

## Pendulum Activity

You saw how important the pendulum was to keeping Bain's clock going. A pendulum is a device that swings back and forth in a consistent and measurable pattern, which is why they are so good for timekeeping.

Our activity is in 2 stages:

A – make a pendulum

B – experiment to test and record oscillation patterns (swings)

### Kit:

1. A length of string about 2–3 feet (0.61–0.91 m) long
2. 1 metal paperclip or 1 piece of metal wire 2 inches (5.1 cm) long
3. 3-4 metal nuts 1/4 inch (0.64 cm) in size (or similar weighted object with a hole for hanging on a hook)
4. Pencil
5. A table or other fixed surface
6. Sticky Tape (eg masking tape. Check that the surface you are planning to use will not be damaged by the sticky tape)
7. Stopwatch or timer
8. Somewhere to record you results (or print this document and use the table provided)



Image by Gerd Altmann, Pixabay

### How to do it A – make a pendulum

#### 1. Fix your pencil (or anchor):

Lay a pencil on a tabletop, at right angle to the table edge, with about 2.5cm extending over the edge, and fix it in place with the tape. The pencil will anchor your pendulum, so be sure to use enough tape to secure it and keep it from moving around.

The pencil should stay in place if you flick it with your finger.



#### 2. Prepare your string:

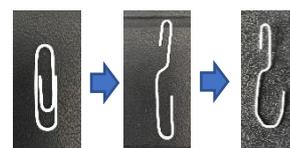
- a. tie a loop about 1 inch (2.5 cm) in diameter at one end of the string. The knot should not slip as the loop needs to remain loose to move freely on the pencil.
- b. Hang the loop on the pencil and pull the string straight down to work out the length to cut. It will need to hang down from the pencil and leave enough room for a hook and weight to hang freely without touching the floor. (Using a table with a height of 75cm, I used a 70cm string.)
- c. Tie a slightly smaller loop at the other end of the string. This is where the hook will attach. (see kit picture). The finished knotted string length was 60cm.

#### 3. Make your hook

- a. If using a metal paper clip, gently bend the inner hook upwards, making the paperclip into an 'S' shape. The smaller hook should attach to the string and the larger hook will be for the nut or pendulum weight. (this larger hook might need re-shaped a little).

**OR...**

- b. If you are working with wire, use pliers to bend it into shape.
- c. Having made the hook, hook it onto the smaller loop at the bottom end of the string.



**4. Add your weight**

Use a standard metallic nut as the weight for your pendulum. The hole in the centre makes a nut ideal for sliding onto the hook (but you may find other suitable weights to try). Do not close the hook around the nut so you can easily change the weight(s) during the experiment. (You might want to gather a variety of possible weights to see what works best).

**5. Test the Pendulum**

With the larger string loop on the pencil anchor, hold the weight to one side, with the string straight and at about 45° from vertical. Let go and watch the pendulum swing.



**How to do it B – Oscillation experiment**

Now that your pendulum is oscillating, or swinging back and forth, lets do a test to see what happens when you make some changes.

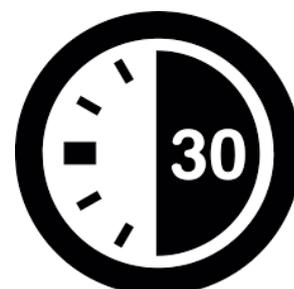
We're going to find out how many swings the pendulum makes in a given time (let's say 30 seconds), and how that number is affected by changes in weight or launch angle.

1. Have a timer set to 30 seconds, ready to start when you launch your pendulum
2. Keeping the pendulum as you made it, with your original weight, launch it from the same 45° angle, and start the timer.
3. Count how many swings it makes in 30 seconds. And note it down.
4. Repeat this 3 or 4 times, recording the number of swings each time.
5. Calculate the average number of swings per 30 seconds. (Add up all the swing totals, and divide that total by the number of times you did it)

So now you've found the average number of swings with one weight and a 45° launch position. You may want to use a table like the one below to record this.

**Change the launch angle**

6. Keeping the same weight, try increasing the launch angle to 90°. So your string will start straight along the edge of the table before you let go.
7. Repeat steps 3 - 5 above and record the results



**Change the weight**

8. Add more nuts, or a heavier object to your pendulum
9. Launch from a 45° angle.
10. Repeat steps 3 - 5 above and record the results

**Change both**

11. Keeping the heavier weight, launch from a 90° angle.
12. Repeat steps 3 - 5 above and record the results

Share your pics or results using **#HunterianFromHome** at:

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**What did you discover?**

**What other things could you change about your pendulum to develop the experiment?**

**Recording sheet**

Attempt	Small weight, 45° angle	Small weight, 90° angle	Large weight, 45° angle	Large weight, 90° angle
	No. of swings in 30 seconds			
1				
2				
3				
4				
Total swings				
Average no. swings: (Total / # attempts)				