

Experiment - 02

Objective:- To determine the value of acceleration due to gravity 'g' with the help of a bar pendulum (compound pendulum)

Apparatus used 1- Bar pendulum, Knife edge, stop watch, meter scale and graph paper.

Formula used 1- The acceleration due to gravity 'g' is given by

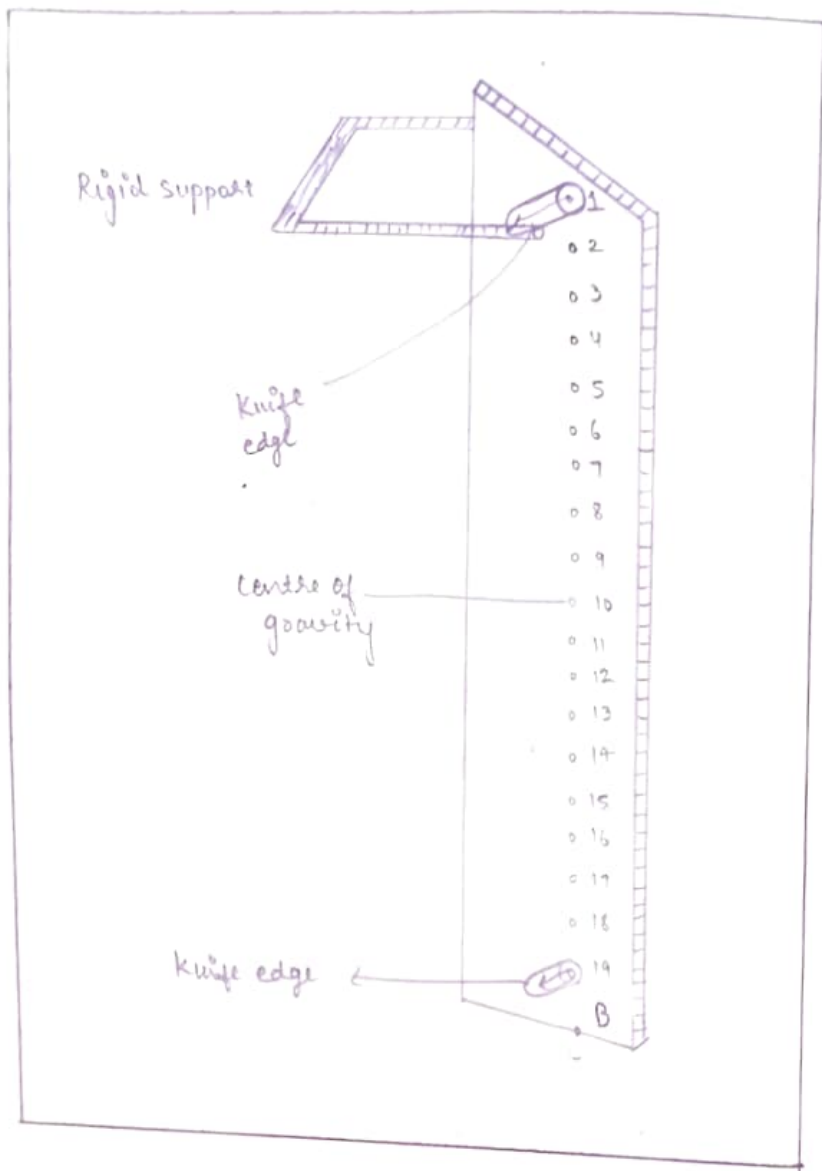
$$T = 2\pi \sqrt{\frac{L}{g}} \quad \text{or} \quad g = \frac{4\pi^2 L}{T^2}$$

where,  $T$  = time period

$L$  = distance b/w centre of suspension and oscillation.

