

Noteguide for Basic Wave Principles (Videos 12A, B, C)

Name _____

Video 12A - two important principles:

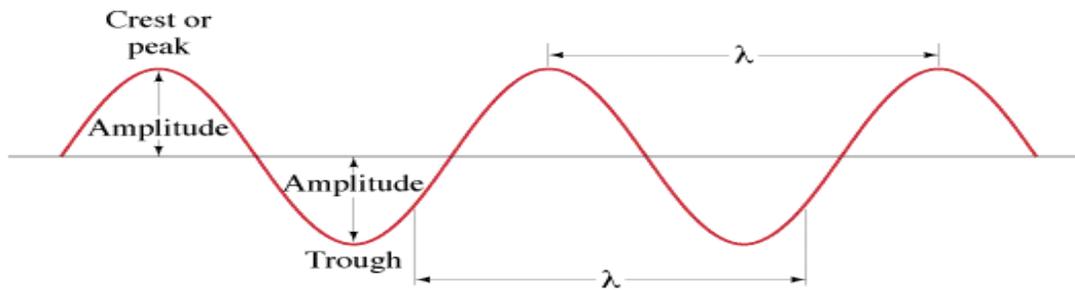
Principle 1:	Principle 2:
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Video 12B - Types of waves:

	Wave moves	Particles move	Examples of
Transverse:			
Longitudinal:			

I have some demos and activities for this in class tomorrow

Video 12C - Wave Calculations - Period, Frequency, Wavelength, and Wave speed



Formula 1:	Formula 2:
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	Symbol	What it is	Units
Medium			N/A
Amplitude			Many answers
Wavelength			
Wave speed			
Period			
Frequency			

Example 1: What is the frequency of a wave that takes 0.12 s for the whole wave to pass by?

Example 2: What is the wavelength of an A 440.0 Hz if the speed of sound is 343 m/s?

Whiteboards:

1. What is the period of a 60. Hz wave?	2. What is the frequency of a wave with a period of 0.003906 s
3. What is the velocity of a 1.12 m wave with a frequency of 32 Hz?	4. What is the wavelength of a 89.1 MHz FM radio signal? MHz = 10^6 Hz $v = c = 3.00 \times 10^8$ m/s (Speed of light)
5. What is the frequency of a sound wave that has a wavelength of 45 cm, where the speed of sound is 335 m/s	6. What is the period of a 12.0 m long radio wave? $v = c = 3.00 \times 10^8$ m/s (Speed of light) (These are EC on the test)

Noteguide for Reflections (Video 12D)

Name _____

Occur when:

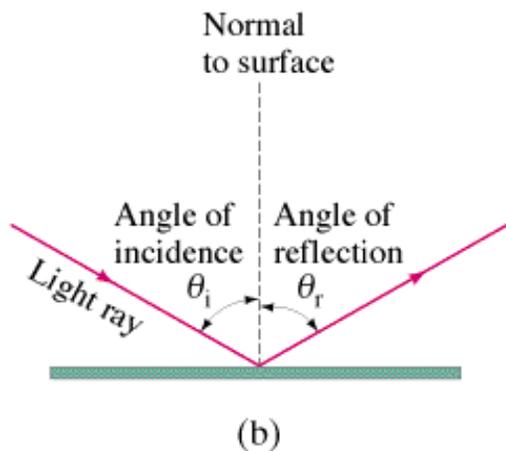
Examples of reflections:

How to prevent reflections:

Fixed vs. Free ends:



Mirrors:



