A wave with frequency 12.6Hz and amplitude 36.0mm moves in the positive x direction with a speed of 8.4m/s. What is the waves wavelength?

Submit Answer Tries 0/10

What is the period of the wave?

Submit Answer Tries 0/10

What is the wave's angular frequency?

Submit Answer Tries 0/10

Transverse waves with a speed of 51.1m/s are to be produced in a taut string. A 4.72m length of string with a total mass of 0.0629kg is used. What is required tension?

Submit Answer Tries 0/10

The displacement of a wave travelling in the positive x-direction is $D(x,t)=(4.26cm)\sin(3.07x-114.0t)$, where x is in meters and t is in seconds. What is the frequency?

Submit Answer Tries 0/10

What is its wavelength?

Submit Answer Tries 0/10

What is the speed of the wave?

Submit Answer Tries 0/10

Suppose that you hear a clap of thunder 33.4s after seeing the associated thunder stroke. The speed of sound waves in air is 343m/s, and the speed of lighting in air is 3.00×10^8m/s. How far are you from the lightning stroke?

Submit Answer Tries 0/10

Bats can detect small insects that are about equal in size to the wavelength of the sound the bat makes with its echolocation system. A bat emits chirps at a frequency of 21.5kHz. Using the speed of sound as 340m/s, what is the smallest insect the bat can detect?

Submit Answer Tries 0/10

A wave has angular frequency 27.1rad/s and wavelength 2.84m. What is its wave number?

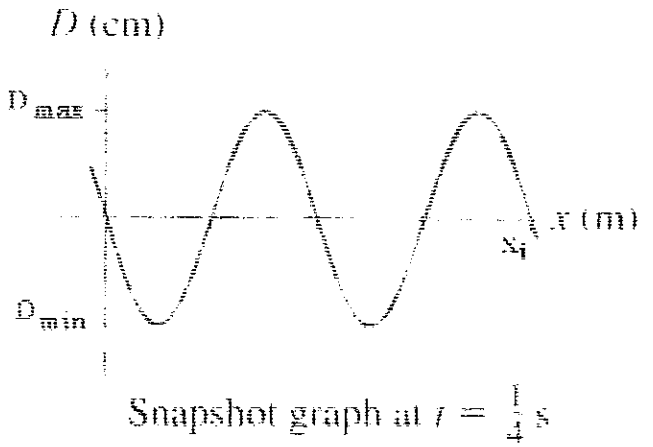
Submit Answer Tries 0/10

What is its wave speed?

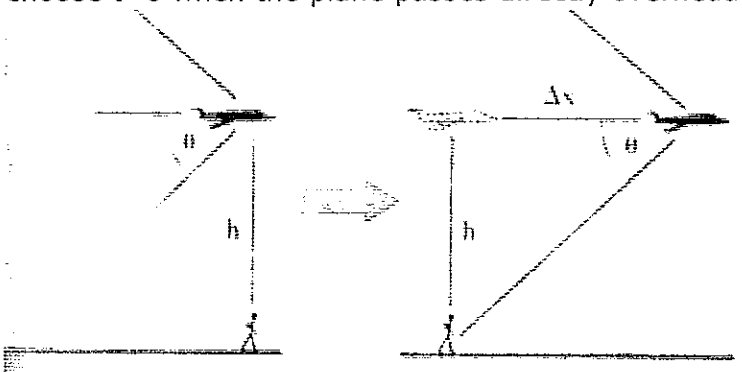
Submit Answer Tries 0/10

A traveling wave has displacement D(x,t)=(2.80cm)sin(1.33x-5.94t), where x is in meters and t is in seconds. What is the wave speed of this wave?

Submit Answer Tries 0/10



A supersonic jet travels at Mach 4 (4 times the speed of sound). It cruises at 18883m above ground. We choose t=0 when the plane passes directly overhead of an observer as shown in the figure below.



At what time t will the observer hear the plane? (Take the speed of sound to be 340m/s.)

Submit Answer Tries 0/10

What distance Δx has the plane traveled by that time?

