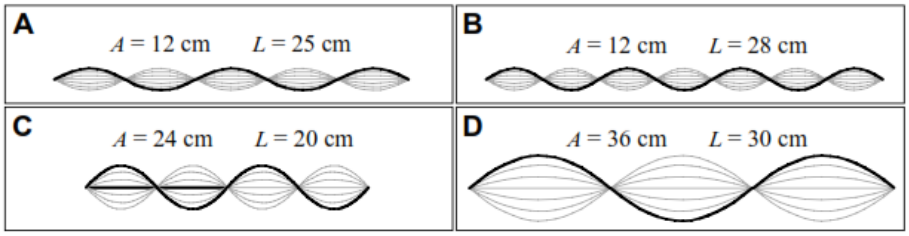
AP Physics 2 – Waves and Refraction

E1-RT12: Standing Waves—Wavelength

A string is stretched so that it is under tension and is tied at both ends so that the endpoints don't move. A mechanical oscillator then vibrates the string so that a standing wave is created. The dark line in each diagram represents a snapshot of a string at an instant in time when the amplitude of the standing wave is a maximum. The lighter lines represent the string at other times during a complete cycle. All of the strings are identical except for their lengths, and all strings have the same tension. The number of nodes and antinodes in each standing wave is different. The lengths of the strings (L) and the amplitudes at the antinodes (A) are given in each figure.



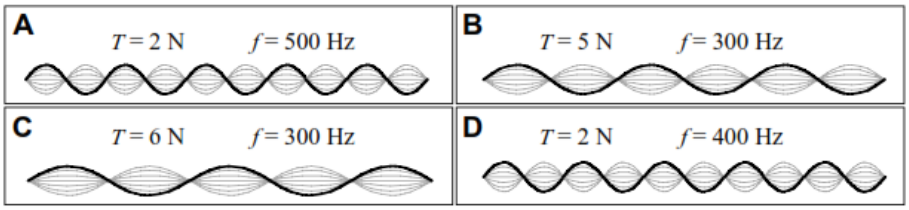
Rank the wavelengths of the waves.

☐ 1 Greatest ☐ 2 ☐ 3 ☐ 4 Least OR ☐ All the same ☐ All zero ☐ Cannot determine

Explain your reasoning.

E1-RT13: Standing Waves Systems—Wave Speed

A string is stretched so that it is under tension and is tied at both ends so that the endpoints don't move. A mechanical oscillator then vibrates the string so that a standing wave is created. The dark line in each diagram represents a snapshot of a string at an instant in time when the amplitude of the standing wave is a maximum. The lighter lines represent the string at other times during a complete cycle. All of the strings have the same length but may not have the same mass. The number of nodes and antinodes in the standing wave is the same in Cases A and D. The tensions in the strings (T) and the standing wave frequencies (f) are given in each figure.



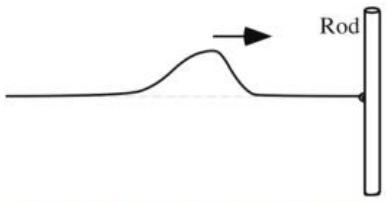
Rank the speeds of the waves in the strings.

☐ 1 Greatest ☐ 2 ☐ 3 ☐ 4 Least OR ☐ All the same ☐ All zero ☐ Cannot determine

Explain your reasoning.

E1-QRT14: Wave Pulse on Horizontal Spring with Fixed End—Reflection Shape

A long spring is firmly connected to a stationary metal rod at one end. A student holding the other end moves her hand rapidly up and down to create a pulse with the shape shown in the figure. The pulse moves along the taut spring toward the rod.

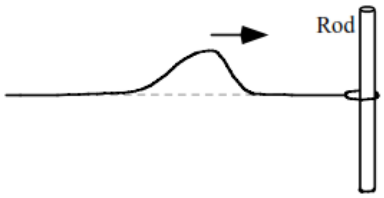


In the space below, draw what the pulse on the spring looks like after it has completely reflected from the wall and is moving to the left.

Explain your reasoning.

E1-QRT15: Wave Pulse on Horizontal Spring with Free End—Reflection Shape

A long spring is connected to a loop that passes around a stationary metal rod at one end. The loop is free to move vertically without friction along the rod. A student holding the other end moves her hand rapidly up and down to create a pulse with the shape shown in the figure. The pulse moves along the taut spring toward the rod.

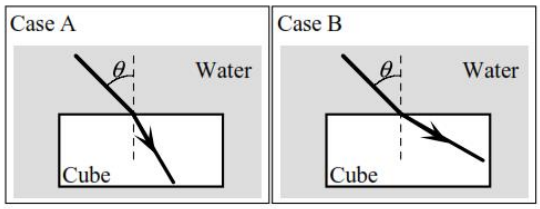


In the space below, draw what the pulse on the spring looks like after it has completely reflected from the wall and is moving to the left.

Explain your reasoning.

E2-CT07: Light Rays Bent at a Surface—Index of Refraction

In both cases shown, a light ray traveling in water bends at the surface of a cube. The cases are identical except that the cube in Case A is made of a different material than the cube in Case B.



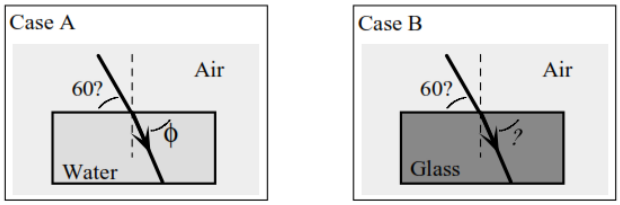
Is the index of refraction of the cube (i) *greater in Case A*, (ii) *greater in Case B*, or (iii) *the same in both cases?*

_____

Explain your reasoning.

E2-CT09: Bending of Laser Beam in Air—Angle Bent

A laser beam traveling in air enters water at an angle of 60° with respect to the surface and is bent in water to an angle of • from the surface as shown in Case A. (Note that the drawings may or may not be accurately portraying the situation.)



If the water is replaced by glass, is the angle with respect to the surface that the laser beam is bent (i) *greater than*, (ii) *smaller than*, or (iii) *equal to* •? _____

Explain your reasoning.

E2-CT11: Laser Light Pulse Traveling through Slab—Time

It has been noted that red light bends less than blue light in glass when it enters the glass at an angle.

Is the time that it takes for a pulse of red light to pass perpendicularly through a slab of glass surrounded by air (i) *greater than*, (ii) *less than*, or (iii) *equal to* the time for a blue light pulse? _____

Explain your reasoning.