Wave Forms with Same Frequency—Wave Speed [119]

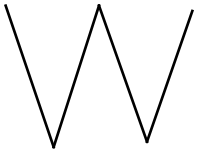
Shown below are six waves, which are all the same kind of wave (e.g., all seismic waves) traveling in various media. The waves all have the same frequency, but their amplitudes, *A*, and wavelengths, λ, vary as shown in the figures. Specific values for these properties are given in each figure.

Rank these waves from greatest to least based on the speed of the waves. That is, put first the wave that is moving fastest and put last the wave that is moving slowest.

A

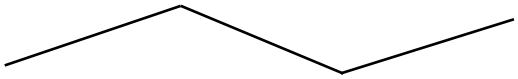
A = 6
λ = 3 m

B



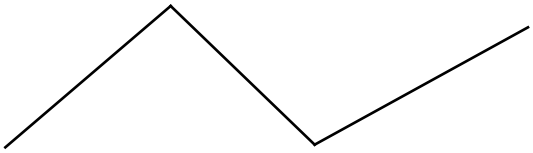
A = 8
λ = 2 m

C



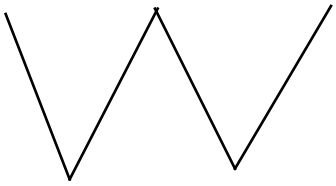
A = 4
λ = 6 m

D



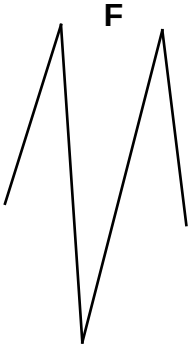
A = 6
λ = 6 m

E



A = 8
λ = 3 m

F



A = 16
λ = 2 m

Fastest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Slowest

Or, all of these waves travel at the same speed. ____

Or, all of these waves are at rest. ____

Please carefully explain your reasoning.

How sure were you of your ranking? (circle one)

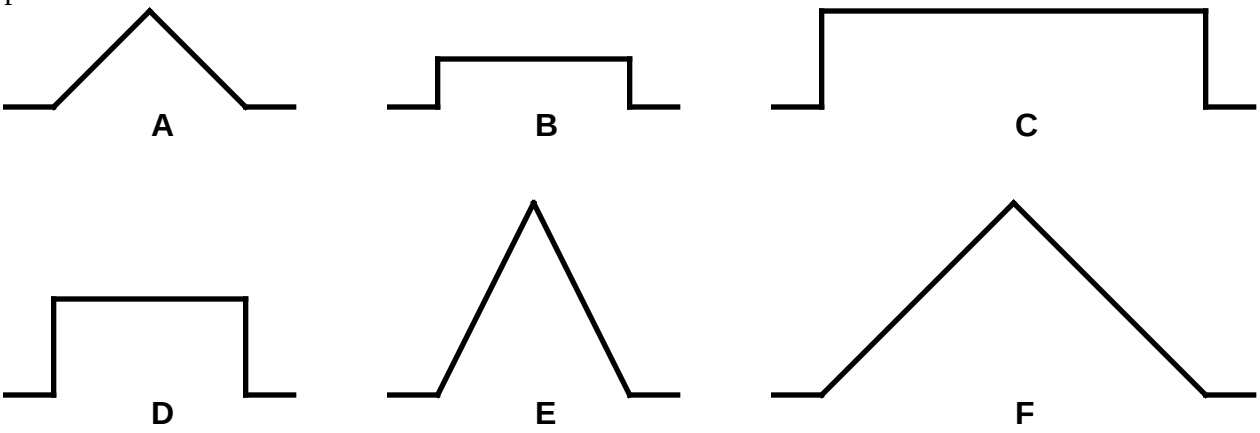
Basically Guessed				Sure					Very Sure
1	2	3	4	5	6	7	8	9	10

[119] D. Maloney

Wave Pulses—Leading Edge Time to Travel [120]

Shown below are six wave pulses of either triangular or square shape. These pulses, which vary in amplitude, are all sent down identical ropes under equal tension. The ropes are all the same length, and there is no distortion of the pulses as they travel down the ropes.

