

Oscillation Problems II

1. A 150 gram mass at rest stretches a spring 6 cm when it is hanging from the spring. It is then pulled down an additional 3 cm and released.
 - a. What is the spring constant?

 - b. What is the period of the resulting oscillations?

 - c. What is the maximum speed of the mass?

2. A 4 kg mass is attached to a spring with a spring constant of 350 N/m. It is oscillating with a maximum acceleration of 5 m/s^2 .
 - a. What is the period of the motion?

 - b. What is the amplitude of the motion?

 - c. What is the maximum speed of the motion?

 - d. How much energy does the system have?

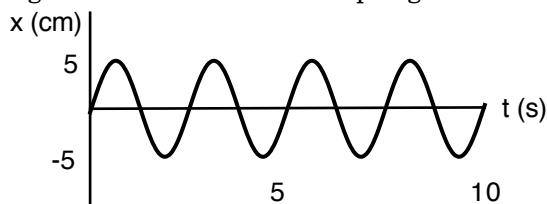
3. A 2.4 kg mass is attached to a spring on a frictionless hill with a base angle of 30° . The mass has a maximum speed of 1.5 m/s and the amplitude of the simple harmonic motion is 25 cm.
 - a. What is the period of the motion?

 - b. What is the spring constant?

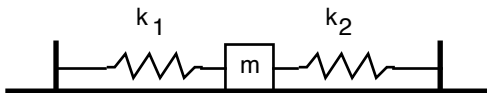
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4. What is the equation of motion for a 300 gram object oscillating on the end of a spring with a spring constant of 500 N/m and a maximum speed of 2.3 m/s?
5. A mass oscillating on a spring has a total energy of 5 J, a maximum acceleration of 12 m/s² and a frequency of 3 Hz. What is the mass?

6. The position as a function of time for a 150 gram object attached to a spring is shown in the diagram below. What is the spring constant?



7. Derive an expression for the period of oscillation for the system shown. The mass is on a horizontal frictionless surface, and between two springs of spring constants k_1 and k_2 .



Answers:

1. a) 25 N/m b) 0.49 s c) 0.39 m/s 2.a) 0.67 m/s b) 0.057 m c) 0.53 m/s d) 0.57 J
- 3.a) 1.05 s b) 86.4 N/m 4) $x = (0.056)\cos(40.8 t)$ 5) 60.9 kg d) 0.14 N/m 7) $T = 2\pi\sqrt{\frac{m}{k_1 + k_2}}$