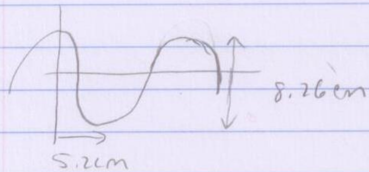
HW #1

Ch 13 CQ 9 prob 41, 43, 45, 46, 51, 52
Ch 14 CQ 2, 6. add't prob

9. $v = f\lambda$ The speed remains the same if the Tension is constant. However the wavelength would be half as much.

41. 

$f = 18.0\ Hz$

a) $A = 8.26cm \cdot \frac{1}{2} = 4.13cm = \underline{.0413m}$
b) $\lambda = 5.2cm \cdot 2 = 10.4cm = \underline{.104m}$
c) $f = 1/T \Rightarrow T = 1/f = 1/18Hz = \underline{0.056\ s}$
d) $v = \lambda f = 0.104m \cdot 18Hz = \underline{1.87\ m/s}$

43. $v = 3.00 \times 10^8\ m/s$ $\lambda = 5.5 \times 10^{-7} m$

a) $F = v/\lambda = \frac{3.00 \times 10^8 m/s}{5.5 \times 10^{-7} m} = \boxed{5.45 \times 10^{14}\ Hz}$
b) $T = 1/f = 1/5.45 \times 10^{14} Hz = \boxed{1.83 \times 10^{-15} s}$

45. $f = \frac{40\ osc}{30.0s} = 1.33\ Hz$
$v = \frac{425cm}{10s} = 0.425\ m/s$
$\lambda = f/v = 1.33\ Hz / 0.425\ m/s = \boxed{3.14\ m}$

46. $F = 60 \times 10^3\ Hz$ $v = 343\ m/s$
$\lambda = v/f = 343 m/s / 60.0 \times 10^3 Hz = \boxed{0.0057m}$

51. $\mu = 5.00 \times 10^{-3}\ kg/m$ $T = 1,350N$

$v = \sqrt{T/\mu} = \sqrt{\frac{1350N}{5.00 \times 10^{-3} kg/m}} = \sqrt{270,000} = \boxed{520\ m/s}$

52. $f = \frac{1}{T}$ eq 1

We know f = frequency which is Hz = $\frac{\text{oscillations}}{\text{second}}$

units are $\frac{\text{osc}}{\text{Time}} = \left[\frac{1}{T}\right]$ so T must be Time/oscilation

$v = \sqrt{T/\mu}$ eq 2 μ is mass/length $v =$ length/Time

$v^2 \cdot \mu = T$

$\left(\frac{\text{length}}{\text{Time}} \cdot \frac{\text{length}}{\text{Time}}\right) \cdot \frac{\text{Mass}}{\text{length}} = \frac{\text{Mass} \cdot \text{length}}{\text{Time}^2} = [T]$

b) if for eq 1 T has units of Time/oscillation it must be period

for eq 2 T has units of $\frac{\text{mass} \cdot \text{length}}{\text{Time}^2}$ which match the units of force so T would be Tension

Ch 14

2. A pipe resonates at a fundamental frequency based on its length. If you change it's length it resonates w/ a new fundamental frequency. So if you supply a range of frequencies to the pipe, the frequency that will resonate and be amplified will be the fundamental for the given length of the pipe.

6. When a guitar string is attached to an acoustic guitar it causes the guitar body to vibrate. The guitar body moves more air than the string so the note is much louder than when you have the string alone. this is caused by Sympathetic (Forced) vibration.

additional Problem:

Describe in detail the difference between resonance and sympathetic vibration. For a piano what is the source of the vibration how pitch is changed and what amplifies the sound?

Resonance is the frequency something likes to vibrate at - the fundamental frequency. The guitar string in 6 above will play a certain note when plucked. This note depends on the string's tension, the density of the string and the length. The body of the guitar will vibrate at whichever frequency the strings vibrate at. So the guitar body is not picky. It will vibrate for a wide range of frequencies which means resonance is not the cause. This is called Sympathetic or Forced vibration.

Piano — Source: hammer striking a string

Change pitch: Piano has 1 string per key. Each String can play only one note

Amplify: Sound board & piano body vibrate via Sympathetic/forced vibration because the strings are attached to the sound board.