Lab Report

Name of the Experiment	:	Compound pendulum and simple harmonic motion
Your Name	:	Md Sahadul Hasan Arian
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Name of the Lab Partner	:	
Date	:	September 19, 2023

Instructor's comments:

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$\theta = 5^\circ$

Table 1

Hole Number		Distance from COM d (cm)	Time for 10 oscillations (s)		Mean time t (s)	Time Period $T=\frac{t}{10}$ (s)
Edge A	1	6·7	25·41	25·90	25·655	2·56
	2	11·4	18·97	19·03	19·000	1·90
	3	17·1	16·66	16·61	16·635	1·66
	4	22·8	15·65	15·59	15·620	1·56
	5	28·5	15·17	15·22	15·195	1·51
	6	34·2	15·43	15·40	15·415	1·54
	7	39·9	15·63	15·67	15·650	1·56
	8	45·6	15·97	15·95	15·960	1·59
Edge B	1	5·7	26·65	26·63	26·640	2·66
	2	11·4	18·71	18·74	18·725	1·87
	3	17·1	16·38	16·35	16·365	1·63
	4	22·8	15·69	15·73	15·710	1·57
	5	28·5	15·27	15·32	15·295	1·52
	6	34·2	15·49	15·47	15·480	1·54
	7	39·9	15·71	15·76	15·735	1·57
	8	45·6	16·01	16·07	16·040	1·60

**Note : COM means Center Of Mass.

Calculation :

Edge A

mean time $(t) = \frac{(T_{10})_1 + (T_{10})_2}{2} = \frac{25.41 + 25.90}{2} = 25.655$ sec

Time period, $T = \frac{t}{10} = \frac{25.655}{10} = 2.56$ sec

Edge B

mean time $(t) = \frac{(T_{10})_1 + (T_{10})_2}{2} = \frac{18.71 + 18.74}{2} = 18.725$ sec

Time period, $T = \frac{t}{10} = \frac{18.725}{10} = 1.87$ sec

TABLE 2 (From the graph)

Observations from the horizontal lines	L (m)	T (sec)	$g = 4\pi^2 \frac{L}{T^2}$ (m/s²)	Mean g (m/s²)	K (m)	Mean K (m)
1. ABCD	$L = \frac{AC + BD}{2}$ 0·643 m	1·57	10·29	10·345	0·642	0·633
2. A'B'C'D'	$L' = \frac{A'C' + B'D'}{2}$ 0·625 m	1·54	10·40		0·624	

Calculation.

A = 43·5 cm	A' = 38 cm
B = 21 cm	B' = 23·5 cm
C = 21·6 cm	C' = 25 cm
D = 42·5 cm	D' = 38·5 cm

$$L = \frac{AC+BD}{2} = \frac{(A+C)+(B+D)}{2} = \frac{(43.5+21.6)+(21+42.5)}{2} = 64.3\text{ cm} = 0.643\text{ m}$$

$$L' = \frac{A'C'+B'D'}{2} = \frac{(A'+C')+(B'+D')}{2} = \frac{(38+25)+(23.5+38.5)}{2} = 62.5\text{ cm} = 0.625\text{ m}$$

$$\text{mean } g = \frac{g_1+g_2}{2} = \frac{10.29+10.40}{2} = 10.345\ \text{m/s}^2$$

$$K = \sqrt{AC \times BD} = \sqrt{(A+C)\times(B+D)} = \sqrt{(43.5+21.6)\times(21+42.5)} = 64.2\text{ cm} = 0.642\text{ m}$$

$$K' = \sqrt{A'C' \times B'D'} = \sqrt{(A'+C')\times(B'+D')} = \sqrt{(38+25)\times(23.5+38.5)} = 62.4\text{ cm} = 0.624\text{ m}$$

$$\text{mean } K = \frac{K+K'}{2} = \frac{0.642+0.624}{2} = 0.633\text{ m}$$

Questions:

1. According to your understanding and the data you have obtained in this experiment, explain the time variation with different suspension of the compound pendulum.

As per theory, I know $T = 2\pi\sqrt{\frac{I}{mgl}}$ and as per data, I can see due to long distance from C.O.M, there is first decrease in Time period then there is an increase. This is due to the ~~increase in~~ torque when there is more distance, that's why when torque ↑, time period ↑.

2. Do you think compound pendulum in comparison to simple pendulum would show better oscillatory motion in air for measurement of g? Why?

No, I don't think compound pendulum gives better oscillatory motion in comparison with simple pendulum; the reason for such comment is because I could only have $g > 10$ in this experiment whereas in simple pendulum I got close to 9.81. This is because of the extra weight distribution in the Compound pendulum.

Graph. 1

Roll No.