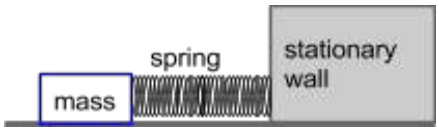
AP Physics 1 Experiment Questions Review

Click here for Experiment and Linearizing Algorithm (scroll to the bottom)



Ex: The picture is a laboratory setup made of a mass connected to a spring. The other end of the spring is held stationary. Describe an experimental procedure that the student could use to determine the **spring constant** experimentally using precise and accurate laboratory procedures and employing simple harmonic motion.

a. **Describe** your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.

b. **Describe** how you will use your measurements to determine the spring constant, in enough detail that another student could duplicate your process.

c. **Describe** one assumption you made about the design of your experiment, and **explain** how it might affect the value obtained for the spring constant.

d. A student doing a different experiment to determine the spring constant obtained mass and frequency values. Use the data table to **calculate** the spring constant and **include an explanation** of your method.

Mass (kg)	Frequency (Hz)
0.10	4.50
0.20	3.18
0.30	2.60
0.40	2.25
0.50	2.01
0.60	1.84

a. Set-up

- Use a balance to measure the mass. Record the mass.
- Attach the smallest *mass* to the end of the *spring*. Connect other end of spring securely to the wall. Prepare a *timing device*.
- Make a mark along the table as a starting point of the edge of the spring. Make a mark along the table as a reference point to pull the mass (to an extension point).

Data Collection

- Pull the mass from the starting point to the extension point. Release.
- Record the time for 10 oscillations with the timer. OR Record the number of oscillations for 10 seconds using the timer.
- Repeat the procedures above for at least 8 other masses.

b. Analysis

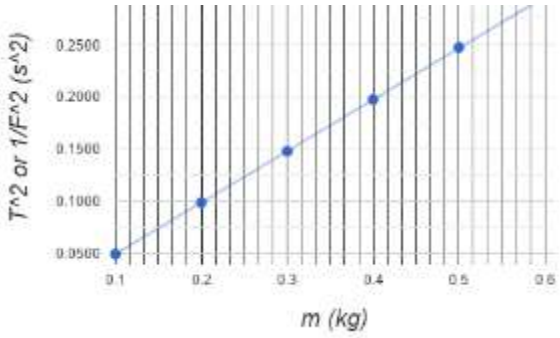
- Calculate the time for one period. OR Calculate the frequency.
- Plot the mass versus the frequency. OR plot the mass versus the period.
- Calculate *period squared* or the *square of the inverse of the frequency*.
- Plot the mass versus the period squared. OR plot the mass versus the inverse square of the frequency.
- Draw the best-fit line.
- Calculate the slope.
- Use the slope to determine the spring constant.

c. It is assumed that the spring is an ideal spring. If it is not an ideal spring, the spring constant's value may be greater or less than the experimental value depending on such factors as the loading force or the region of linear elasticity.

d.

- Calculate *square of the inverse of the frequency*.
- Plot the mass versus the inverse square of the frequency.
- Draw the best-fit line. Calculate the slope.
- Use the slope to determine the spring constant.

1/Frequency^2 (s^2)	m Mass (kg)
0.0494	0.10
0.0989	0.20
0.1479	0.30
0.1975	0.40
0.2475	0.50
0.2954	0.60



$$T = 2\pi\sqrt{\frac{m}{k}} \qquad T = \frac{1}{F} \qquad \frac{1}{F^2} = \left(\frac{4\pi^2}{k}\right)m$$

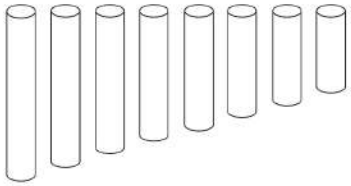
$$\frac{1}{F^2} = \left(\frac{4\pi^2}{k}\right)m$$

y = mx + b

$$slope = \frac{(0.300-0.050)\,s^2}{(0.60-.10)\,kg} = 0.50\,\frac{s^2}{kg} = \frac{4\pi^2}{k}$$

$$k = \frac{4\pi}{0.50\,\frac{s^2}{kg}} = 25\,\frac{N}{m}$$

Released sample question:



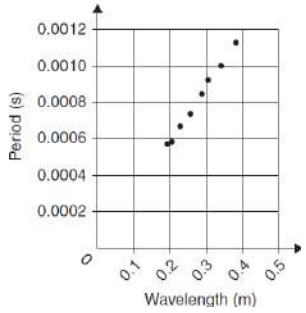
1. You are given a set of chimes that consists of eight hollow metal tubes open at both ends, as shown above. The chimes are played by striking them with a small hammer to produce musical sounds. Your task is to use the chimes to determine the speed of sound in air at room temperature. You have available a set of tuning forks and other common laboratory equipment but are not allowed to use electronic equipment, such as a sound sensor. (A tuning fork vibrates when struck and produces sound at a particular frequency, which is printed on the tuning fork.)

