ConcepTest 14.13 Open and Closed Pipes

You blow into an open pipe and produce a tone. What happens to the frequency of the tone if you close the end of the pipe and blow into it again?

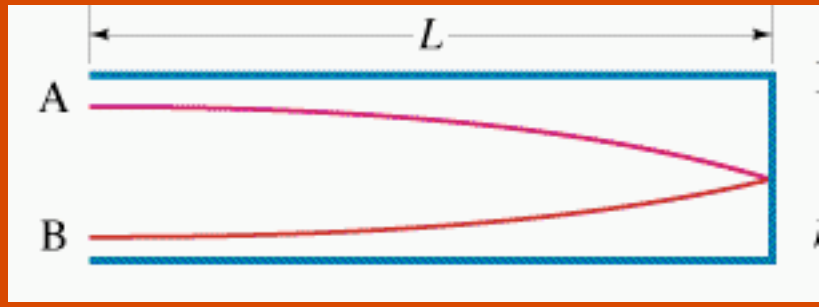
1) depends on the speed of sound in the pipe
2) you hear the same frequency
3) you hear a higher frequency
4) you hear a lower frequency

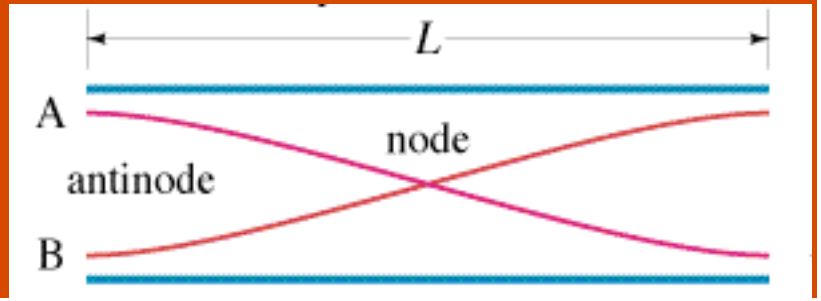
ConcepTest 14.13 Open and Closed Pipes

You blow into an open pipe and produce a tone. What happens to the frequency of the tone if you close the end of the pipe and blow into it again?

1) depends on the speed of sound in the pipe
2) you hear the same frequency
3) you hear a higher frequency
4) you hear a lower frequency

In the open pipe, 1/2 of a wave "fits" into the pipe, while in the closed pipe, only 1/4 of a wave fits. Because the wavelength is larger in the closed pipe, the frequency will be lower.



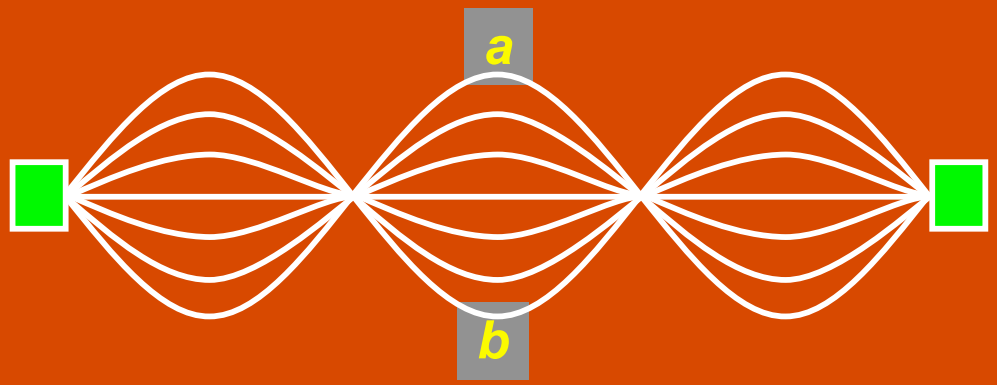


Follow-up: What would you have to do to the pipe to increase the frequency?

ConcepTest 15.2a Standing Waves I

A string is clamped at both ends and plucked so it vibrates in a standing mode between two extreme positions *a* and *b*. Let upward motion correspond to positive velocities. When the string is in position *b*, the instantaneous velocity of points on the string:

1) **is zero everywhere**
2) **is positive everywhere**
3) **is negative everywhere**
4) **depends on the position along the string**