Rank these pulses, from greatest to least, on the basis of how long it takes the leading edge to travel 3 m. That is, put first the pulse that takes the most time for the leading edge to travel 3 m, and put last the pulse that travels 3 m in the shortest time.



Largest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Smallest

Or, all six of these pulses take the same time to travel 3 m. _____

Please carefully explain your reasoning.

How sure were you of your ranking? (circle one)

Basically Guessed				Sure					Very Sure
1	2	3	4	5	6	7	8	9	10

[120] C. Hieggelke, D. Maloney, T. O'Kuma

Standing Waves—Frequency [121]

The figures below show systems of standing waves set up in strings, fixed at both ends, under tension. All of the strings are identical except for their lengths and are under the same tension. The variables in these situations, in addition to the lengths (L) of the strings, are the amplitudes (A) at the antinodes and the number of nodes.

Rank these systems, from greatest to least, on the basis of the frequencies of the waves.

A A = 12 cm L = 25 cm

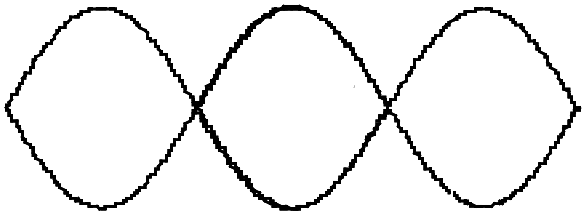
B A = 12 cm L = 28 cm

C A = 18 cm L = 27 cm

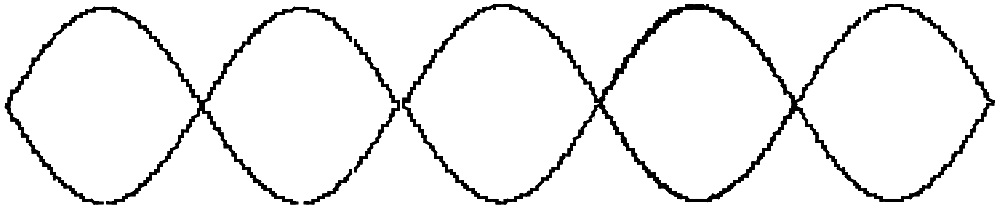
D A = 16 cm L = 28 cm

E A = 24 cm L = 20 cm

F A = 36 cm L = 30 cm



G A = 36 cm L = 50 cm



Greatest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ 7 _____ Least

Or, all of these systems have the same frequency. _____

Please carefully explain your reasoning.

How sure were you of your ranking? (circle one)

Basically Guessed				Sure					Very Sure
1	2	3	4	5	6	7	8	9	10

[121] C. Hieggelke, D. Maloney, T. O'Kuma

Standing Waves—Wavelength [122]

The figures below show systems of standing waves set up in strings, fixed at both ends, under tension. All of the strings are identical except for their lengths and are under the same tension. The variables in these situations, in addition to the lengths (L) of the strings, are the amplitudes (A) at the antinodes and the number of nodes.

Rank these systems, from greatest to least, on the basis of the wavelengths of the waves.

