Physics 221

Exam 1

Learning Goals

Students will be able to:

describe how sounds are produced with vibrations.

describe how tones can be varied by changing the length of a resonant cavity or string.

define frequency and amplitude in terms of a sound wave and how humans perceive sound.

Students will be able to describe resonance and sympathetic vibration and how they relate to one another.

describe natural frequency as well as where and how it appears in instruments.

describe harmonics and how they relate to natural frequency and how they are created in instruments.

Describe standing waves on strings and be able to identify wavelengths that will and will not create standing waves on a particular string.

Calculate the wave speed of a particular string.

determine how instruments they have not studied in class work. 1. Identify the source of the sound, 2.the way to change pitch and 3. The mechanism used to amplify the sounds.

Calculate the period, frequency, wavelength and speed of a wave or oscillating object such as attached to a spring or pendulum.

Apply and use the equations of motion for simple harmonic motion

Identify when an object is undergoing periodic motion and or simple harmonic motion.

Apply a free body diagram to an object in simple harmonic motion and use this to identify the locations of minimum and maximum displacement, velocity, acceleration, kinetic energy and potential energy

Identify and describe transverse and longitudinal waves

Describe the Doppler effect and calculate the frequency shift caused by the source and observer speeds.

Apply the concept of conservation of energy to an object undergoing simple harmonic motion.

Calculate intensity, intensity level or power given any one of the other three.

Create the history graph of a given wave from the position graph and vice versa.

Apply the principle of superposition to two interfering waves including drawing the waves at any given time as they pass by one another.

Define constructive and destructive interference.

We skipped section 16.4 “Standing sound waves”

Describe beat frequency

Exam 1 Equations

$v = 331 \text{ m/s} \sqrt{1 + \frac{T}{273}}$ T in degrees Celsius

$F = -kx$ $a = -\frac{k}{m} x$ $T = 1/f$

Springs: $T = 2\pi\sqrt{\frac{m}{k}}$ $f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$ pendulum: $T = 2\pi\sqrt{\frac{L}{g}}$ $f = \frac{1}{2\pi}\sqrt{\frac{g}{L}}$ $g = 9.8$ m/s^2

$E = ½ kx^2 + ½mv^2$ $U_g = mgh$ $K = ½mv^2$

Equations of motion general: $x = A \cos(2\pi f t)$ $v = -2\pi f A \sin(2\pi f t)$ $a = -(2\pi f)^2 A \cos(2\pi f t)$

$v_{max} = 2\pi f A$ $a_{max} = A(2\pi f)^2$

$v = \sqrt{\frac{T}{\mu}}$ $v = \lambda f$

$I = \frac{P}{4\pi r^2}$ $\beta = 10 \log(\frac{I}{I_o})$ $I_o = 1 \times 10^{-12} \text{ W/m}^2$

$f' = f\frac{v \pm v_o}{v \pm v_s}$ + observer moving towards, - observer moving away,

- source moving towards, + source moving away.