ConcepTest 15.2a Standing Waves I

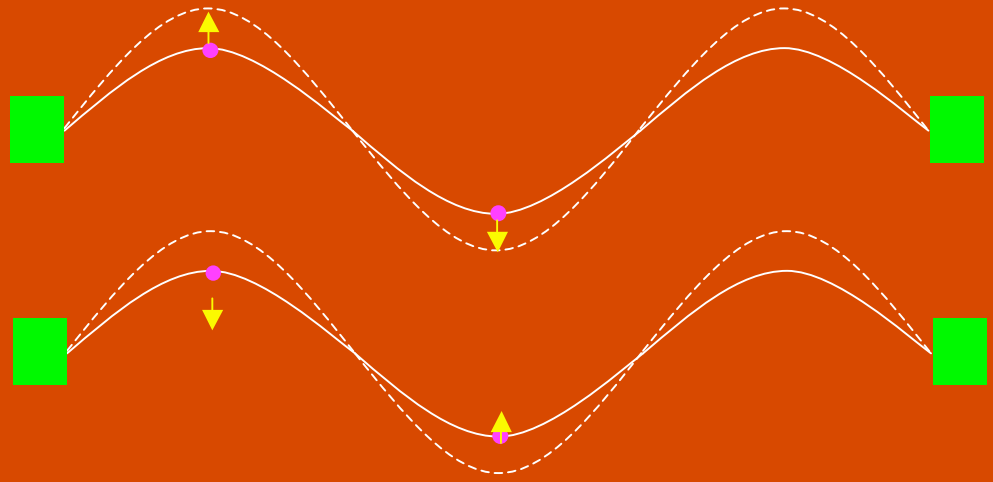
A string is clamped at both ends and plucked so it vibrates in a standing mode between two extreme positions *a* and *b*. Let upward motion correspond to positive velocities. When the string is in position *b*, the instantaneous velocity of points on the string:

1) **is zero everywhere**
2) **is positive everywhere**
3) **is negative everywhere**
4) **depends on the position along the string**

Observe two points:

Just before *b*

Just after *b*



Both points change direction before and after *b*, so at *b* all points must have zero velocity.

ConcepTest 15.3 Beats

The traces below show beats that occur when two different pairs of waves interfere. For which case is the *difference in frequency* of the original waves *greater*?

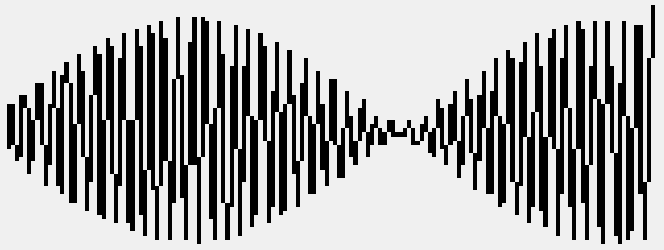
1) pair 1

2) pair 2

3) same for both pairs

4) impossible to tell by just looking

Pair 1



Pair 2

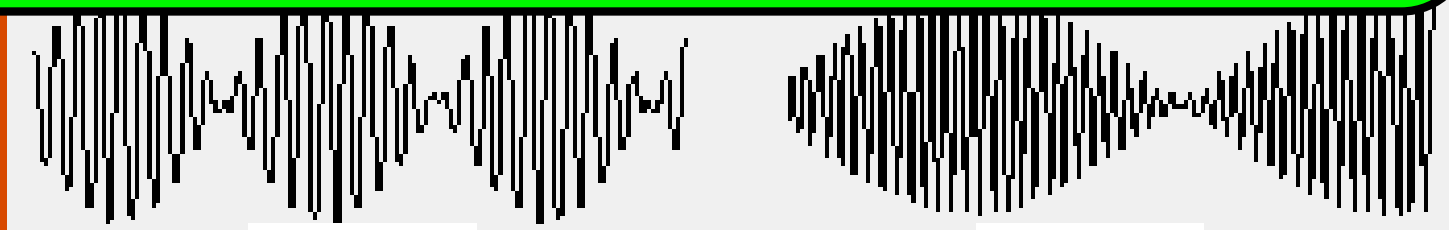
ConcepTest 15.3 Beats

The traces below show beats that occur when two different pairs of waves interfere. For which case is the *difference in frequency* of the original waves *greater*?

1) pair 1
2) pair 2
3) same for both pairs
4) impossible to tell by just looking

Recall that the beat frequency is the difference in frequency between the two waves: $f_{beat} = f_2 - f_1$

Pair 1 has the greater beat frequency (more oscillations in same time period), so Pair 1 has the greater frequency difference.



ConcepTest 14.10a Sound Intensity I

You stand a certain distance away from a speaker and you hear a certain intensity of sound. If you double your distance from the speaker, what happens to the sound intensity at your new position?

1) **drops to 1/2 its original value**
2) **drops to 1/4 its original value**
3) **drops to 1/8 its original value**
4) **drops to 1/16 its original value**
5) **does not change at all**

ConcepTest 14.10a Sound Intensity I

You stand a certain distance away from a speaker and you hear a certain intensity of sound. If you double your distance from the speaker, what happens to the sound intensity at your new position?

1) drops to 1/2 its original value
2) drops to 1/4 its original value
3) drops to 1/8 its original value
4) drops to 1/16 its original value
5) does not change at all

For a source of a given power P, the intensity is given by $I = P/4\pi r^2$. So if the distance doubles, the intensity must decrease to one-quarter its original value.