A A = 12 cm L = 25 cm

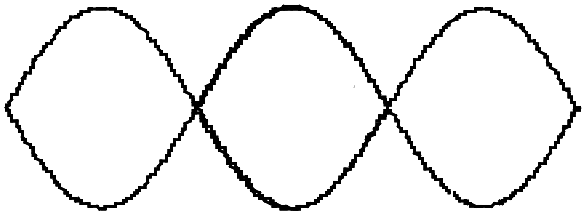
B A = 12 cm L = 28 cm

C A = 18 cm L = 27 cm

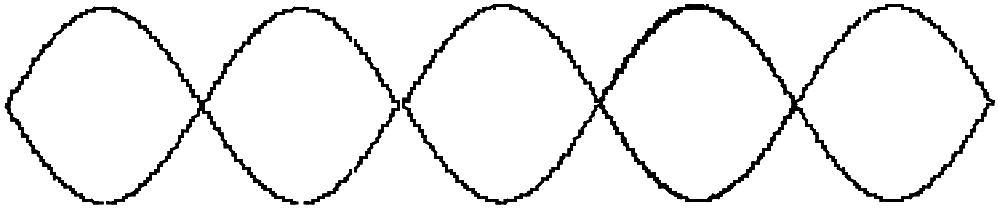
D A = 16 cm L = 28 cm

E A = 24 cm L = 20 cm

F A = 36 cm L = 30 cm



G A = 36 cm L = 50 cm



Greatest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ 7 _____ Least

Or, all of these systems have the same wavelength. _____

Please carefully explain your reasoning.

How sure were you of your ranking? (circle one)

Basically Guessed				Sure					Very Sure
1	2	3	4	5	6	7	8	9	10

[122] C. Hieggelke, D. Maloney, T. O'Kuma

Standing Waves Systems—Wave Speed [123]

Shown below are six standing wave systems in strings. These systems vary in frequency of oscillation, tension in the strings, and number of nodes. The systems are also set up in various strings. The specific values for the string tensions and the frequencies of oscillation are given in each figure. All of the strings have the same length.

Rank these systems, from greatest to least, on the basis of the speeds of the waves in the strings. That is, put first the system whose waves have the greatest speed in their string and put last the system whose waves are traveling slowest in their string.

A T = 2 N f = 500 Hz

B T = 8 N f = 500 Hz

C T = 5 N f = 300 Hz

D T = 6 N f = 300 Hz

E T = 2 N f = 4 00 Hz

F T = 5 N f = 200 Hz

Greatest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Least

Or, all of the waves in these systems have the same speed. _____

Please carefully explain your reasoning.

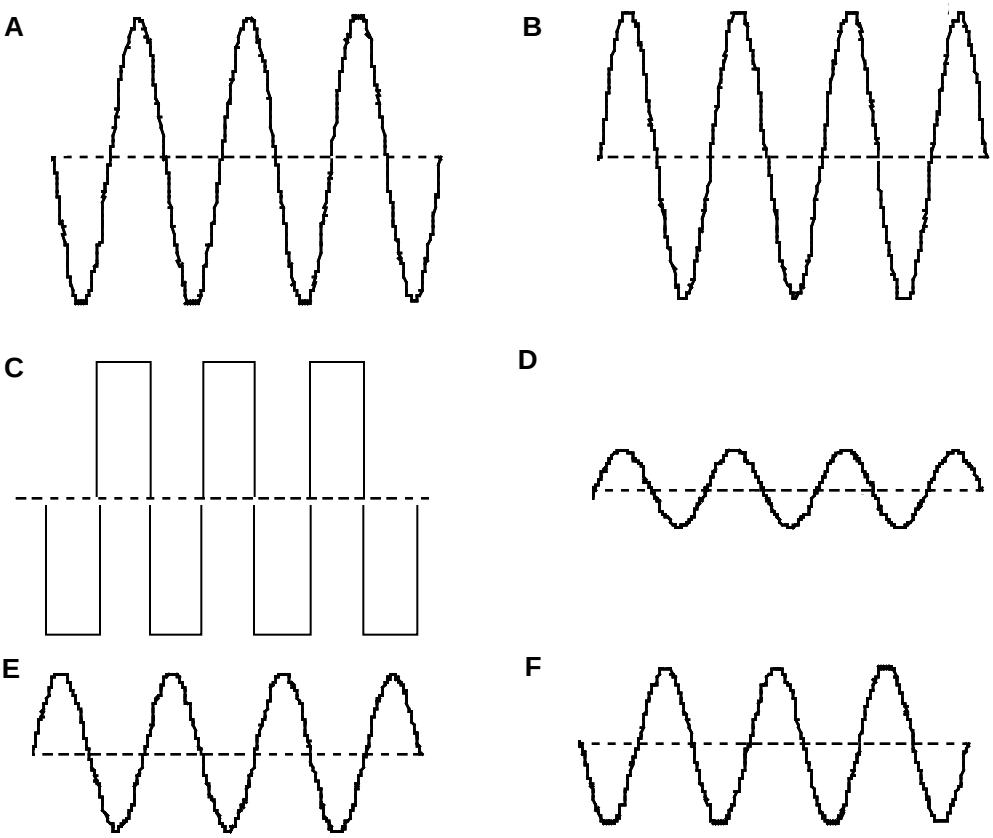
How sure were you of your ranking? (circle one)