Submit Answer Tries 0/10

A sinusoidal wave is described by the equation D(x,t)=(0.420m)sin(0.590x-0.794t), where x is in meters and t is in seconds. What is the amplitude of the wave?

Submit Answer Tries 0/10

What is the angular frequency of the wave?

Submit Answer Tries 0/10

What is the angular wave number?

Submit Answer Tries 0/10

What is the wavelength?

Submit Answer Tries 0/10

What is the speed of the wave?

Submit Answer Tries 0/10

Consider the sinusoidal wave with the wave function y=(17.5cm)cos(0.170x-66.5t) (where the units of k are rad/cm). At a certain instant, let point A be at the origin and point B be the first point along the x axis where the wave is 60.0° out of phase with point A. What is the position (in cm) along the x-axis of point B? Enter a positive answer.

Submit Answer Tries 0/10

Oliver (m = 87.6kg) uses a 4.60m long rope to pull Jordan (m = 72.3kg) across the floor (μ_k = 0.200) at a constant speed of 1.77m/s. Jordan signals to Oliver to stop by "plucking" the rope, sending a wave pulse forward along the rope. The pulse reaches Oliver 523.0ms later. What is the mass of the rope?

Submit Answer Tries 0/10

A hammer taps on the end of a 8.41m long metal bar at room temperature. A microphone at the other end of the bar picks up two pulses of sound, one that travels through the metal and one that travels through the air. The pulses are separated in time by 5.22ms. What is the speed of sound in this metal? (the speed of sound in air is 343 m/s)

Submit Answer Tries 0/10

A transverse traveling wave on a taut wire has an amplitude of 0.190mm and a frequency of 511Hz. It travels with a speed of 195m/s. The mass per unit length of this wire is 4.22*g*/m. Calculate the tension in the wire.

