1) mass oscillates on spring with given amplitude.

a) $\omega = \sqrt{\frac{k}{m}} = \sqrt{\frac{120\ N/m}{0.3\ kg}} = \boxed{20\ s^{-1} = \omega}$

b) $a_{max} = \omega^2 A = (20\ s^{-1})^2 (0.04\ m) = \boxed{16\ m/s = a_{max}}$

c) $E = \frac{1}{2} k A^2 = \frac{1}{2}(120\ N/m)(0.04\ m)^2$

$= 9.6 \times 10^{-2}\ J = \boxed{0.096\ J = E}$

2) $y(x,t) = (1.5\ cm) \sin\left[\left(2.5\ \frac{rad}{m}\right)x + \left(20\ \frac{rad}{s}\right)t\right]$

a) travels toward $-$ve x; as t increases, x must decrease to hold phase const.

b) from standard form of wave:

$y(x,t) = A \sin\left[\frac{2\pi}{\lambda} x \pm 2\pi f t\right]$

we can write:

2) b) (CONT.)

λ: $\frac{2\pi}{\lambda} = 2.5 \frac{rad}{m} \Rightarrow \lambda = \frac{2\pi}{2.5\,m^{-1}} = \boxed{2.51\ m = \lambda}$

f: $2\pi f = 20 \frac{rad}{s} \Rightarrow f = \frac{20\ rad/s}{2\pi} = \boxed{3.18\,Hz = f}$

v: $v = \lambda f = (2.51\ m)(3.18\ s^{-1}) = \boxed{7.98\ m/s = v}$

c) $y(0.8\,m, 0.1\,s) = (0.015\ m) \sin\left[2.5 \frac{rad}{m}(0.8\,m) + 20 \frac{rad}{s}(0.1\,s)\right]$

$= \boxed{-1.14 \times 10^{-2}\ m = y(0.8, 0.1)}$

3) $I = 3.2 \times 10^{-6}\ W/m^2$

a) $\beta = ?$

$\beta = (10\,dB) \log\left(\frac{3.2 \times 10^{-6}\ W/m^2}{1 \times 10^{-12}\ W/m^2}\right) = \boxed{65\ dB = \beta}$

b) If 12 dB louder, what is factor on I?

3) b) (CONT.)

$$\beta' = \beta + 12 = (10\,dB)\log\left(\frac{nI}{I_0}\right)$$

using
$\log ab = \log a + \log b$

$$\beta + 12 = (10\,dB)\log n + \underbrace{(10\,dB)\log\left(\frac{I}{I_0}\right)}_{=\beta}$$

$$12 = (10\,dB)\log n$$

$$\frac{12}{10} = \log n$$

$$n = 10^{12/10} = \boxed{15.8 = n}$$

4) mosquito: $f_s = 600\text{Hz}$ $V_s = 3.5\,m/s$

$$f_o = f_s = \frac{1 \pm V_o/v}{1 \mp V_s/v}$$

a) Flying towards: $V_o = 0$, use - sign denom.

$$f_o = f_o \frac{1}{1 - V_s/v} = 600 \frac{1}{1 - 3.5/343} = \boxed{606.2\text{ Hz}}$$

b) Flying away: $V_o = 0$, use + sign in denom.

$$f_o = f_o \frac{1}{1 + V_s/v} = 600 \frac{1}{1 + 3.5/343} = \boxed{593.9\text{ Hz} = f_o}$$

5) $f_{beat} = |\Delta f| = |f_1 - f_2|$

a) $f_{beat} = 6\,Hz = |512 - f_2|$

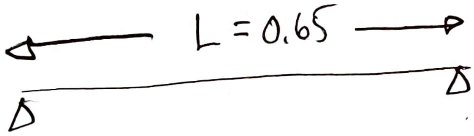
$\Rightarrow \boxed{f_2 = 506\,Hz \text{ or } 518\,Hz}$

b) Δf increases with increase in f_2,

f_2 must be higher!

$\boxed{f_2 = 518\,Hz}$

6)



$\mu = 1.8 \times 10^{-3}\,\frac{kg}{m} \quad T = 95\,N$

a) $v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{95\,N}{1.8 \times 10^{-3}\,\frac{kg}{m}}} = \boxed{2.29 \times 10^{2}\,m/s = v}$

b) $f = n\left(\frac{v}{2L}\right) = \frac{2.29 \times 10^{2}\,m/s}{2(0.65\,m)} = \boxed{1.77 \times 10^{2}\,Hz = f}$

6) (CONT.)

c) $f \propto v$, so we must double v, but $v \propto \sqrt{T}$ so to double v we must increase T by a factor of 4!

$$T' = 4T = \boxed{380\,N = T'}$$

7) Fundamental $\Rightarrow n=1$, so either

a) open/open or closed/open

$$f = \frac{v}{2L} \qquad\qquad f = \frac{v}{4L}$$

$$= \frac{343\,m/s}{0.8} = 428\,Hz \qquad\qquad = \frac{343\,m/s}{1.6} = 303\,Hz$$

closer!

$\Rightarrow$ $\boxed{\text{open/open}}$

b) $v = 2Lf$

$= 2(0.4m)(430\,Hz)$

$$\boxed{v = 344\,m/s}$$

c) $f_2 = 2\frac{v}{2L} = 2\frac{344\,m/s}{2(0.4m)}$

$$\boxed{f_2 = 860\,Hz}$$