Simple Harmonic Oscillator

Review the Textbook on Hook's Law (Spring Force), and Vibrations (Simple Harmonic Motion).

- **Phys 1402:** Serway/Vuille: Sections. 13.1, 13.3, 13.4
- **Phys 2426:** Serway/Jewett: Sections 7.4, 15.1, 15.2

1. A spring of a kitchen scale stretches 6.2 cm from un-stretched position (equilibrium) when a bunch of bananas is suspended from it. What is the mass of the bananas if the spring constant of the kitchen scale is 126 N/m?
(800 g)

2. A position of a simple harmonic oscillator as a function of time is presented on the graph below. Determine the amplitude, the period, and the frequency of the oscillation from the graph.
(amplitude = 1 m; T = 2 s; f = 0.5 Hz)

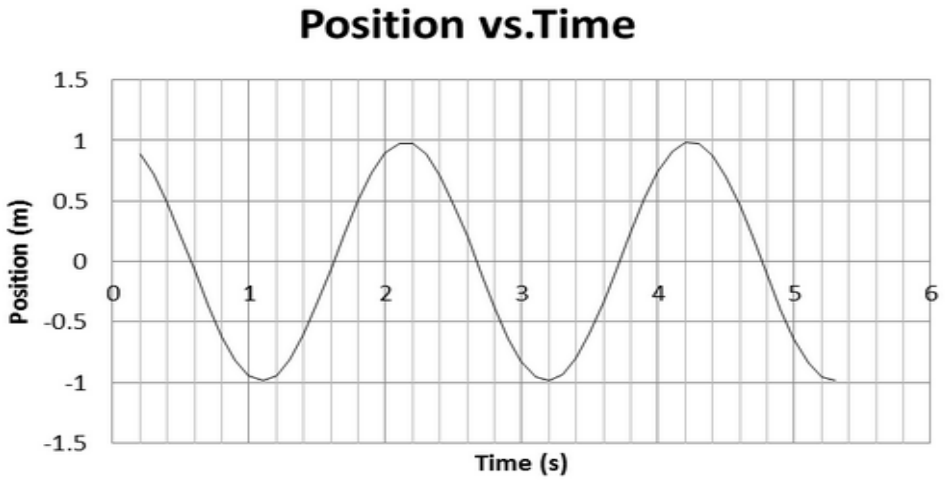

Figure 1. Sample graph of Position vs. Time, used in Question 2.

3. A mass of 125 g is suspended from a spring of a spring constant of 38 N/m. When this mass is pulled down 3 mm and set in oscillation, what is the period and frequency of the oscillation? How different would be both, the period and frequency, if the mass would be pulled down 5 mm instead?
(0.36s; 2.8Hz; there will be no difference in any of them)

4. A certain mechanism has a part acting as a simple harmonic oscillator. It includes a spring of a spring constant 32 N/m and a mass of 75 g attached to it. It is necessary **to increase** the period of the oscillation 2 times without changing the spring but by adjusting the attached mass. What should be the adjusted mass? What should be the adjusted mass in order **to decrease** the period of oscillation 2 times?
(300g; 19g)

5. A certain mechanism includes a set of two springs suspended parallel to each other that act as a simple harmonic oscillator. Each spring has a spring constant of **k** (measured in N/m). A mass **m** could be attached either to one spring only or to both of them together. When two springs are combined the spring constant doubles. What is the ratio T_1/T_2, where T_1 is the period when the mass is attached to a single spring and T_2 is the period when the mass is attached to a doubled spring? What is the ratio of frequencies, f_1/f_2?
($\sqrt{2}$; $1/\sqrt{2}$)