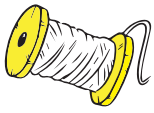
The Science Lab

ACTIVITY SHEET 1: HOW TO MAKE A SIMPLE PENDULUM

Aim:

In this activity you are going to make a simple pendulum, and observe how it moves.

You will need:



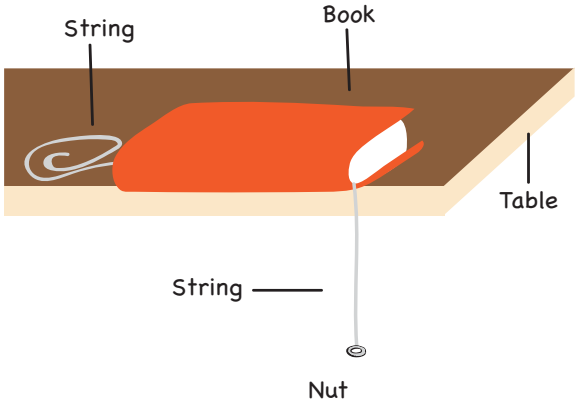
String
(about 1 m)

One weight
(metal washer or nut)

Heavy book

What to do:

1. Tie the weight to the end of a string.
2. Suspend the weight so it can swing freely. You can use a heavy book on a table, or tie the string to a hook. Make sure the weight can swing freely without any obstructions.
3. Make the weight swing by pulling it to one side, and releasing it. Make sure that the string is taut as you do this, and release the weight gently without applying any force.
4. Observe the movement of the weight. How does it move?



Discuss:

- Can you think of other objects which move periodically?

- Do you remember swinging on a swing? In what ways is it similar to a pendulum? In what ways is it different?

- How does the swing move during one oscillation — does it move at the same speed throughout? Where does it seem to move the fastest? Does it seem to stop anywhere?

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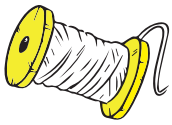
ACTIVITY SHEET II: HOW TO MEASURE THE TIME PERIOD OF A PENDULUM

Aim:

In this activity you are going to measure how long a pendulum takes to complete one oscillation. One complete back and forth movement is called an oscillation. The time taken for one complete oscillation is called the **time period of the pendulum**.

You will need:



String (about 1 m)

One weight (metal washer or nut)

Stopwatch (or phone with timer)

What to do:

1. Make the weight swing as you did in Activity Sheet I.
2. Use a stopwatch to measure how long it takes to make 10 complete oscillations.
3. Make sure you count an oscillation when the pendulum bob (or weight) is at the same point each time. (Tip: It is convenient to count a completed oscillation when the pendulum bob returns to the point where you released it from.)
4. Record your observations in the table.

Trial	Time for 10 oscillations	Time for 1 oscillation
1.		
2.		
3.		
Average time period		

5. Calculate the time period for one oscillation by dividing the time you measured by 10.
6. You can repeat this a few times and then calculate the average time period for one oscillation. (Tip: To calculate the average, add up the time for one oscillation for each trial and divide by the number of trials).

Discuss:

(a) Measuring time period:

- Was the time period of one oscillation the same in each trial? Why do you think there are differences?

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- Do you think you measured the time for 10 oscillations accurately? What could you do to measure the time more accurately?

- Is it better to measure 100 oscillations or 10 oscillations to find the time period? Why?

(b) Making the pendulum move faster:

- Do you think you can reduce the time period of the pendulum (make the pendulum move faster)? How?

- Do you think the position from which you let it go (its initial displacement) makes a difference to the time period of the pendulum? Why do you think so?

- Do you think the length of the string makes a difference to the time period of the pendulum? Why do you think so?

- Do you think the weight of the pendulum makes a difference to the time period of the pendulum? Why do you think so?

- Can you think of other factors which could change the time period of the pendulum?

- How would you test your ideas?

Design: Vidya Kamalesh

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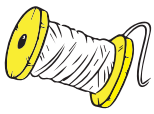
The Science Lab

ACTIVITY SHEET III: DOES THE TIME PERIOD OF A PENDULUM DEPEND ON THE INITIAL DISPLACEMENT?

Aim:

In this activity, you will test whether the initial displacement of the pendulum makes a difference to its time period. For a fair test, make sure that you change only the initial displacement, while keeping the pendulum exactly the same in all other ways.

