MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) For an object undergoing simple harmonic motion, 1) _____
A) the acceleration is greatest when the speed is greatest.
B) the displacement is greatest when the speed is greatest.
C) the acceleration is greatest when the displacement is greatest.
D) the maximum potential energy is larger than the maximum kinetic energy.
E) the total energy oscillates at frequency $f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$.

2) A coin is placed on a platform attached to a spring that oscillates vertically in simple harmonic motion. The amplitude of the displacement is 1.20 cm. What is the maximum frequency for which the coin will always remain in contact with the platform? 2) _____
A) 2.25 Hz B) 6.89 Hz C) 12.2 Hz D) 4.55 Hz E) 8.75 Hz

3) If both the mass of a simple pendulum and its length are doubled, the period will 3) _____
A) be unchanged.
B) increase by a factor of 2.
C) increase by a factor of 4.
D) increase by a factor of 1.4
E) increase by a factor of 0.71.

Situation: A 5.0–kg block is attached to a spring whose force constant is 125 N/m. The block is pulled from its equilibrium position at $x = 0$ m to a position at $x = +0.687$ m and is released from rest. The block then executes damped oscillation along the x–axis. The damping force is proportional to the velocity. When the block first returns to $x = 0$ m, its x–component of velocity is –2.0 m/s and its x–component of acceleration is $+5.6$ m/s^2.

4) In the Situation above, the magnitude of the acceleration of the block upon release at $x = +0.687$ m is closest to: 4) _____

A) 16.4 m/s^2
B) 17.2 m/s^2
C) 18.0 m/s^2
D) 18.8 m/s^2
E) 19.6 m/s^2

5) A transverse wave is propagated in a string stretched along the x–axis. The equation of the wave, in SI units, is given by: $y = 0.004 \cos \pi (38t - 18x)$. The maximum velocity of a particle on the string, in SI units, is closest to: 5) _____

A) 0.48 B) 0.63 C) 0.78 D) 0.93 E) 1.1

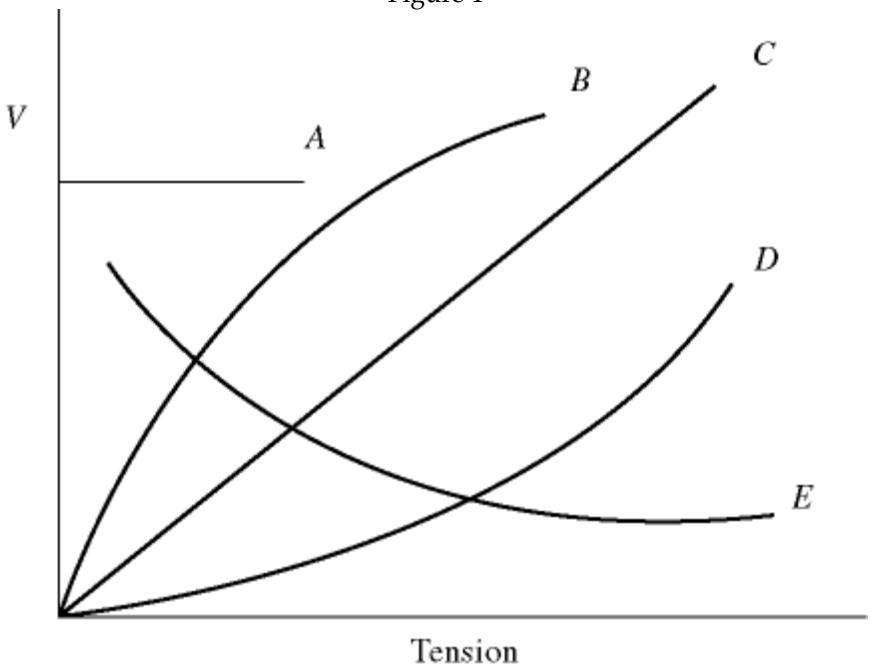
6) A string, 20 cm long and having a mass of 94 g, is attached to a 710–Hz vibrator at one end. The other end of the string is fixed and the string is kept under tension. The vibrator produces a transverse wave in the string, whose amplitude is 8.0 mm, and that propagates with a velocity of 44 m/s. The energy of the wave is absorbed at the fixed end. In this situation, the maximum transverse velocity, of a point on the string, in SI units, is closest to: 6) _____

A) 36 B) 33 C) 31 D) 38 E) 40

7) The equation $y(x,t) = 0.015\cos(13.4x + 488t)$, where all quantities are in SI units, represents a traveling wave having: 7) _____

A) wavelength = 0.0746 m and period = 0.00205 s
B) wavelength = 0.469 m and period = 12.9 ms
C) wavelength = 13.4 m and frequency = 488 Hz
D) wavelength = 0.469 m and frequency = 3060 s
E) frequency = 488 Hz and period = 12.9 ms

Figure 1



8) In Fig. 1, which of the curves best represents the variation of wave speed as a function of tension for transverse waves on a stretched string? 8) _____

A) A B) B C) C D) D E) E

9) A crane lifts a 2500–kg mass using a steel cable whose mass per unit length is 0.65 kg/m. What is the speed of transverse waves on this cable? 9) _____

A) 225 m/s B) 578 m/s C) 1220 m/s D) 1880 m/s E) 194 m/s

10) A 6.0–g string, 0.13 m long, is under tension. The string produces a 800–Hz tone when it vibrates in the third harmonic. The speed of sound in air is 344 m/s. The wavelength of the tone in air, in SI units, is closest to: 10) _____

A) 0.43 B) 0.33 C) 0.23 D) 0.13 E) 0.087

Situation: A mass m is hung from the ceiling by a thin 8.25–g wire that is 65.0 cm long. When you gently pluck the upper end of the wire, a pulse travels down the wire and returns 7.84 ms later, having reflected off the lower end. The speed of sound in the room is 344 m/s, and m is great enough to prevent the lower end of the wire from moving.

11) In the Situation above, if the wire is vibrating in its third harmonic, the frequency of the sound it will produce is closest to: 11) _____

A) 128 Hz B) 191 Hz C) 255 Hz D) 383 Hz E) 765 Hz

12) Consider the waves on a vibrating guitar string and the sound waves the guitar produces in the surrounding air. The string waves and the sound waves have the same 12) _____

A) wavelength.
B) velocity.
C) frequency.
D) amplitude.
E) More than one of the above is true.

Answer Key
Testname: P130MT_FALL2009_SEC2

1) C
2) D
3) D
4) B
5) A
6) A
7) B
8) B
9) E
10) A
11) D
12) C