

Physics 10  
Wave Speed WS

1. Three teachers are resting in the sun on an off-shore raft. They estimate that 3.0 m separates a trough and an adjacent crest of the surface waves on the ocean. They count 14 crests that pass by in 20 seconds. Unfortunately, they aren't science teachers so they need help. How fast are the waves moving?

$$F = 14/20 = 0.7 \text{ Hz} \quad \lambda = 6.0 \text{ m} \quad v = 6.0 \times 0.7 = \underline{4.2 \text{ m/s}}$$

2. Waves made by a motorboat have an amplitude of 10 cm, and 2 wave crests pass by every 4 seconds. If the distance between the wave crests is 0.5 m: a) determine the wave speed and period of the waves. b) Suppose the same boat circles back and passes by with waves of amplitude 85 cm. If the distance between waves is now 0.8 m, determine the wave speed and frequency of the waves.

a.  $T = 2 \text{ seconds}$        $f = 0.5 \text{ Hz}$        $\lambda = 0.5 \text{ m}$        $v = \underline{0.25 \text{ m/s}}$

b.  $v = 0.25 \text{ m/s}$  (NO CHANGE IN THE MEDIUM)  $\lambda = 0.8 \text{ m}$        $f = \underline{0.31 \text{ Hz}}$

3. A wave of amplitude 0.5 m interferes with a wave of amplitude of 0.2m. What is the maximum resultant displacement that may occur? What is the minimum resultant displacement that may occur?

Max: 0.7 m Min: 0.3 m

4. A string is rigidly attached to a post. Two pulses both with an amplitude of 0.5m are sent down the string. The first is reflected off of the post. Assuming their amplitudes remain the same, what is the displacement when the two waves cross each other? What is this called?

Destructive interference. Displacement is 0 m

5. Repeat problem #4 with a string attached to a free moving boundary.

Constructive interference. Displacement is 1.0 m

6. Little Timmy (a physics prodigy) is visiting the grand canyon on a balmy 32 degree Celsius day with his family. Always the show off, Timmy claims that he can determine the width of the canyon with only his voice and a stop watch. He makes a quick, high pitch yell as he starts the watch. He stops the watch when he hears his echo, 17 seconds later. How wide is this section of the canyon?

$V = 349.2 \text{ m/s}$        $t = 17 \text{ s}$        $d = 5940 \text{ m}$       one way distance: 2950 m