Solutions to Homework, Week 1

Assignment 1

Chapter 1

R3: A longitudinal wave is a wave in which the disturbance is parallel to the direction of travel. A sound wave is an example of a longitudinal wave. A transverse wave is a wave in which the disturbance is perpendicular (or transverse) to the direction of travel. A vibrating guitar string is an example of a transverse wave.

R4: Four processes that can produce sound are:

1) vibrating bodies: speaker, tuning fork, violin soundboard, drum head, etc.
2) systems that change airflow: siren, vocal cords, lips of a brass player, etc.
3) rapid changes in heat: lightning, explosions, electrical sparks, etc.
4) sonic booms: supersonic airplanes, cracking end of a whip, bullet, etc.

Chapter 2

E4:

(a)

$$F = mg = -kx$$

$$so \quad k = -\frac{mg}{x}$$

$$= \frac{1.0\,kg \cdot 9.8\ m/s^2}{-0.2\,m} = 49\,N$$

(b)

$$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}} = \frac{1}{2\pi}\sqrt{\frac{49\,N}{1.0\,kg}} = 1.11\,Hz$$

Assignment 2

E3:

One whole period is the same as one whole vibration, here half a vibration is 1.0 s so a whole vibration $T = 2.0\,s$

$$T = 2\pi\sqrt{\frac{l}{g}}$$

$$so\ \ T^2 = 4\pi^2\frac{l}{g} \Rightarrow \frac{T^2 g}{4\pi^2} = l$$

$$l = \frac{T^2 g}{4\pi^2} = \frac{(2.0\,s)^2 \cdot 9.8\,m/s^2}{4\pi^2} \approx 1.0\,m$$

E6:

$$f_1 = \frac{1}{2\pi}\sqrt{\frac{k}{m}} = \frac{1}{2\pi}\sqrt{\frac{100\,N}{2.0\,kg}} = 1.12\,Hz$$

$$f_2 = \frac{1}{2\pi}\sqrt{\frac{3k}{m}} = \frac{1}{2\pi}\sqrt{\frac{(3)100\,N}{2.0\,kg}} = 1.95\,Hz$$