

Two problems to be done during the first hour on the black board and two to be handed in for marking

For the problems to be marked each problem is worth 10 points

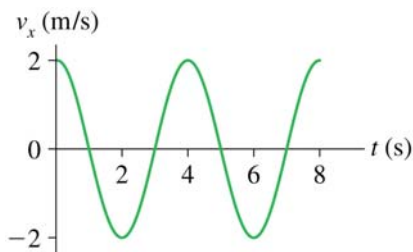
A student may discuss the problems with other students but may not copy from others.

Problem 14.32

An object oscillating on a spring has the velocity graph shown in figure P14.32. Draw a velocity graph if the following changes are made.

- The amplitude is doubled and the frequency is halved.
- The mass is quadrupled.

Parts a and b are independent questions each starting from the graph shown.

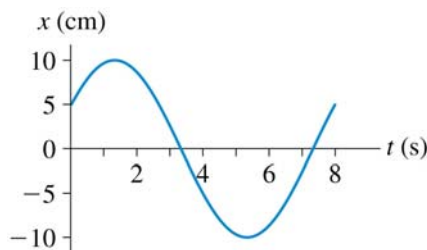


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Problem 14.33

Fig. 14.33 is the position versus time graph of a particle in simple harmonic motion.

- What is the phase constant?
- What is the velocity at $t = 0$ s?
- What is v_{\max} ?

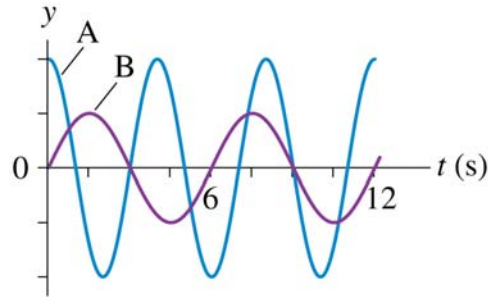


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Problem 14.35

Two graphs in Figure P14.35 are for two different vertical mass-spring systems.

- What is the frequency of system A? What is the first time the mass has maximum speed while traveling in the upward direction?
- What is the period of the system B? What is the first time at which the energy is all potential?
- If both systems have the same mass, what is the ratio k_A/k_B of their spring constants?



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Problem 14.37

A 1.0 kg block oscillates on a spring with spring constant 20 N/m. At $t = 0$ s the block is 20 cm to the right of the equilibrium position and moving to the left at a speed of 100 cm/s. Determine the period of oscillation and draw a graph of position versus time.

Problem 14.38

An object in SHM oscillates with a period of 4.0 s and amplitude of 10 cm. How long does the object take to move from $x = 0.0$ cm to $x = 6.0$ cm?

Problem 14.43

A 100 g ball attached to a spring with spring constant 2.5 N/m oscillates horizontally on a frictionless table. Its velocity is 20 cm/s when $x = -5.0$ cm.

- What is the amplitude of oscillations?
- What is the ball's maximum acceleration?
- What is the ball's position when the acceleration is maximum?
- What is the speed of the ball when $x = 3.0$ cm?

Problem 14.50

A spring with spring constant k is suspended vertically from a support and a mass m is attached. The mass is held at the point where the spring is not stretched. Then the mass is released and begins to oscillate. The lowest point in the oscillation is 20 cm below the point where the mass was released. What is the oscillation frequency?

. Problem 14.53

A compact car has a mass of 1200 kg. Assume that the car has one spring on each wheel, that the springs are identical, and that the mass is equally distributed over the four springs.

(a) What is the spring constant of each spring if the empty car bounces up and down 2.0 times each second?

(b).What will be the car's oscillation frequency while carrying four 70 kg passengers?

. Problem 14.54

Figure P14.54 shows a 1.0 kg mass riding on top of a 5.0 kg mass as it oscillates on a frictionless surface. The spring constant is 50 N/m and the coefficient of static friction between the two blocks is 0.50. What is the maximum oscillation amplitude for which the upper block does not slip?

