Problem 1

(a) $U_{max} = K_{max}$

$\frac{1}{2} k X_m^2 = K_{max}$

$k = \frac{2 K_{max}}{X_m^2} = \frac{2 (2.0\,J)}{(0.10\,m)^2} = 400\ N/m$ ✓

(b) $f = \frac{\omega}{2\pi} = \frac{1}{2\pi}\sqrt{\frac{k}{m}} = \frac{1}{2\pi}\sqrt{\frac{400\,N/m}{4.0\,kg}} = \frac{5}{\pi} = 1.6\ Hz$ ✓

Problem 2

$\Delta P = \Delta P_m \sin\left(\frac{2\pi}{\lambda} x + 2\pi f t + \phi_0\right)$

$\frac{\lambda}{2} = 0.050\,m \Rightarrow \lambda = 0.10\,m$

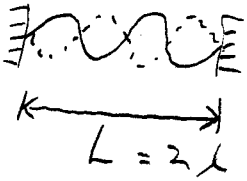
$f = \frac{v}{\lambda} = \frac{343\ m/s}{0.10\,m} = 3430\ Hz$

$\Delta P(0,0) = 0 \Rightarrow \phi_0 = 0$

$\Delta P = (0.20 P_a) \sin\left(\frac{2\pi}{0.10\,m} x - 2\pi (3430\ Hz) t\right)$ ✓

Problem 3

(a)



✓

(b) $y_m = A \sin Kx = A \sin \frac{2\pi}{\lambda} x = A \sin\left[\frac{2\pi}{\lambda/2} \frac{L}{10}\right]$

$= A \sin \frac{4\pi}{10}$

$= A \sin\left(\frac{2\pi}{5}\right)$ ✓

Problem 4

$$\Delta\varphi = 2\pi \frac{L_2 - L_1}{\lambda} + \pi = \left(n + \frac{1}{2}\right) 2\pi$$

$$\frac{f}{v}(L_2 - L_1) + \frac{1}{2} = n + \frac{1}{2}$$

$$f_n = n \frac{v}{L_2 - L_1} = n \frac{343\ m/s}{110_m - 100_m} = n\ 34.3\ Hz$$

$$\left.\begin{aligned} f_1 &= 34.3\ Hz \\ f_2 &= 68.6\ Hz \end{aligned}\right\} \checkmark$$

Problem 5

(a) $$f_{beat} = f\frac{v}{v - v_s} - f\frac{v}{v + v_s} = f\left(\frac{v}{v - v_s} - \frac{v}{v + v_s}\right)$$

$$= (1000\ Hz)\left(\frac{343\ m/s}{340\ m/s} - \frac{343\ m/s}{346\ m/s}\right) = 17\ Hz \checkmark$$

(b) $$f_{beat} = f\frac{v}{v - v_s} - f\frac{v}{v - v_s} = 0\ Hz \checkmark$$

Problem 6

Answer is $\underline{\underline{C}}$ ✓