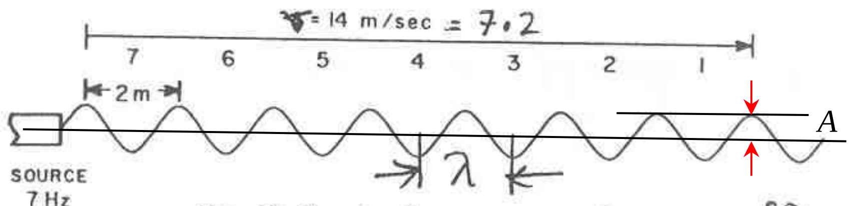

FIG. 12. Speed = frequency × wavelength.

A = displacement amplitude of wave = max ***displacement*** from equilibrium position (meters, *m*)

f = frequency of wave = number of complete cycles per second of wave (*cycles per second* = *cps* = *Hertz*, or *Hz*).

λ = "lambda" = spatial wavelength of wave – distance to complete one oscillation cycle (meters, *m*)

τ = "tau" = period of wave = time to complete one oscillation cycle = "temporal wavelength" (*seconds* (*secs*, or *s*)):

$$\boxed{\tau = 1/f}$$

v = speed of propagation of wave (*meters*/*second* = *m*/*s*): $\boxed{v = f\lambda}$

ω = "omega" = angular frequency (*radians*/*second* = *rads*/*sec*, or *rads*/s):

$$\boxed{\omega = 2\pi f, \quad f = \omega/2\pi}$$

k = spatial wave number (<u>inverse</u> *meters*, i.e. 1/*meters* = 1/*m*):

$$\boxed{k = 2\pi/\lambda}$$ Hence, we also see that: $\boxed{v = f\lambda = 2\pi f \cdot \lambda/2\pi = \omega/k}$

Sinusoidal ***<u>longitudinal</u>*** wave propagation {in the +*ve* *z*-direction} (relevant *e.g*. for sound propagation in air/water) is mathematically described by:

$$\boxed{Z(z,t) = Z_o \sin(\omega t - kz)}$$

where z = listener's position, Z_o = longitudinal displacement amplitude (i.e. along the direction of propagation) and $Z(z,t)$ is the instantaneous ***longitudinal*** <u>displacement</u> (*i.e*. longitudinal <u>deviation</u>) from the wave's <u>equilibrium</u> position at the point z at time t.

Note that the ***argument*** of the sine function $(\omega t - kz)$ = **<u>constant</u>**. Thus, as time t increases, the position z must also increase – hence the name **<u>traveling</u>** wave. Hence, we also see that an argument of the sine function of the form $(\omega t + kz)$ = <u>constant</u> mathematically represents a traveling longitudinal displacement plane wave propagating in the $-z$ direction: $\boxed{Z(z,t) = Z_o \sin(\omega t + kz)}$.