Basically Guessed				Sure					Very Sure
1	2	3	4	5	6	7	8	9	10

[123] C. Hieggelke, D. Maloney, T. O'Kuma

Wave Forms with Same Wavelength—Wave Speed [124]

Shown below are six waves of equal wavelengths traveling in the same medium. Rank these waves from greatest to lowest according to their speed in the medium. Assume the waves are all the same type.



Greatest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Lowest

Or, all of the waves have the same wave speed. _____

Please carefully explain your reasoning.

How sure were you of your ranking? (circle one)

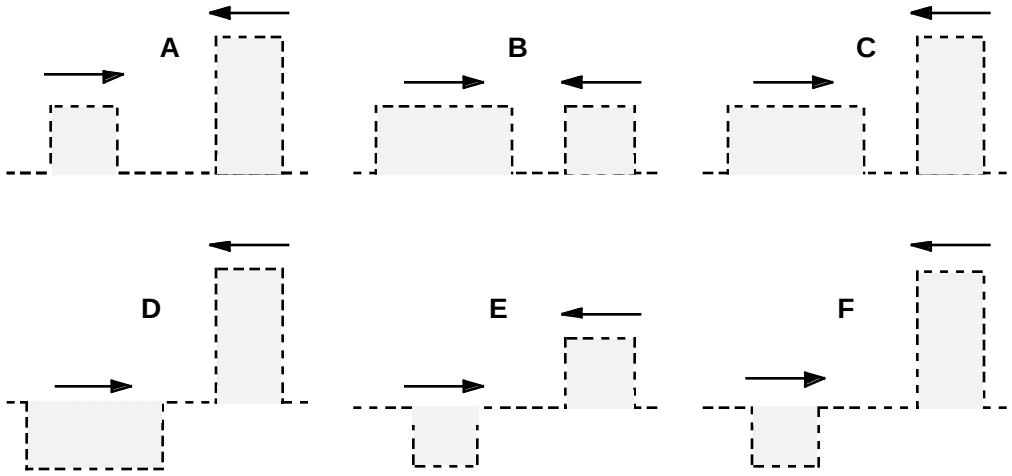
Basically Guessed				Sure					Very Sure
1	2	3	4	5	6	7	8	9	10

[124] I. Szalai, D. Maloney, T. O'Kuma

Pairs of Transverse Waves—Superposition[125]

Shown below are six different pairs of rectangular transverse wave pulses that vary in height (*H*) and length (*L*). Specific values for the heights and lengths are given in each figure for each pulse. In each pair the pulses are moving toward each other. At some point in time the pulses meet and interact (interfere) with each other.

Left	Right	Left	Right	Left	Right
H = 2 cm	*H* = 4 cm	*H* = 2 cm	*H* = 2 cm	*H* = 2 cm	*H* = 4 cm
L = 2 cm	*L* = 2 cm	*L* =4 cm	*L* = 2 cm	*L* =4 cm	*L* = 2 cm



Left	Right	Left	Right	Left	Right
H = -2 cm	*H* = 4 cm	*H* = -2 cm	*H* = 2 cm	*H* = -2 cm	*H* = 4 cm
L = 4 cm	*L* = 2 cm	*L* = 2 cm	*L* = 2 cm	*L* = 2 cm	*L* = 2 cm

Rank these pairs, from highest to lowest, on the basis of the maximum (peak) height of the combined (resultant) pulse at the center of the combined waves at the time when the centers of the pairs coincide.

