MCQ Part 1

1. (Giancoli Chapter 11) A mass on a spring in SHM (Fig. 11–1) has amplitude A and period T. At what point in the motion is the velocity zero and the acceleration zero simultaneously?
   (a) $x = A$
   (b) $x > 0$ but $x < A$
   (c) $x = 0$
   (d) $x < 0$
   (e) None of the above

2. (Giancoli Chapter 11) An object of mass M oscillates on the end of a spring. To double the period, replace the object with one of mass:
   (a) $2M$
   (b) $M/2$
   (c) $4M$
   (d) $M/4$
   (e) None of the above

3. A grandfather clock is "losing" time because its pendulum moves too slowly. Assume that the pendulum is a massive bob at the end of a string. The motion of this pendulum can be sped up by (list all that work):
   (a) shortening the string.
   (b) lengthening the string.
   (c) increasing the mass of the bob.
   (d) decreasing the mass of the bob.

4. Suppose you pull a simple pendulum to one side by an angle of 5°, let go, and measure the period of oscillation that ensues. Then you stop the oscillation, pull the pendulum to an angle of 10°, and let go. The resulting oscillation will have a period about _____ the period of the first oscillation.
   (a) four times
   (b) twice
   (c) half
   (d) one-fourth
   (e) the same as

MCQ Part 2

A particle on a spring executes simple harmonic motion; when it passes through the equilibrium position it has a speed v. The particle is stopped, and then the oscillations are restarted so that it now passes through the equilibrium position with a speed of $2v$. After this change

5. the frequency of oscillation will change by a factor of
   (a) 4
   (b) $\sqrt{8}$
   (c) 2
   (d) $\sqrt{2}$
   (e) 1 (it remains unchanged)

6. the maximum displacement of the particle will change by a factor of
   (a) 4
   (b) $\sqrt{8}$
   (c) 2
   (d) $\sqrt{2}$
   (e) 1 (it remains unchanged)

7. the magnitude of the maximum acceleration of the particle will change by a factor of
   (a) 4
   (b) $\sqrt{8}$
   (c) 2
   (d) $\sqrt{2}$
   (e) 1 (it remains unchanged)

8. A particle on a spring executes simple harmonic motion. When the particle is found at $x = x_{\max}/2$ the speed of the particle is
   (a) $v_x = v_{\max}$
   (b) $v_x = \sqrt{3}v_{\max}/2$
   (c) $v_x = \sqrt{2}v_{\max}/2$
   (d) $v_x = v_{\max}/2$

Fun Problems

9. A 5.22-kg object is attached to the bottom of a vertical spring and set vibrating. The maximum speed of the object is 15.3 cm/s and the period is 645 ms. Find (a) the force constant of the spring, (b) the amplitude of the motion, and (c) the frequency of oscillation.

10. A pendulum with mass m and string length l is released from rest at a height h from it's equilibrium position. What is the tension in the string at the lowest point of the pendulum's oscillation in terms of the given variables?

11. Three 10,000-kg ore cars are held at rest on a 26.0° incline on a mine railway using a cable that is parallel to the incline (Fig. 17-23). The cable is observed to stretch 14.2 cm just before a coupling breaks, detaching one of the cars. Find (a) the frequency of the resulting oscillations of the remaining two cars and (b) the amplitude of the oscillations.

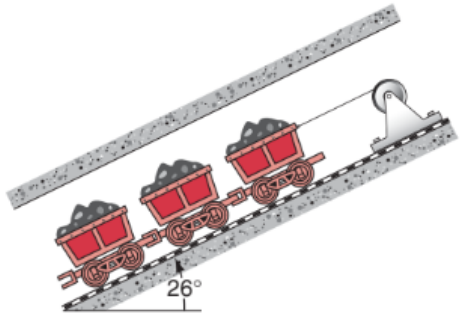

FIGURE 17-23. Exercise 15.