Chapter Summary

16.9. Waves
- State the characteristics of a wave.
- Calculate the wavelength of a wave.
- Calculate the velocity of wave propagation.
- Explain transverse and longitudinal waves.

16.10. Superposition and Interference
- State the superposition principle.
- Explain standing waves.
- Describe the mathematical representation of harmonics and beat frequency.

17.1. Sound
- Describe sound as a longitudinal wave.
- Identify sound wave parts, such as rarefactions and compressions

17.2. Speed of Sound, Frequency, and Wavelength
- Define pitch.
- Describe the relationship between the speed of sound, its frequency, and its wavelength.
- Describe the effects of temperature on the speed of sound.

17.4. Doppler Effect and Sonic Booms
- Define Doppler effect, Doppler shift, and sonic boom.
- Calculate the frequency of a sound heard by someone observing Doppler shift.
- Describe the sounds produced by objects moving faster than the speed of sound.

17.5. Sound Interference and Resonance: Standing Waves in Air Columns
- Define antinode, node, fundamental, and harmonics.
- Identify instances of sound interference in everyday situations.
- Calculate the length of a tube using sound wave measurements.

Key Equations

$$f = \frac{1}{T} \iff T = \frac{1}{f}$$

$$v = \lambda f$$

$$y = A\cos(\omega t + \phi)$$

$$v_{air} = 331.3\sqrt{1 + \frac{T}{273.15}} \text{ m/s}$$

$$d = vt$$

$$\omega = 2\pi f$$

$$f_o = f_s \frac{v \pm v_o}{v \pm v_s}$$

Tube with 1 open end: $\lambda_i = \dfrac{4L}{n}$ where i = 1,2,3, etc. and n = 1,3,5,etc.

$$f_B = |f_1 - f_2|$$

Tube with 2 open ends: $\lambda_i = \dfrac{2L}{n}$ where i = 1,2,3, etc. and n = 1,2,3,etc.

$$v_{source} = v_{sound}\left(\frac{2^{\frac{\Delta Pitch}{12}} - 1}{2^{\frac{\Delta Pitch}{12}} + 1}\right)$$

Multiple Choice (Approx 15-20)

- Units for the parameters in the key equations and key terms
- Difference between transverse and longitudinal waves, plus examples of each
- Effect of air temperature on the speed of sound
- Relationship between wavelength and frequency of a wave
- Change in frequency of a sound with motion of the source and/or observer
- Nodes and antinodes of a vibrating string fixed at both ends
- Beat frequency
- Constructive and destructive interference
- Mach numbers and sonic booms
- Resonance in tubes, wine glasses and bridges
- Labeling parts of a wave on a y versus x graph and a y versus t graph

Problems (Approx 5-8)
- Notes and practice problems in class