Submit Answer Tries 0/10

Submit All

Physics 1A03
Assignment 6 solutions

1. a) $\lambda = \frac{v}{f}$

$= \frac{8.4\ m/s}{12.6\ Hz}$

$= 0.67\ m$

b) $T = \frac{1}{f}$

$= \frac{1}{12.6\ Hz}$

$= 0.0794\ s$

c) $\omega = 2\pi f$

$= 2\pi (12.6\ Hz)$

$= 79.13\ rad/s$

2. $\mu = \frac{m}{l}$

$= \frac{0.0629\ kg}{4.72\ m}$

$= 0.0133\ kg/m$

$T = \mu \cdot c^2$

$= (0.0133\ kg/m)(51.1\ m/s)^2$

$= 34.73\ \frac{kg \cdot m}{s^2}$ OR N

3. $D(x,t) = A\sin(kx + \omega t)$

$= (4.26\text{cm})\sin(3.07x - 114.0t)$

a) $\omega = 2\pi f$

$114.0\frac{\text{rad}}{\text{s}} = 2\pi f$

$f = \frac{114.0}{2\pi}$

$= 18.153\ \text{Hz}$

b) $k = \frac{2\pi}{\lambda}$

$3.07\frac{\text{rad}}{\text{m}} = \frac{2\pi}{\lambda}$

$\lambda = \frac{2\pi}{3.07}$

$= 2.05\text{m}$

c) $v = f \cdot \lambda$

$= (18.153\text{Hz})(2.05\text{m})$

$= 37.21\text{m/s}$

4. $d = v \cdot \Delta t$

$= (343\text{m/s})(33.4\text{s})$

$= 11456.2\text{m}$

5. $\lambda = \frac{v}{f}$

$= \frac{340\text{m/s}}{18.4\times10^3\text{Hz}}$

$= 0.0185\text{m}$

6. a) $k = \frac{2\pi}{\lambda}$

$= \frac{2(3.14)}{2.84\,m}$

$= 2.21\ rad/m$

b) $\omega = \frac{2\pi}{\lambda}$

$= 2\pi f$

$f = \frac{\omega}{2\pi}$

$= \frac{27.1\ rad/s}{2\pi}$

$= 4.32\,Hz$

$v = \lambda \cdot f$

$= (2.84\,m)(4.32\,Hz)$

$= 12.26\ m/s$

7. $v = f \cdot \lambda$

$\lambda = ?$ $f = ?$

$k = 1.33\ rad/m$

$= \frac{2\pi}{\lambda}$

$\lambda = \frac{2\pi}{k}$

$= \frac{2\pi}{1.33\ rad/m}$

$\omega = \frac{2\pi}{T} = 2\pi f = 5.94\ rad/s$

$f = \frac{\omega}{2\pi}$

$= \frac{5.94\ rad/s}{2\pi}$

$v = \lambda \cdot f$

$= \frac{2\pi}{1.33\ rad/m} \cdot \frac{5.94\ rad/s}{2\pi}$

$= 4.47\ m/s$

8. a) $t = \frac{h}{v}$

$= \frac{18883\,m}{340\,m/s}$

b) $\Delta x = v \cdot t$

$= (4.340\,m/s)(55.5\,s)$

$= 75532.0\,m$

9. $D(x,t) = A \sin(kx - \omega t)$

$= (0.420\,m)\sin(0.590x - 0.794t)$

a) $A = 0.420\,m$

b) $\omega = 0.794\ rad/s$

c) $k = 0.590\ rad/m$

d) $k = \frac{2\pi}{\lambda}$

$\lambda = \frac{2\pi}{k}$

$= \frac{2\pi}{0.590\ rad/m}$

$= 10.64\,m$

e) $v = f \cdot \lambda$

$f = \frac{\omega}{2\pi} \quad \lambda = \frac{2\pi}{k}$

$v = \frac{\omega}{2\pi} \cdot \frac{2\pi}{k}$

$= \frac{\omega}{k}$

$= \frac{0.794\ rad/s}{0.590\ rad/m}$

$= 1.35\,m/s$

10. $y = A\cos(\overbrace{kx + \omega t}^{\text{phase of the wave}})$

$= (17.5\text{cm})\cos(0.170x - 66.5^\circ)$

since this is at an instant, t is constant and we can set $t = 0$ to make things easier:

$y = (17.5\text{cm})\cos(0.170x)$

$x_A = 0 \quad x_{13} = ?$

$y(A) = (17.5\text{cm})\cos[0.170(0)]$

$y(13) = (17.5\text{cm})\cos(0.170(x_{13}))$

any difference in position due to the phase of the wave is due to x_{13}. we know that the wave is 60.0° (or, $\frac{\pi}{3}$ rad) out of phase, so:

$0.170\,x_{13} = \pi/3$

$x_{13} = 6.16\text{cm}$

11. $\mu = \frac{T}{c^2}$

$\frac{m}{\ell} = \frac{T}{c^2}$

$m = \frac{T \cdot \ell}{c^2} \longrightarrow T = ? \quad \ell = ?$

$T = F_f$

$= F_N \cdot \mu_k$

$= m_J \cdot g \cdot \mu_k$

$= (72.3\text{kg})(9.8\text{m/s}^2)(0.200)$

$= 141.708\text{N}$

$$c = \frac{L}{\Delta t}$$

$$= \frac{4.60\,m}{0.523\,s}$$

$$= 8.795\,m/s$$

so: $$m = \frac{T \cdot l}{c^2}$$

$$= \frac{(141.708N)(4.60m)}{(8.80\,m/s)^2}$$

$$= 8.43\,kg$$

12. in air:

$$\Delta t = \frac{\Delta d}{v}$$

$$= \frac{8.41\,m}{343\,m/s}$$

$$= 0.0245\,s$$

in metal:

$$\Delta t - 0.00522\,s = \frac{\Delta d}{v}$$

$$v = \frac{\Delta d}{\Delta t - 0.00522\,s}$$

$$= \frac{8.41\,m}{0.0245\,s - 0.00522\,s}$$

$$= 436.2\,m/s$$

* sound travels faster through metal!

13. $c = 195\ m/s$

$\mu = 0.00422\ kg/m$

all other information is irrelevant.

$$c = \sqrt{\frac{T}{\mu}}$$

$$T = \mu \cdot c^2$$

$$= (0.00422\ kg/m)(195\ m/s)^2$$

$$= 160.5\ N$$