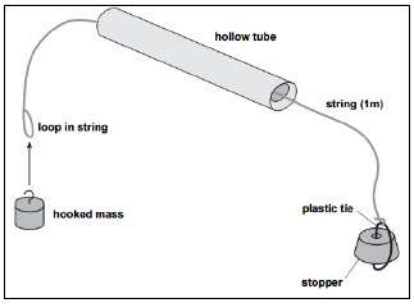
   (a) Describe your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.

   (b) Describe how you will use your measurements to determine the speed of sound, in enough detail that another student could duplicate your process.

   (c) Describe one assumption you made about the design of your experiment, and explain how it might affect the value obtained for the speed of sound.

   (d) A student doing a different experiment to determine the speed of sound in air obtained wavelength and period measurements and created the following plot of the data. Use the graph to calculate the speed of sound and include an explanation of your method.





#2 You are given the materials in the picture above. While holding the hollow tube in your hand, the stopper can be spun overhead in such a way that the hooked mass stays stationary. Your task is to determine the *mass of the stopper*.

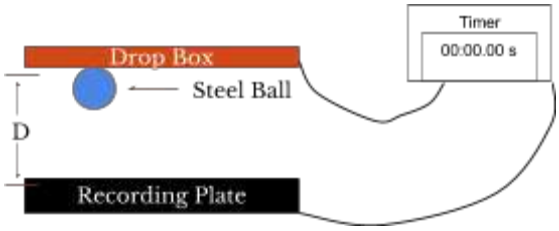
a. **Describe** your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.

b. **Describe** how you will use your measurements to determine the *mass of the stopper*, in enough detail that another student could duplicate your process.

c. **Describe** one assumption you made about the design of your experiment, and **explain** how it might affect the value obtained for the *mass of the stopper*.

d. A student doing a different experiment to determine the *mass of the stopper* obtained the values in the data table below. Use the data table to **calculate** the *mass of the stopper* and **include an explanation** of your method.

radius (m)	hanging mass (kg)	v (m/s)
0.2	0.5	3.8
0.3	0.5	4.9
0.4	0.5	5.8
0.5	0.5	6.5
0.6	0.5	7.1
0.7	0.5	8.2



#3 You are given the materials in the picture above. The steel ball can be released to start a timer. When the ball strikes the recording plate, the timer stops. Your task is to determine the *acceleration due to gravity (**g**)*.

a. **Describe** your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.

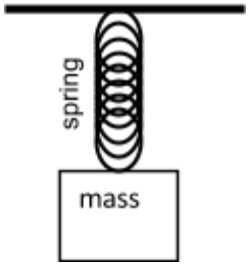
b. **Describe** how you will use your measurements to determine the *acceleration due to gravity*, in enough detail that another student could duplicate your process.

#3 continued

t (s)	D (m)
0.63	2.0
0.54	1.5
0.41	1.0
0.25	0.5

c. **Describe** one assumption you made about the design of your experiment, and **explain** how it might affect the value obtained for the *acceleration due to gravity*.

d. A student doing a different experiment to determine the *acceleration due to gravity* obtains the values in the data table. Use the data table to **calculate** the *acceleration due to gravity* and **include an explanation** of your method.



#4 You are given the materials in the picture above. Your task is to determine the *spring constant*.

a. **Describe** your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.
b. **Describe** how you will use your measurements to determine the *spring constant*, in enough detail that another student could duplicate your process.

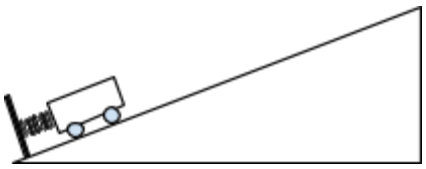
#4 continued

Weight (N)	Extension (m)
1.0	0.0090
2.0	0.0222
3.0	0.0286
4.0	0.0421

c. **Describe** one assumption you made about the design of your experiment, and **explain** how it might affect the value obtained for the *spring constant*.
d. A student doing a different experiment to determine the *spring constant* obtains the values in the data table. Use the data table to **calculate** the *spring constant* and **include an explanation** of your method.

