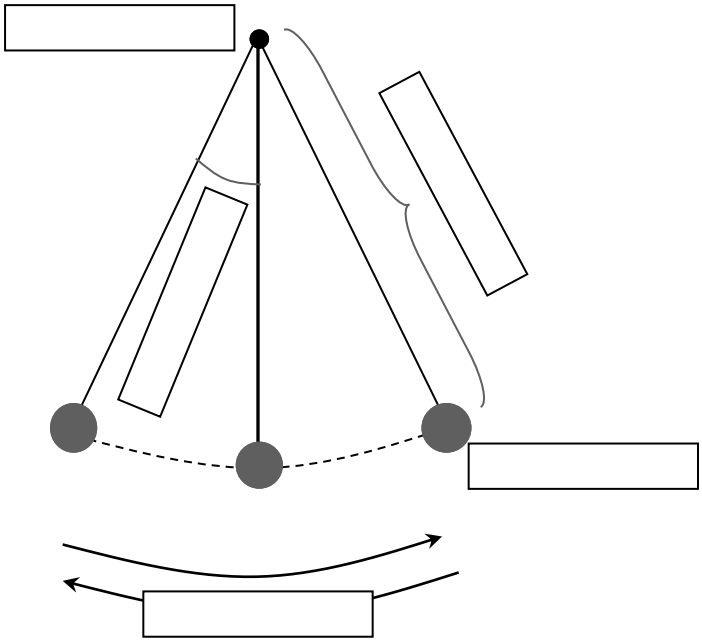
BACK AND FORTH

Name_____ Date_____

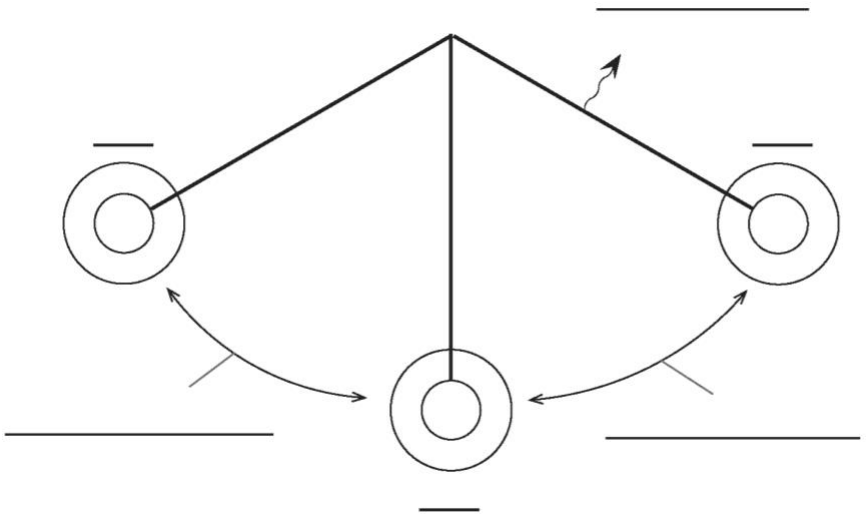
Warm Up

1. Use the word bank below to label the parts of the pendulum:

   EQUILIBRIUM PIVOT POINT LENGTH AMPLITUDE BOB PERIOD



2. Label the diagram below with the locations where gravitational potential energy (GPE), kinetic energy (KE), and thermal energy are found:



Name_____ Date_____

3. Refer to the image in question 2 to answer the following questions:

- Where will the pendulum have the greatest GPE?

- Where will it have the greatest KE?

- What happens to the GPE as the pendulum moves down?

- What happens to the KE as the pendulum swings up?

- Why does the pendulum eventually stop?

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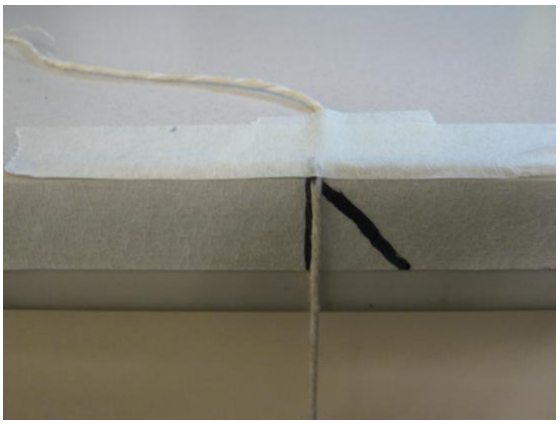
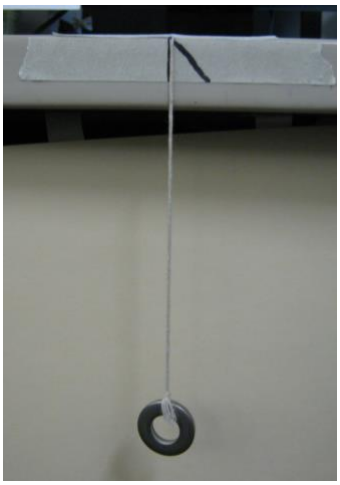
Part 1: Testing the Pendulum (Control)