You will need:

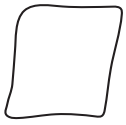


String (about 1 m)

One weight (metal washer or nut)

Stopwatch (or phone with timer)

Protractor



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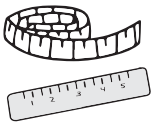
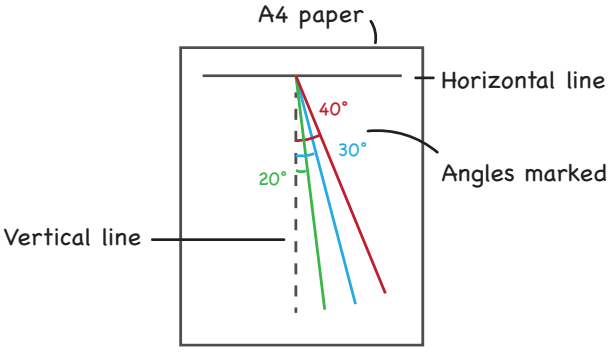
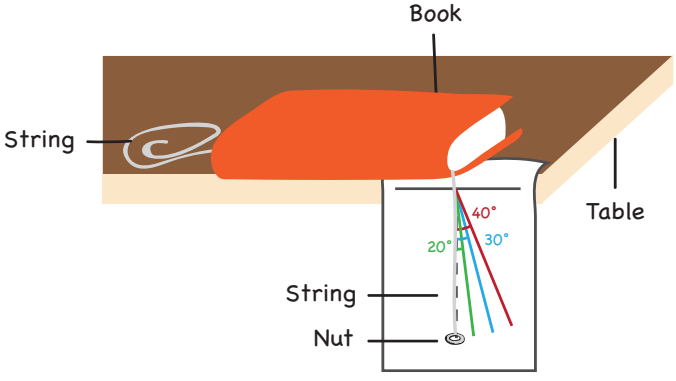


Metre scale or tape measure

What to do:

1. Measure the length of the pendulum — the distance from the point it is suspended till the point it is tied to the metal nut. Note this down.
2. Draw a vertical line on the paper and mark the angles at 20°, 30°, and 40°. You can use these markings to check where you are releasing the pendulum weight from.
3. Fix the paper behind the pendulum so that the string is in line with the vertical line when it is stationary (see image of set-up). The pendulum should hang free and not touch the paper.
4. Release the weight from the 20° position. Make sure the pendulum is moving parallel to the paper and not touching it.
5. Measure the time for 10 oscillations like you did in Activity Sheet II.
6. Conduct at least three trials, releasing the weight from the 20° position. Calculate the average time period.
7. Repeat these steps to find the average time period when you release the pendulum weight from the 30° position, and then the 40° position.





PTO

Record: your observations of time taken for 10 oscillations in each trial. Use this to calculate the time for one oscillation in each trial. Then calculate the average time period for each angle of release.

Angle of release	Trial	Time for 10 oscillations	Time for 1 oscillation	Avg. Time Period
20°	1.			
	2.			
	3.			
30°	1.			
	2.			
	3.			
40°	1.			
	2.			
	3.			

Discuss:

- What did you keep the same in this experiment? What did you change?

  What I kept the same:

  Length of the pendulum = _____ cm

  Number of nuts used as the weight =

  What I changed:

- Did the time period of the pendulum change when you changed the position you released it from?

- If yes, did the time period of the pendulum increase or decrease when you increased its initial displacement?

- What can you conclude from this experiment? Does the time period of a pendulum depend on the initial displacement of the weight?

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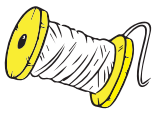
ACTIVITY SHEET IV: DOES THE TIME PERIOD OF OSCILLATION DEPEND ON THE LENGTH OF THE PENDULUM?

Aim:

In this activity you are going to test whether the length of the pendulum makes a difference to its time period. For a fair test make sure that you are changing only the length, while keeping the pendulum exactly the same in other ways.

You will need:

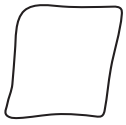


String (about 1 m)

1 weight (metal washer or nut)

Stopwatch (or phone with timer)

Protractor



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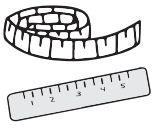
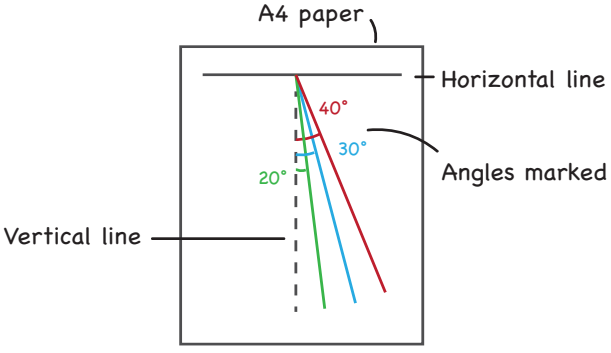
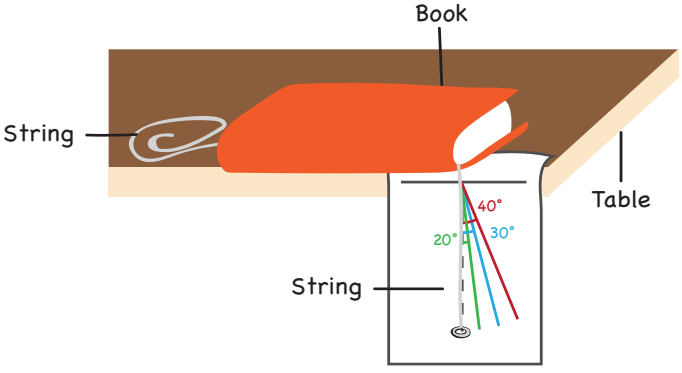