(Effective length of bar pendulum)

Observation :- for the measurement of  $L$  and  $T$



Compound pendulum (Bar pendulum)

Expt. No. \_\_\_\_\_

| No. of hole | Distance (l) | No. of oscillation (n) | Min Time taken |     |           | periodic time<br>$T(\text{sec}) = \frac{T}{n}$ |
|-------------|--------------|------------------------|----------------|-----|-----------|------------------------------------------------|
|             |              |                        | Min            | sec | total (t) |                                                |
| 1.          | 45           | 20                     | 0              | 31  | 31        | 1.55                                           |
| 2.          | 40           | 20                     | 0              | 31  | 31        | 1.55                                           |
| 3.          | 35           | 20                     | 0              | 29  | 29        | 1.4                                            |
| 4.          | 30           | 20                     | 0              | 29  | 29        | 1.4                                            |
| 5.          | 25           | 20                     | 0              | 29  | 29        | 1.4                                            |
| 6.          | 20           | 20                     | 0              | 30  | 30        | 1.44                                           |
| 7.          | 15           | 20                     | 0              | 30  | 30        | 1.44                                           |
| 8.          | 10           | 20                     | 0              | 35  | 30        | 1.7                                            |
| 9.          | 5            | 20                     | 0              | 31  | 51        | 2.55                                           |

[B] After crossing the position of C-G

| No. of hole | Distance (l) | No. of oscillation (n) | Time taken |     |           | periodic time<br>$T(\text{sec}) = \frac{T}{n}$ |
|-------------|--------------|------------------------|------------|-----|-----------|------------------------------------------------|
|             |              |                        | Min        | sec | Total (t) |                                                |
| 1.          | 5            | 20                     | 0          | 47  | 47        | 2.35                                           |
| 2.          | 10           | 20                     | 0          | 35  | 35        | 1.7                                            |
| 3.          | 15           | 20                     | 0          | 27  | 27        | 1.33                                           |
| 4.          | 20           | 20                     | 0          | 27  | 27        | 1.33                                           |
| 5.          | 25           | 20                     | 0          | 26  | 26        | 1.3                                            |
| 6.          | 30           | 20                     | 0          | 26  | 26        | 1.3                                            |
| 7.          | 35           | 20                     | 0          | 26  | 26        | 1.3                                            |
| 8.          | 40           | 20                     | 0          | 29  | 29        | 1.44                                           |
| 9.          | 45           | 20                     | 0          | 29  | 29        | 1.44                                           |

Teacher's Signature \_\_\_\_\_

[A]

$$\text{total time } t_1 = 1.55 + 1.55 + 1.4 + 1.4 + 1.4 + 1.44 + 1.44 + 1.7 + 1.7$$

$$= 14.43$$

$$\text{mean value of } t_1 = \frac{14.43}{9} = 1.603 \text{ sec}$$

[B]

$$\text{total time } t_2 = 2.35 + 1.7 + 1.33 + 1.33 + 1.3 + 1.3 + 1.3 + 1.44 + 1.44$$

$$= 13.49$$

$$\text{mean value of } t_2 = \frac{13.49}{9} = 1.498 \text{ sec}$$

$$\text{Mean value of } T = \frac{t_1 + t_2}{2} = \frac{1.603 + 1.498}{2} = \frac{3.101}{2}$$

$$= 1.55 \text{ sec}$$

$$\text{value of } l = \frac{AC + BD}{2} = \frac{60 + 60}{2} = 60 \text{ cm}$$

$$L = 0.6 \text{ m}$$

$$g = \frac{4\pi^2 l}{T^2} = \frac{4 \times (3.14)^2 \times 0.6}{(1.55)^2} = \frac{23.66}{2.4}$$

$$g = 9.85 \text{ m/sec}^2$$

Expt. No. \_\_\_\_\_

- calculation 1- from graph,

$$L = \frac{AC + BD}{2} = 0.6 \text{ metres}$$

and,

$$T = 1.55 \text{ sec.}$$

$$\therefore g = \frac{4\pi^2 L}{T^2} = 9.8 \text{ m/s}^2$$

- Result 1- The value of acceleration due to gravity  
 $= 9.8 \text{ ms}^{-2}$

Sources of error and precautions 1-

1. Before starting the equipment, the knife edge is made horizontal.
2. The amplitude of oscillations should be kept small.
3. The time of oscillations should be counted at least for 40 oscillations.
4. The pendulum should vibrate only in a vertical plane.
5. Curves on the graph should be drawn smoothly.

Teacher's Signature

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Scale:- along X axis, 1 cm = 5 cm  
along Y axis, 1 cm = 0.25 sec

