

Assignment 13

PHY1001

NO LATE SUBMISSION IS ACCEPTED

3 In Fig. 15-20, two springs are attached to a block that can oscillate over a frictionless floor. If the left spring is removed, the block oscillates at a frequency of 30 Hz. If, instead, the spring on the right is removed, the block oscillates at a frequency of 50 Hz. At what frequency does the block oscillate with both springs attached?

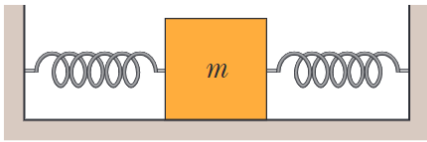


Figure 15-20

7 In Fig. 15-23, the pendulum consists of a uniform disk with radius $r = 10.0$ cm and mass 500 g attached to a uniform rod with length $L = 500$ mm and mass 250 g. (a) Calculate the rotational inertia of the pendulum about the pivot point. (b) What is the distance between the pivot point and the center of mass of the pendulum? (c) Calculate the period of oscillation.

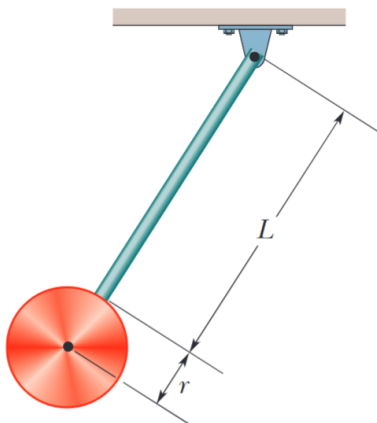


Figure 15-23 Problem 7.

12 The suspension system of a 2400 kg automobile “sags” 10 cm when the chassis is placed on it. Also, the oscillation amplitude decreases by 50% each cycle. Estimate the values of (a) the spring constant k and (b) the damping constant b for the spring and shock absorber system of one wheel, assuming each wheel supports 600 kg.

13 A block of mass $M = 5.4$ kg, at rest on a horizontal frictionless table, is attached to a rigid support by a spring of constant $k = 6000$ N/m. A bullet of mass $m = 9.5$ g and velocity \vec{v} of magnitude 680 m/s strikes and is embedded in the block (Fig. 15-26). Assuming the compression of the spring is negligible until the bullet is embedded, determine (a) the speed of the block immediately after the collision and (b) the amplitude of the resulting simple harmonic motion.

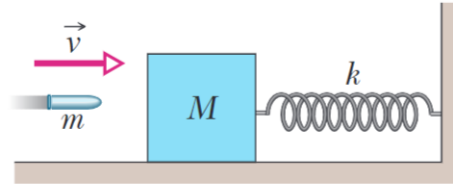


Figure 15-26 Problem 13.

14 In Fig. 15-27, two springs are joined and connected to a block of mass 0.490 kg that is set oscillating over a frictionless floor. The springs each have spring constant $k = 5000$ N/m. What is the frequency of the oscillations?

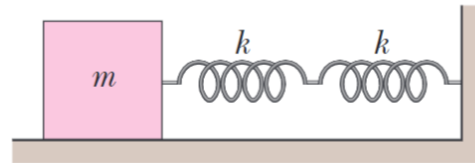


Figure 15-27 Problem 14.

29 A 1000 kg car carrying four 82 kg people travels over a “wash-board” dirt road with corrugations 5.0 m apart. The car bounces with maximum amplitude when its speed is 16 km/h. When the car stops, and the people get out, by how much does the car body rise on its suspension?

53 An oscillator consists of a block attached to a spring ($k = 425 \text{ N/m}$). At some time t , the position (measured from the system's equilibrium location), velocity, and acceleration of the block are $x = 0.100 \text{ m}$, $v = -13.6 \text{ m/s}$, and $a = -123 \text{ m/s}^2$. Calculate (a) the frequency of oscillation, (b) the mass of the block, and (c) the amplitude of the motion.

59 The balance wheel of an old-fashioned watch oscillates with angular amplitude π rad and period 0.600 s . Find (a) the maximum angular speed of the wheel, (b) the angular speed at displacement $\pi/2$ rad, and (c) the magnitude of the angular acceleration at displacement $\pi/4$ rad.