and the standard deviation, δ is

$$\delta = \left\{ \frac{1}{7} \sum_i \left[\left(\ell/T^2\right)_i - \left(\overline{\ell/T^2}\right) \right]^2 \right\}^{\frac{1}{2}}$$

$= 0.997\ cm/s^2$

Result:

a) Algebraic method

The value of ℓ/T^2 is thus,

$$\ell/T^2 = (24.94 \pm 0.997)\, cm/sec^2$$

Multiplying the above result by 4 gives the value of g determined by the experiment. Thus,

$$g = 4\Pi^2\, \ell / T^2 = 39.48\,(24.94 \pm 0.997)\ cm/sec^2$$

$$g = (984.59 \pm 39.360)\ cm/sec^2$$

$$g = (985 \pm 39)\ cm/sec^2$$

b) Graphically: As derived in the theory section the graphic of ℓ versus T^2 should be a straight line whose slope is $g/4\Pi^2$. The graph is shown in fig. 6.

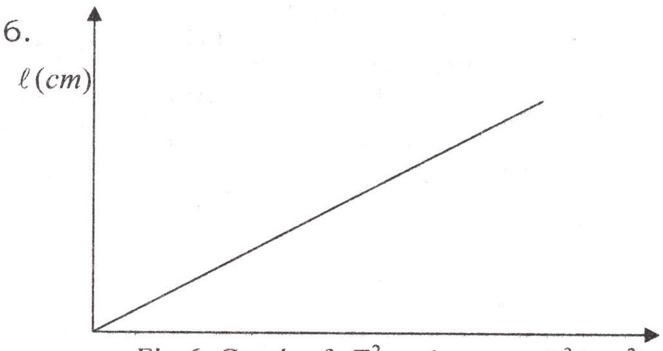

Fig.6. Graph of T^2 vs. ℓ

Errors: Possible sources of errors are in measuring the length ℓ from the center of the bob; the peg may not be perfectly rigid; the rate of the stop watch and recording the time, etc.

Conclusion:

The acceleration due to gravity found from the ± 0.2423, experiment is 985 cm/sec^2 with a standard deviation of $\pm 39.35 \pm 39.35\, cm/\sec^2$. This is in fact close to many published values of g. the alight variation from the usually quoted values, 980 cm/sec^2. Thus is in fact close to many published values of g. The alight variation from the usually quoted values, 980 cm/sec^2 can not be accounted from this experiment alone. For one thing one needs to have a reference value for our locality before any companions are made, since g varies with altitude and latitude.