NEATH PORT TALBOT COLLEGE
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School of Maths & Science
Science Practical

Oscillating Paper Clips in a Compound Pendulum

◆ Aim

In this experiment you are to investigate the oscillations of a compound pendulum which consists of a chain of paper clips.

◆ Safety

Control Measures

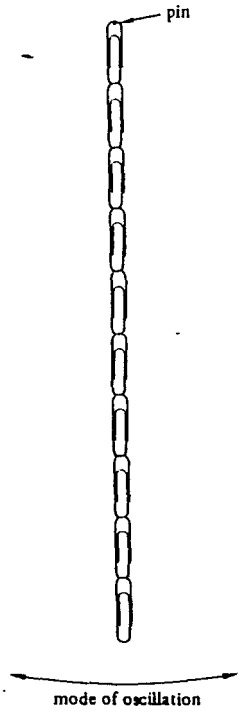
- You are reminded of the need of good laboratory practice in order to maintain a safe working environment.
- **Goggles must be worn at all times.**

Hazards

General Danger Make sure that the retort stand is securely fastened to the bench using a G – clamp.

◆ Apparatus Required

30 large paper clip, retort stand and clamp, cork and pin and stopwatch.



◆ Procedure

1. Arrange the apparatus, as shown in the diagram, using 10 paper clips. Ensure that the links are all free to move relative to one another.

2. Set the chain oscillating with a small amplitude. Do this by displacing the bottom link a small amount while keeping the chain straight. When oscillating correctly the chain should swing smoothly. Measure and record T, the period of oscillation in the table below.

3. Make up the chain of paper clips to be 30 links long. Ensure that the paper clips are all the same way up. Measure and record the new period of oscillation below.

4. Repeat the procedure until you have a total of five sets of corresponding values for T and N, the number of links in the chain, for $10 < N \leq 30$. Record your results in the table along with the corresponding values of $\log_{10} T$ and $\log_{10} N$.

N	**T_1 / s**	**T_2 /s**	**T_{av} / s**	**T_{av} /s (one oscillation)**	**$\log_{10}$ (T /s)**	**$\log_{10}$ N**
10						
30						

5. Plot a graph of $\log_{10} T$ (y-axis) against $\log_{10} N$ (x-axis).

6. Theory suggests that the period T is given by:

$$T=kN^n$$

where k and n are constants.

a. Use your graph to determine a value for n.
b. Justify the number of significant figures in your final answer.
c. Determine the percentage uncertainty in the value of n.

d. Using the corresponding values of any point on your line, or otherwise, determine a value for k.

7. The value of k is given by:

$$k = 2\pi \sqrt{(aL/g)}$$

where L is the length of one link of the chain
g is the acceleration of free fall (9.8 ms^{-2})
a is another constant.

a. Determine and record the value of L. Explain clearly how you ensured that this measurement was as accurate as possible.
b. Determine the value of a.