1. Take the pendulum with one washer and hang it off the table so that the 15 cm mark rests on the edge of the desk and the string is parallel to the vertical line on the tape. (see images below)





2. Move the washer up and to the side so that the string matches the 45 degree angle line.
3. Release the pendulum and use the stopwatch to time the period (time to swing back and forth) of 3 swings.
4. Repeat the experiment three times, and calculate the average of the times you measured.
5. Record your data in tables 1.a and 1.b below

Table 1.a	
Number of washers (mass)	
Length of string	
Amplitude (release angle)	

Table 1.b	
Trial number	**Period time** (seconds)
Trial 1	
Trial 2	
Trial 3	
Average	

6. You will use the data you collected in this experiment as your control measurement. You will compare the data you collect in the next three parts to the control measurement data to draw conclusions.

Name_____ Date_____

Part 2: Changing the Mass

Now we're going to change one independent variable: the mass of the bob. We will not change the length of the string nor the angle of displacement.

1. Take the pendulum with two washers and hang it off the table so that the 15 cm mark rests on the edge of the desk and the string is parallel to the vertical line on the tape.
2. Move the washers up and to the side so that the string matches the 45 degree angle line.
3. Release the pendulum and use the stopwatch to time the period (time to swing back and forth) of 3 swings.
4. Repeat the experiment three times, and calculate the average of the times you measured.
5. Record your data in tables 2.a and 2.b below.

Table 2.a	
Number of washers (mass)	
Length of string	
Amplitude (release angle)	

Table 2.b	
Trial number	**Period time** (seconds)
Trial 1	
Trial 2	
Trial 3	
Average	

6. How does the change in mass (changing the number of washers) affect the period of the pendulum swing?

Name_____ Date_____

Part 3: Changing the Pendulum's Length

Now we're going to change a different independent variable: the length of the pendulum's string. Notice that we're going back to a single washer pendulum, and we are leaving the angle of displacement unchanged.

1. Take the pendulum with one washer and hang it off the table so that the 30 cm mark rests on the edge of the desk and the string is parallel to the vertical line on the tape. Tape it in place.
2. Move the washer up and to the side so that the string matches the 45 degree angle line.
3. Release the pendulum and use the stopwatch to time the period (time to swing back and forth) of 3 swings.
4. Repeat the experiment three times, and calculate the average of the times you measured.
5. Record this time in tables 3.a and 3.b below.

Table 3.a	
Number of washers (mass)	
Length of string	
Amplitude (release angle)	

Table 3.b	
Trial number	**Period time** (seconds)
Trial 1	
Trial 2	
Trial 3	
Average	

6. How does the change in the length of the string affect the period of the pendulum swing?

Name_____ Date_____

Part 4: Changing the Pendulum's Amplitude

This time we will return the pendulum's mass and string length to the original setup, and change the angle at which we release the pendulum—the amplitude.

1. Take the pendulum with one washer and hang it off the table so that the 15 cm mark rests on the edge of the desk and the string is parallel to the vertical line on the tape.
2. Draw a line beginning at the top of the vertical line and making a 22.5 degree angle to the right. This line will lie exactly between the vertical line and the 45 degree line.
3. Move the washer up and to the side so that the string matches the 22.5 degree angle line.
4. Release the pendulum and use the stopwatch to time the period (time to swing back and forth) of 3 swings.
5. Repeat the experiment three times, and calculate the average of the times you measured.
6. Record this time in tables 4.a and 4.b below.

Table 4.a	
Number of washers (mass)	
Length of string	
Amplitude (release angle)	

Table 4.b	
Trial number	**Period time** (seconds)
Trail 1	
Trial 2	
Trial 3	
Average	

7. How does the change in the angle of the initial displacement affect the period of the pendulum swing?