Flipping Physics Lecture Notes:

Wave Speed Equation Derivation and Demonstration

https://www.flippingphysics.com/wave-speed.html

The equation for the magnitude of velocity is: $v=\frac{\Delta x}{\Delta t}$

If the magnitude of the displacement of the wave equals the wavelength of the wave, λ, then the time for that to occur is the period, T: $v=\frac{\Delta x}{\Delta t}=\frac{\lambda}{T}$

We know frequency and period are inversely related: $f=\frac{1}{T}$

Therefore, the equation for the magnitude of the velocity of a wave is: $v=\frac{\Delta x}{\Delta t}=\frac{\lambda}{T}=f\lambda \Rightarrow \boxed{v=f\lambda}$

The amplitude, frequency, and wavelength of the wave do not affect the speed of the wave. The only thing that affects the speed of the wave in the medium is the properties of the medium itself.

An important point to notice is that this equation describes the speed of the wave pulse, not the speed of the particles of the medium. Also, we use the symbol "v" for the speed of the wave here. Frequency and wavelength are both scalars, so "v" here cannot be velocity because velocity is a vector, however, we use the velocity equation to derive the speed of the wave, so the symbol "v" is typically what is used.

Looking at the demonstration of 1 wave passing through the screen we can take the following measurements:

The length of one wave measured on the screen: $\lambda=1.58\text{m}$

The time it takes 1 full wave to pass by a point is 0.29 seconds: $T=0.29\text{sec}$

Therefore: $f=\frac{1}{T}=\frac{1}{0.29}=3.448276\text{ Hz}$ and $v=f\lambda=\left(3.448276\right)\left(1.58\right)=5.448276\approx 5.4\frac{m}{s}$

The time it takes one wave to go across the entire screen is 0.35 sec: $\Delta t=0.35\text{sec}$

The width of the screen is 1.92 m: $\Delta x=1.92m$

Therefore: $v=\frac{\Delta x}{\Delta t}=\frac{1.92}{0.35}=5.485714\approx 5.5\frac{m}{s}$

The percentage difference between those two measurements is:

$$\%_{difference}=\frac{5.485714\text{-}5.448276}{\left(5.485714+5.448276\right)/2}\times 100=0.681150\approx 0.68\%$$