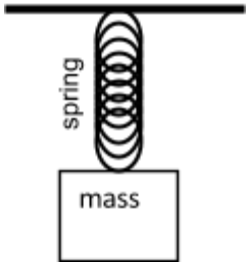
#5 A pendulum consists of a mass hanging from a string. Your task is to experimentally determine the *acceleration due to gravity*.

a. **Describe** your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.
b. **Describe** how you will use your measurements to determine the *acceleration due to gravity*, in enough detail that another student could duplicate your process.
c. **Describe** one assumption you made about the design of your experiment, and **explain** how it might affect the value obtained for the *acceleration due to gravity*.



#6 A cart that contains a spring loaded plunger is placed at the bottom of an incline. The plunger is then released. Your task is to experimentally determine the spring constant of the plunger.

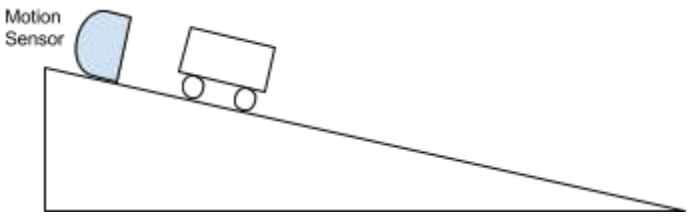
a. **Describe** your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.
b. **Describe** how you will use your measurements to determine the *spring constant*, in enough detail that another student could duplicate your process.
c. **Describe** one assumption you made about the design of your experiment, and **explain** how it might affect the value obtained for the *spring constant*.
d. A student doing a different experiment to determine the *spring constant* obtains the values in the data table. Use the data table to **calculate** the *spring constant* and **include an explanation** of your method.



#6 You are given the materials in the picture above which includes a spring of KNOWN spring constant. Your task is to determine the *acceleration due to gravity*.

a. **Describe** your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.
b. **Describe** how you will use your measurements to determine the *acceleration due to gravity*, in enough detail that another student could duplicate your process.
c. **Describe** one assumption you made about the design of your experiment, and **explain** how it might affect the value obtained for the *acceleration due to gravity*.

Experiment: coefficient of friction



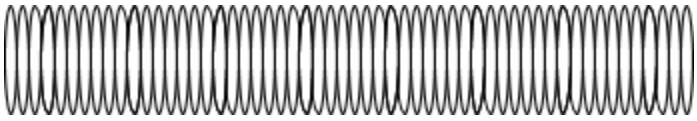
#7 You are given the materials in the picture above. Your task is to determine the *acceleration down the incline.*

a. **Describe** your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.
b. **Describe** how you will use your measurements to determine the *acceleration*, in enough detail that another student could duplicate your process.
c. **Describe** one assumption you made about the design of your experiment, and **explain** how it might affect the value obtained for the *acceleration*.

#7 continued

t (s)	x (m)
2.4008	0.258
2.6009	0.307
2.0011	0.388
3.3015	0.515
3.8020	0.703
4.3027	0.913

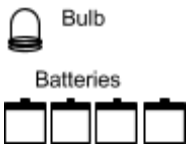
d. A student doing a different experiment to determine the *acceleration* obtains the values in the data table. Use the data table to **calculate** the *acceleration* and **include an explanation** of your method.



#8 You are given the slinky above. Your task is to determine the *wave speed.*

a. **Describe** your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.
b. **Describe** how you will use your measurements to determine the *wave speed*, in enough detail that another student could duplicate your process.
c. **Describe** one assumption you made about the design of your experiment, and **explain** how it might affect the value obtained for the *wave speed*.

Experiment: modified Atwood's machine



#9 You are given the materials in the picture above. Your task is to determine the *resistance of the bulb.*

a. **Describe** your experimental procedure in enough detail so that another student could perform your experiment. Include what measurements you will take and how you will take them.
b. **Describe** how you will use your measurements to determine the *resistance of the bulb*, in enough detail that another student could duplicate your process.
c. **Describe** one assumption you made about the design of your experiment, and **explain** how it might affect the value obtained for the *resistance of the bulb*.

#9 Continued

# of Batteries	Ammeter Reading (A)
1	0.075
2	0.140
3	0.230
4	0.290

d. A student doing a different experiment to determine the *resistance* obtains the values in the data table. Each battery is approximately 1.5V. Use the data table to **calculate** the *resistance* and **include an explanation** of your method.