Resonance

Lesson objectives

Students will be able to describe the process of resonance, and analyze resonance in open and closed pipes.

1.1

Lesson objectives | Teachers' notes | Lesson notes

Resonance

The natural frequency of vibration of an object is its resonant frequency.

The if we exert a force at the resonant frequency, we can greatly increase the amplitude of the object's vibration. This is theforced frequency.

Mechanical resonance is the increase in amplitude of oscillation of a system as a result of a periodic force whose frequency is equal or very close to the resonant frequency of the system.

Quicklab 7-5: Investigating Mechanical Resonance

Problem: How can we cause a pendulum to begin oscillating at its resonant frequency by using a forced frequency?

Why do engineers care about resonance?

Bridges

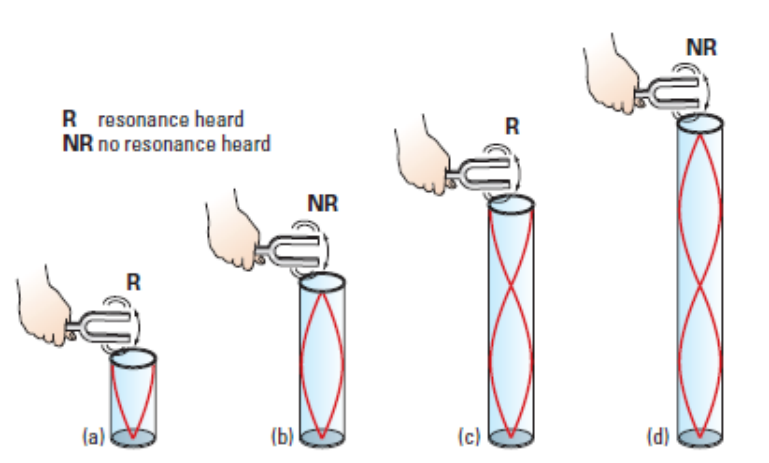
Buildings

Resonance in Air Columns

All wind instruments use the principles of resonance t produce music. Blowing into the instrument sets up a standing wave. The resonant frequency of the note depends on the length of the tube.

Closed-pipe resonance:

Nodes are located every half-wavelength from the en at which the wave is reflected.



Resonance occurs when the pipe is 1/4λ, 3/4λ, 5/4λ long.

Example 8.3, p. 419

A tuning fork with a frequency of 384 Hz is held above an air column. As the column is lengthened, a closed-pipe resonant point is found when the length of the air column is 67.5 cm. What are possible wavelengths for this data? If the speed of sound is known to be slightly greater than 300 m/s, what is (a) the actual wavelength, and (b) the actual speed of sound?

Practice Problems #1-4, p. 420

Open-pipe resonance:

For an open pipe, the longest possible wavelength is twice the length of the pipe (i.e $l = \lambda/2$).