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AP Physics C: 8.2 Pendulum Period

1. No matter what mass you hang at the end of a pendulum it has the same period, why?

because gravity acc all mass at the same rate.

2. Explain the difference between frequency and period.

3. What is the unit for frequency and what does it mean in real words?

Hz in real words it's cycles/sec

4. What are the formulas for the period of a pendulum?

$$T = 2\pi\sqrt{\frac{L}{g}} \quad T = \frac{1}{f}$$

5. The period of a pendulum is 2.5 seconds, what is the frequency of the pendulum? (ans: 0.4 Hz)

6. A pendulum completes 3 cycles every second. What is the frequency and period of the pendulum? (ans: 3 Hz, 0.333 secs)

7. You spot a ginormous pendulum, if the length of the pendulum is 7.2 m,

- a. Calculate the period? (ans: 5.386 seconds)

- b. If the length of the pendulum was doubled, how does that change the period?

_____ Doubles it _____ increases by $\sqrt{2}$ _____ decreases by $\sqrt{2}$

8. When I went to the Natural Science Museum of Houston they had this giant pendulum that was 4 stories tall, if each story was 11-feet tall, convert to meters

- a. How long would it take the pendulum to complete a period? (ans: 7.34 seconds)

- b. The angle on the pendulum would constantly get smaller over time because it was losing energy, would this change the period of 7.34 seconds? Why?

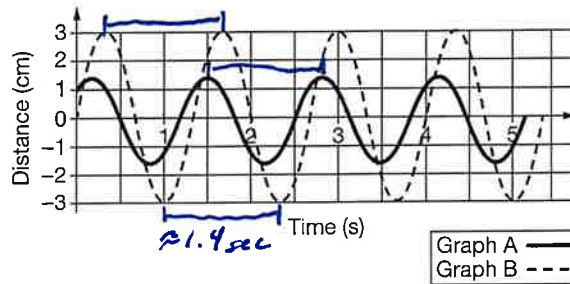
This would not affect the period because length is all that changes the period.

- c. If all the air was removed from the room, how would the period change?

_____ increase _____ decrease X stay the same

Oscillate your fingers around the keyboard and put your name: _____

11. Below is a graph of a pendulum that was swung twice. The y-axis represents the distance the pendulum is from the equilibrium. The bold line represents the pendulum when it was first dropped while the dotted line represents the second time.



- a. Calculate the period for the pendulum for each time it was dropped.

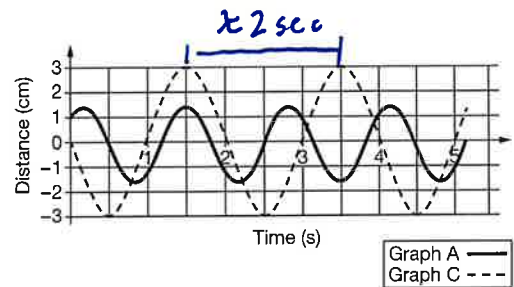
It's about 1.4 seconds for each pendulum.

- b. When releasing a pendulum you can change the amplitude, mass and length of the string. What do you know this student changed about the pendulum when releasing the second time?

amplitude

- c. The student then releases another pendulum with a different attribute changed from trial A and B. What was changed about the 3rd trial?

The period of the pendulum changed, so...



12. Humans have finally traveled to another planet but we haven't calculated the value for gravity on the planet yet.

- a. Solve for g on the formula for the period of a pendulum.

$$T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow \frac{T}{2\pi} = \sqrt{\frac{l}{g}} \Rightarrow \left(\frac{T}{2\pi}\right)^2 = \frac{l}{g} \Rightarrow \frac{T^2}{4\pi^2} = \frac{l}{g} \Rightarrow g = \frac{4\pi^2 l}{T^2}$$

- b. The astronaut makes a pendulum and releases multiple masses from different amplitudes and records the periods. The astronaut then graphs the results, what two characteristics should be graphed to create a linear function?

Length Period Period squared Amplitude length squared

- c. If the slope of the graph discussed is length/period², what would you multiply it by to calculate gravity on the planet?

$$\frac{4\pi^2}{l}$$