Metre scale or tape measure

What to do:

1. Measure the length of the pendulum. Note this down.
2. Decide where you will release the weight from. Note down this position (this is the angle marked on the paper you fixed behind the pendulum in Activity Sheet III). You need to release the weight from the same position in each trial.
3. Release the weight from this position and find the average time period like you did in Activity Sheets II and III.
4. Increase the length of the pendulum by 10 cm. Measure the length and note it down.
5. Find the time period for the pendulum again. Make sure you are releasing the weight from the same position you did in Step 2.
6. Increase the length of the pendulum by another 10 cm. Measure the length and note it down.
7. Find the time period for the pendulum again. Make sure you are releasing the weight from the same position you did in step 2.





PTO

Record: your observations from steps 1 to 7:

Length of string (cm)	Trial	Time for 10 oscillations	Time for 1 oscillation	Avg. Time Period
	1.			
	2.			
	3.			
	1.			
	2.			
	3.			
	1.			
	2.			
	3.			

Discuss:

- What did you keep the same in this experiment? What did you change?
  What I kept the same:
  Angle from where I released the pendulum = _____
  Number of nuts used as the weight =
  What I changed:

- Did the time period of the pendulum change when you changed its length?

- If yes, did the time period of the pendulum increase or decrease when you increased its length?

- What can you conclude from this experiment? Does the time period of a pendulum depend on its length?

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ACTIVITY SHEET V: DOES THE TIME PERIOD OF OSCILLATION DEPEND ON THE WEIGHT OF THE PENDULUM?

Aim:

In this activity you are going to test whether the weight of the pendulum bob makes a difference to its time period. For a fair test, make sure that you are changing only the weight, while keeping the pendulum exactly the same in other ways.

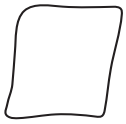
You will need:

String (about 1 m)

3 equal weights (metal washers or nuts)

Stopwatch (or phone with timer)

Protractor



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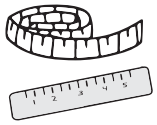

Metre scale or tape measure

What to do:

1. Make the pendulum by attaching one metal nut to the end of the string.
2. Measure the length of the pendulum. Note this down. You will be keeping this the same throughout this experiment
3. Decide where you will release the weight from. Note down this position (marked on the paper you fixed behind the pendulum as in Activity Sheets III and IV). You need to release the weight from the same position in each trial.
4. Release the weight from this position and measure the time period like you did in Activity Sheets II, III, and IV.
5. Increase the weight of the pendulum by adding another metal nut to the end. Make sure you adjust the length so that it remains exactly the same as before.
6. Measure the time period for the pendulum again. Make sure you release the weight from the same position as you did in Step 3.
7. Increase the weight of the pendulum by adding a third metal nut to the end. Make sure you adjust the length so that it remains exactly the same as before.
8. Measure the time period for the pendulum again. Make sure you release the weight from the same position as you did in Step 3.

How to tie the 3 nuts correctly

PTO

Record: your observations from steps 1 to 7:

No. of equal weights	Trial	Time for 10 oscillations	Time for 1 oscillation	Avg. Time Period
1	1.			
	2.			
	3.			
2	1.			
	2.			
	3.			
3	1.			
	2.			
	3.			

Discuss:

- What did you keep the same in this experiment? What did you change?
  What I kept the same:
  Angle from where I released the pendulum = _____
  Length of the pendulum =
  What I changed:
- Did the time period of the pendulum change when you changed the weight of the bob?
- If yes, did the time period of the pendulum increase or decrease when you increase the weight of the bob?
- What can you conclude from this experiment? Does the time period of a pendulum depend on the weight of the bob?

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ACTIVITY SHEET VI: DISCUSS TOGETHER

Discuss together:

1. What can you conclude from Activities III, IV and V? What affects the time period of a pendulum?

2. Were your initial predictions about changing the time period of the pendulum correct?

3. What other factors do you think might affect the time period of a pendulum? How would you test them?

4. Why do we change only one thing about the pendulum in each experiment? What would happen if you changed more than one thing at a time in an experiment?

5. If you were to choose a swing to swing on, which one would you choose — the longer one or the shorter one? Why?

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