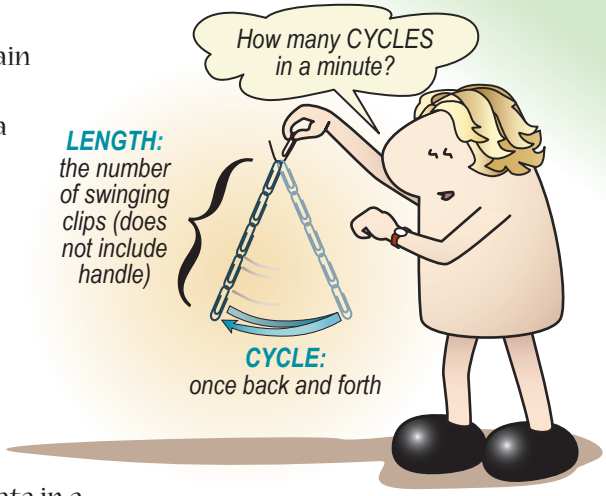
Another FREE SAMPLE LAB from TOPS LEARNING SYSTEMS!

This **TOPS Idea** is taken from an original series of black-and-white line masters, adapted to stand alone as an independent mini-lesson. Please purchase our original book to get the whole in-depth program.

paper clip pendulums

…adapted from **PENDULUMS #34** by TOPS Learning Systems

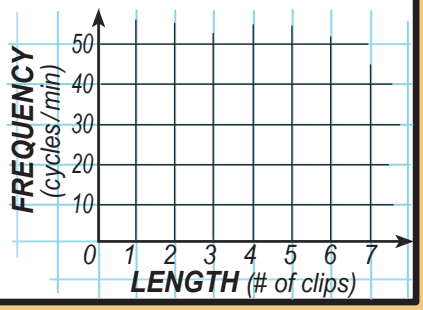
1. Make a chain of paper clips to swing like a pendulum. This scientist is finding the frequency of a 5-clip chain.



2. List your data in a table.

LENGTH (# of clips)	FREQUENCY (cycles/min)
1	208
2	
3	
4	

3. Graph your results.



OBJECTIVE

To graph how the frequency of a paper-clip pendulum changes with length.

LAB NOTES

Photocopy the lab for each student or lab team.

Step 1. Students can pull a "handle" clip open into a hook as a reminder not to count its length.

Step 2. It helps to start with a slower, easier-to-count 16-link chain and work up towards shorter, faster chains. High frequency pendulums can be estimated by counting cycles for 10 seconds and multiplying by 6. The frequency of a single clip chain is given as 208 c/m. This applies *only* to paper clips of standard length, as illustrated below.

EXTENSION

Pendulums are mathematically beautiful! Can you find frequency relationships among chains of different lengths (within limits of experimental error)?

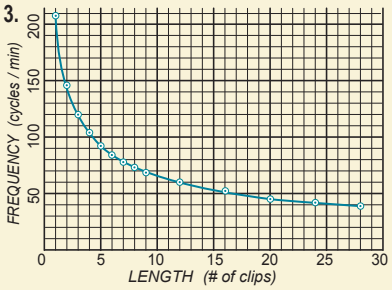
Changing length by a factor of 4 changes frequency by a factor of 2. Changing length by a factor of 9 changes frequency by a factor of 3. (Changing length by **n** changes frequency by $\sqrt{n}$.)

ANSWERS

2. Length / Frequency:

1 / 208	5 / 92	9 / 69
2 / 146	6 / 84	12 / 60
3 / 120	7 / 78	16 / 52
4 / 104	8 / 73	20 / 46
		24 / 42
		28 / 39

3.



MATERIALS

- Paper clips of uniform size and weight.
- A clock with a second hand.
- Graph paper.

More science with simple things at www.topscience.org

Find more at **www.TOPScience.org**!

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04 BALANCING (gr 6-11)
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06 METRIC MEASURE (gr 8-12)
07 MATH LAB (gr 7-12)
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39 Green Thumbs: CORN & BEANS (gr 4-12)
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41 PLANETS & STARS (gr 7-12)
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71 Primary LENTIL SCIENCE (gr K-3)
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73 GET A GRIP Workstation (gr K-6)
91 GLOBAL TOPS (gr 3-10)
100 TRIPLE MAGNIFIER (gr 3-12)
200 CARTESIAN DIVER (adapts K-12)