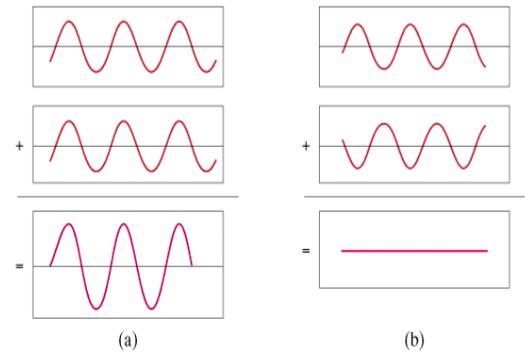
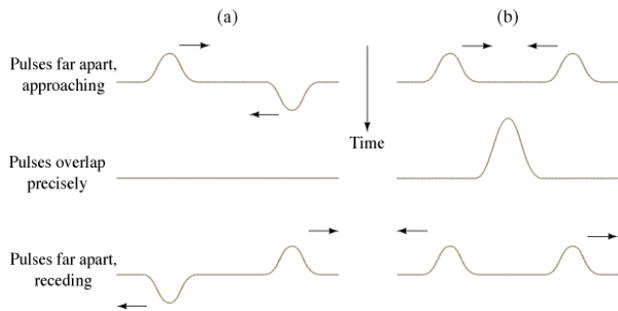
Noteguide for Superposition and Interference (Videos 12E)

Name _____

Superposition: (Overlapping waves add)

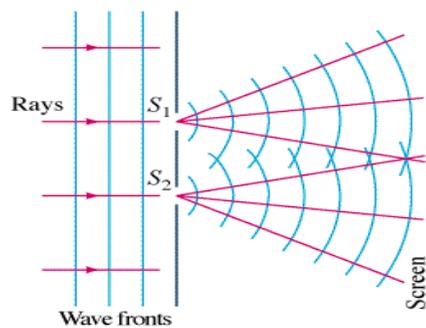
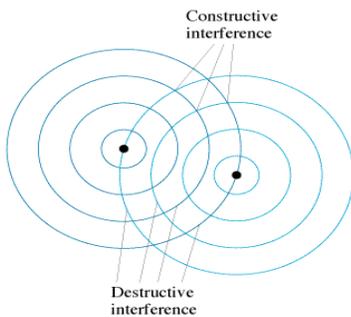
Examples:

Interference:



<p>Wavelength rule for constructive interference:</p>	<p>Wavelength rule for destructive interference:</p>
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Other Examples:



Video F - Intro to standing waves

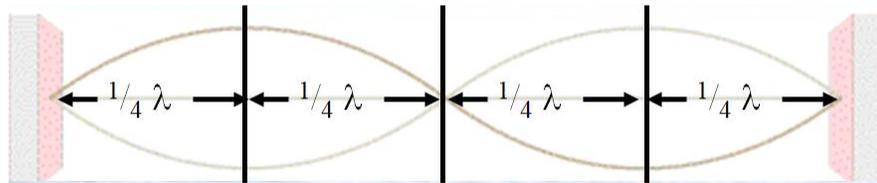
Watch the demos of all three kinds first

Draw the next two modes: (from the video)

Harmonic	Both ends fixed	Both ends free	One end fixed
1			
2			
3			

Haha - we will talk in class why they happen. (I try to explain it on the video)

Video G - Part 1 - Calculations



One whole wavelength:

So a quarter wavelength is either:



OR

Formulas:

$$L = \frac{n\lambda}{4}$$

So count the quarter wavelengths:



Formulas: $L = \frac{n\lambda}{4}$ $v = f\lambda$

Example: This waveform is 8.45 m long. What is the wavelength of the standing wave? If it has a frequency of 30.4 Hz, what is the wave speed?

What is meant by the **waveform**:

What is meant by the **wavelength**:

Do **all** of the examples



This **waveform** is 45 cm long. What is the wavelength?



The **wavelength** is 0.80 m long. What is the length of the standing wave? (The waveform)



This **waveform** is 2.42 m long. What is the wavelength? If it is a sound wave ($v = 343$ m/s), what is the frequency?