Greatest 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ Least

Or, all of these pairs will have the same maximum height._____

Please carefully explain your reasoning.

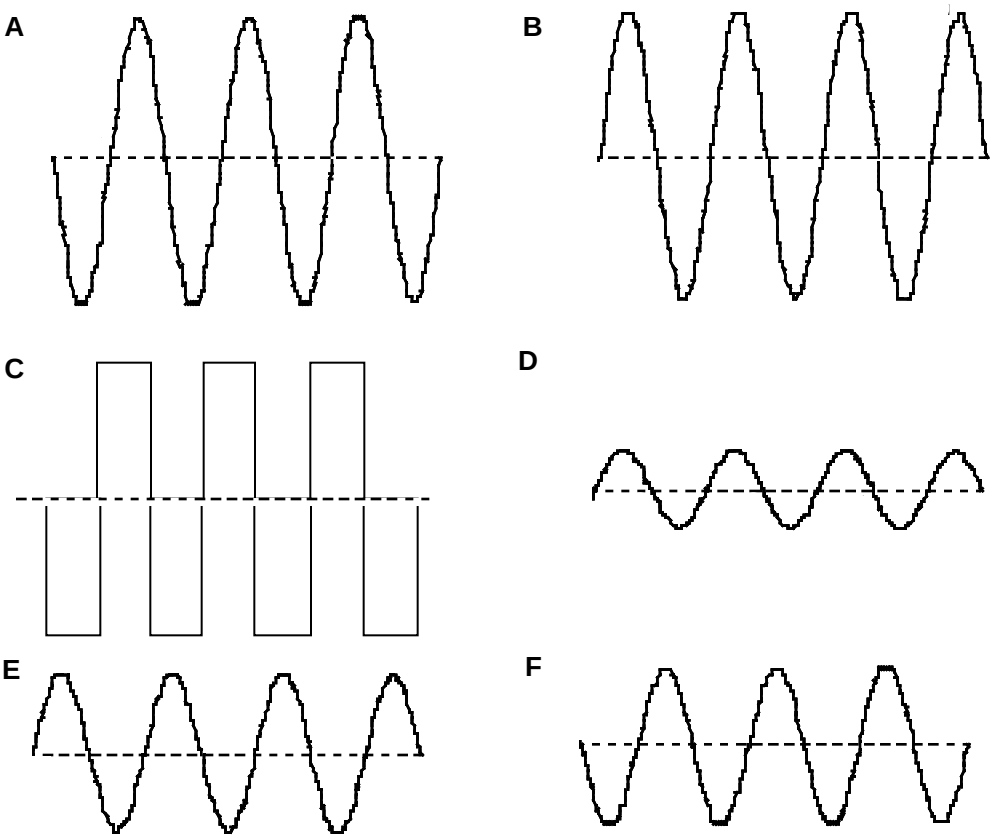
How sure were you of your ranking? (circle one)

Guessed				Sure					Very Sure
1	2	3	4	5	6	7	8	9	10

[125] C. Hieggelke, D. Maloney, T. O'Kuma

Wave Forms with Same Wavelength—Wave Energy [126]

Shown are six waves of equal wavelengths traveling in the same medium. Rank these waves from highest to lowest according to their energy in the medium. Assume the waves are all the same type.



Greatest 1_____ 2_____ 3_____ 4_____ 5_____ 6_____ Least

Or, all waves have the same wave average energy. _____

Please carefully explain your reasoning.

How sure were you of your ranking? (circle one)

Basically Guessed Sure Very Sure

1 2 3 4 5 6 7 8 9 10

[126] I. Szalai, D. Maloney, T. O'Kuma