Follow-up: What distance would reduce the intensity by a factor of 100?

ConcepTest 14.11a Decibel Level I

When Mary talks, she creates an intensity level of 60 dB at your location. Alice talks with the same volume, also giving 60 dB at your location. If both Mary and Alice talk simultaneously from the same spot, what would be the new intensity level that you hear?

1) more than 120 dB
2) 120 dB
3) between 60 dB and 120 dB
4) 60 dB
5) less than 60 dB

ConcepTest 14.11a Decibel Level I

When Mary talks, she creates an intensity level of 60 dB at your location. Alice talks with the same volume, also giving 60 dB at your location. If both Mary and Alice talk simultaneously from the same spot, what would be the new intensity level that you hear?

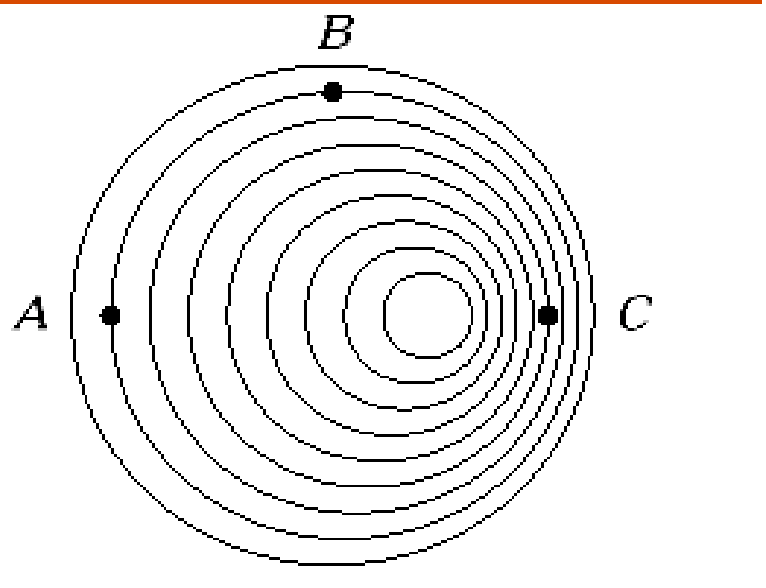
1) more than 120 dB
2) 120 dB
3) between 60 dB and 120 dB
4) 60 dB
5) less than 60 dB

Recall that a difference of 10 dB in intensity level b corresponds to a factor of 10^1 in intensity. Similarly, a difference of 60 dB in b corresponds to a factor of 10^6 in intensity!! In this case, with two voices adding up, the intensity increases by only a factor of 2, meaning that the intensity level is higher by an amount equal to: Db = 10 log(2) = 3 dB. The new intensity level is b = 63 dB.

ConcepTest 14.15a Doppler Effect I

Observers A, B and C listen to a moving source of sound. The location of the wave fronts of the moving source with respect to the observers is shown below. Which of the following is true?

1) **frequency is highest at A**
2) **frequency is highest at B**
3) **frequency is highest at C**
4) **frequency is the same at all three points**

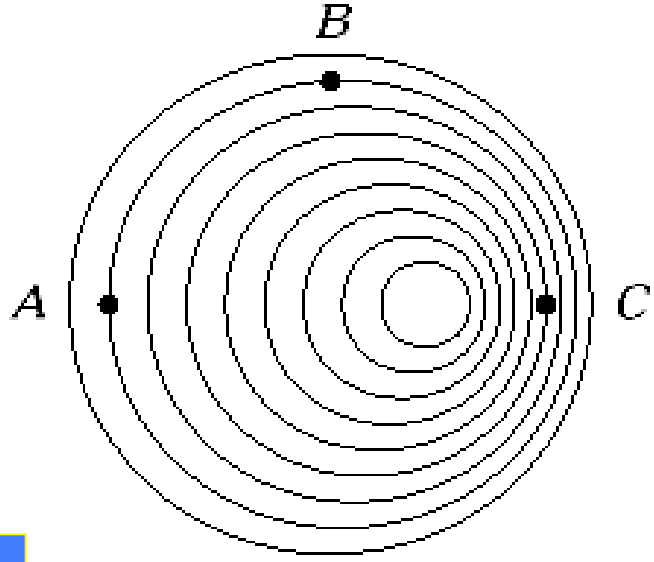


ConcepTest 14.15a Doppler Effect I

Observers A, B and C listen to a moving source of sound. The location of the wave fronts of the moving source with respect to the observers is shown below. Which of the following is true?

1) frequency is highest at A
2) frequency is highest at B
3) frequency is highest at C
4) frequency is the same at all three points

The number of wave fronts hitting observer C per unit time is greatest – thus the observed frequency is highest there.



Follow-up: Where is the frequency lowest?