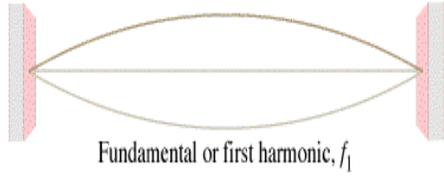
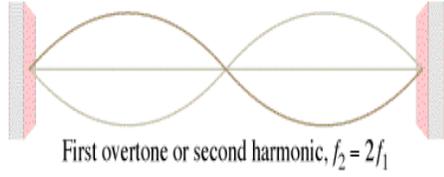
The **wavelength** is 124 cm long. What is the length of the waveform? If it is a sound wave ($v = 343$ m/s), what is its frequency?

Noteguide for Standing Waves (Videos 12G, Part 2)

Name _____

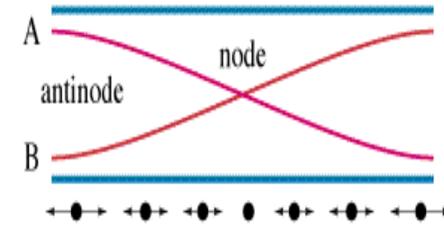
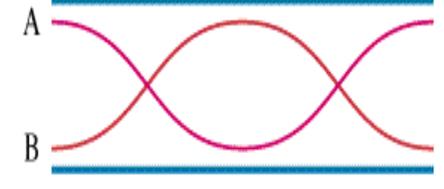
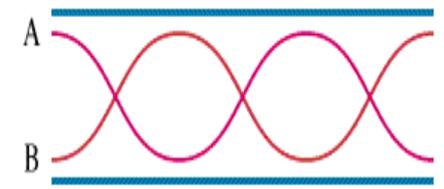
Video G Part 2 - First three modes of vibration

This string is 32.0 cm long, and has a wave speed of 281.6 m/s. Find the wavelength and frequency for each mode:

	Wavelength	Frequency
 <p>Fundamental or first harmonic, f_1</p>		
 <p>First overtone or second harmonic, $f_2 = 2f_1$</p>		
 <p>Second overtone or third harmonic, $f_3 = 3f_1$</p>		

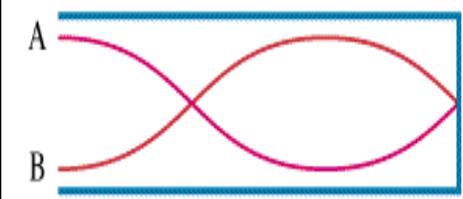
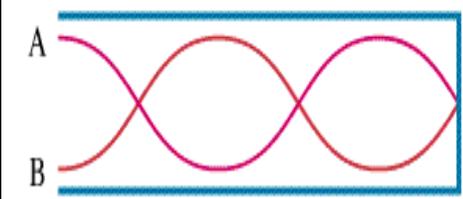
What is the pattern of frequencies:

This pipe is 1.715 m long, sound travels at 343 m/s along the pipe. Find the wavelength and frequency for each mode:

	Wavelength	Frequency
 <p>node antinode</p>		
		
		

What is the pattern of frequencies:

This pipe is 1.715 m long, sound travels at 343 m/s along the pipe. Find the wavelength and frequency for each mode:

	Wavelength	Frequency
		
		
		

What is the pattern of frequencies:

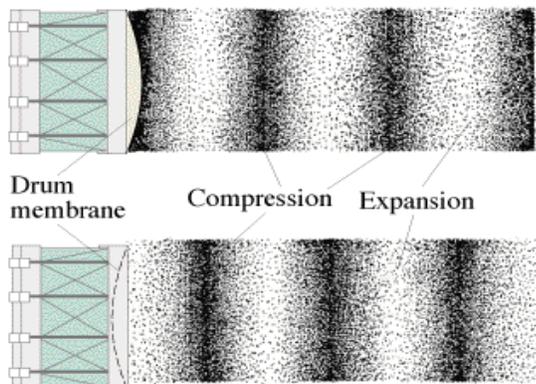
Whiteboards:

<p>1. The third harmonic on a flute (both ends open pipe) has a frequency of 480. Hz. How long is the waveform if the speed of sound inside the flute is 335 m/s?</p>	<p>2. What is the frequency of the 2nd harmonic on a 0.31 m long pan pipe (One end open, one end closed) where the speed of sound is 343 m/s</p>
<p>3. What is the wave speed on a 0.34m long violin string if the first harmonic has a frequency of 440 Hz?</p>	<p>4. What is the frequency of the 3rd harmonic on a violin string that is 0.34 m long where the wave speed is 299.2 m/s</p>

Noteguide for Sound (Videos 12H)

Name _____

What type of wave is sound:



Range of human hearing:

Most sound is:

$$v = (331 + 0.60T) \text{ m/s, } T = \text{temperature in } ^\circ\text{C}$$

Example 1 – What is the speed of sound at 20 °C? 42 °C?

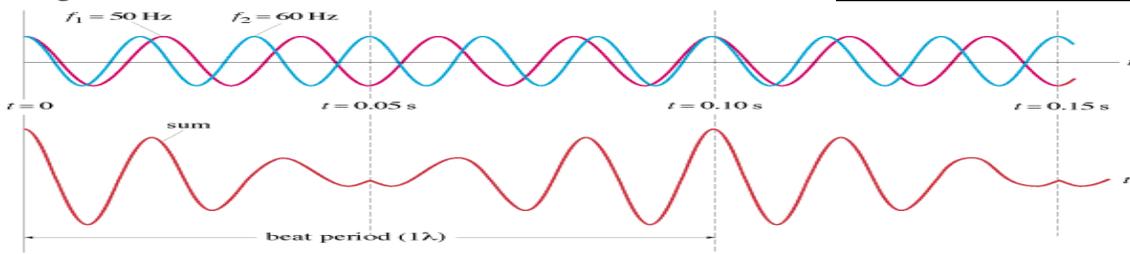
Whiteboards:

1. What is the speed of sound in air at 80 °C?
(379 m/s)

2. At what temperature in Celsius is the speed of
sound 318 m/s? (-21.7 °C)

Noteguide for Beats (Videos 12I)

Name _____



$$f_{\text{beat}} = |f_1 - f_2|$$

Examples:

1. I play a pitch of 256 Hz (C) on my Pennywhistle, and you play a pitch of 384 Hz (G) on your whistle. What is the beat frequency?

2. If I am playing a pitch of 384 Hz, and I hear a beat frequency of 10.0 Hz, what are the possible other frequencies that are playing?

Whiteboards:

1. What beats do you hear if you play an e 640 Hz with a c 1024 Hz?
(384 Hz, G in octave below the E)

2. If you are playing an A 440 Hz, and you hear a beat frequency of 20 Hz, what are the other possible frequencies that could be playing?
(460 Hz or 420 Hz)

3. The concertmaster is playing an A 440.0 Hz. Another violin hears a beat every 0.20 seconds. What frequency are they playing?
(445.0 Hz or 435.0 Hz)

Video K - Introduction to Doppler (Watch all three videos)

Receding source/observer

Approaching source/observer

Frequency is _____

Frequency is _____

Video L - Feel free to skip the derivation if it does not interest you, but write down what all the variables are in the formulas:

<p>Moving Source</p> $f' = f \left(\frac{v}{v \pm u_s} \right)$ <p>f':</p> <p>f:</p> <p>v:</p> <p>u_s:</p>	<p>Moving Observer</p> $f' = f \left(\frac{v \pm u_o}{v} \right)$ <p>f':</p> <p>f:</p> <p>v:</p> <p>u_o:</p>
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Do Examples 1 and 3. We will not be solving for source or observer speed, but it is extra credit on the test if you want to learn how to do it

<p>Example 1 - A car with a 256 Hz horn approaches you at 40.0 m/s. What frequency do you hear? (3) (use v sound = 343 m/s)</p>	<p>Example 3 - You run at 8.50 m/s toward a violinist playing 660. Hz. What frequency do you hear? (Use 343 m/s as the speed of sound)</p>
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