## Question: How can you change the period of a pendulum?

In this Investigation, you will:

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- 1. Learn how to describe the motion of a pendulum.
- 2. Explore how changes in the length, mass, and amplitude of a pendulum affect its motion.



As you watch moving things, you see two kinds of motion. One kind of motion goes from one place to another, like a person walking from home to school. This is **linear motion**. We use words like distance, time, speed, and acceleration to describe linear motion.

The second kind of motion is motion that repeats itself over and over, like a child going back and forth on a swing. This motion is called **harmonic motion**. The word harmonic comes from the word *harmony* which means "multiples of."

Many moving things have both linear and harmonic motion. A bicycle, for example, moves forward, but the wheels and pedals go around and around in harmonic motion.

You will need to learn some new words in order to describe and measure harmonic motion:



- A **cycle** is one complete back and forth motion. For a pendulum, you could define a cycle as starting when the pendulum is all the way to the left. The cycle would be complete when the pendulum has swung as far to the right as it will go and has come all the way back to the left again.
- The **period** is the time it takes to complete one full cycle. The period of a pendulum is the time it takes for the pendulum to swing from left to right and back again.
- The **amplitude** describes the size of the cycle. The diagram below shows the difference between a pendulum with a small and a large amplitude. For a pendulum, the amplitude is measured as the maximum distance or the maximum number of degrees that it moves from the center.



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Question: How can you change the period of a pendulum?

- Define the following terms
  - o Amplitude –
  - o Cycle
  - o Frequency –
  - o Period –

Part I – What happens to the period when you change the mass of the pendulum? String Length = \_\_\_\_\_

Amplitude = \_\_\_\_\_

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Number of Washers	Time for Ten Cycles (seconds)	Period (seconds)	
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1. How does adding mass to the pendulum affect its period?

Part II – What happens to the period when you change the amplitude of a pendulum? Number of Washers = \_\_\_\_\_\_ String Length = \_\_\_\_\_\_

Amplitude (degrees)	Time for Ten Cycles (seconds)	Period (seconds)		

2. How does changing the amplitude of the pendulum affect its period?

Part III – What happens when you change the string length of the pendulum? Amplitude = \_\_\_\_\_\_ Number of Washers = \_\_\_\_\_

String Length (cm)	Time for Ten Cycles (seconds)	Period (seconds)	
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- 3. How does changing the string length of the pendulum affect its period?
- **4.** Make a graph of each of your data tables. Use the following graphs, on each graph the variable you changed should go on the X-axis. The period of the pendulum should go on the Y-axis. The scale for the period should be the same for all three graphs. Remember to label you axes and give each graph a title.

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A-I The Pendulum

**Answer Sheet** 



## Questions

Which pictures show periodic motion?

- a. A girl running a 100 m race
- b. The swinging pendulum of a clock
- c. An ocean wave rising and falling
- d. A boy riding a swing
- e. a truck moving down the street.
- Match the four measured periods with the most likely pendulum.

A B C D	Group	Period	Pendulum
P P P P	1	1.0 sec	I
	2	1.2 sec	
	3	1.4 sec	
	4	1.7 sec	

There are several periodic motions associated with Earth. One is that Earth rotates once every 24 hours. List at least two other examples, and give the period of each.

Which of the four experiments has the longest period? Why?



CHALLENGE! A pendulum swings past its pole 20 times in 18 seconds. What is the period of the pendulum?

A-I The Pendulum

**Answer Sheet** 





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